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and
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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

ARMSCII-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>

1.4 lua 5.1.5

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1.5 libpcap 1.2.1

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1.10 iptables 1.4.20

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1.12 dmidecode 2.12

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1.13 libpcap 1.7.4

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threshold
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That's all there is to it!
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1.18 pxelinux 6.03

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src/base/md5.c
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#
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
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src/pcf/pcf.c
src/pcf/pcf.h
src/pcf/pcfdrivr.c
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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
src/gzip/zutil.h
#
src/tools/apinames.c
src/tools/ftrandom/ftrandom.c
#
#
EOF

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1.21 e2fsprogs 1.43.7

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@@ -4,11 +4,11 @@ Rev: 23371
Last Changed Date: 2007-06-06 20:14:06 -0400 (Wed, 06 Jun 2007)
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-
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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): $(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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libet and libss libraries for more information.

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Theodore Ts'o
23-June-2007

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1.22 cairo 1.14.2

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1.24 curl 7.62.0

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1.25 logback-core 1.2.3

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<body>
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1.26 freerdp 2.0.0-rc4

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1.27 bzip2 1.0.8

1.28 ldns 1.7.1

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*
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* Modified by Jelte Jansen to fit in ldns, and not clash with any
* system-defined SHA code.
* 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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* $Id:
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1.37 commons-pool 1.6

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1.38 glibc 2.23

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1.41 hd-parm 9.48

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The source code for a work means the preferred form of the work for making modifications to it. For an executable work, 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 executable. 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.

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1.46 glibc 2.25

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same job as widely used non-free libraries. In this
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former
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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.)
@end enumerate

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2 above provided that you accompany
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medium customarily used for software interchange.

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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
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@item
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creates an executable that is a derivative of the Library (because

it
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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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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.

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@enumerate a
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@end enumerate

@subheading END OF TERMS AND CONDITIONS

@page
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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.

@smallexample
@var{one line to give the library's name and an idea of what it does.}
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1.49 rsyslog 7.6.7

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1.51 swagger-annotations 1.5.22

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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 "";
}
```

1.52 opus 1.1.2

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1.54 python-requests 2.22.0

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1.55 urllib3 1.25.3

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Contributions to the urllib3 project

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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/@WBRSRlBZDhBFXQB6/>
 * 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

* Benjamen 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]

1.56 importlib-metadata 0.18

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1.57 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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Gadi Oxman, August 1995

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```
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```

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```
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package are flexible, if you give me enough lead time.

Theodore Ts'o
23-June-2007

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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:

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DAMAGE.
#
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
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1.58 jansi 1.18

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PNG

IHDR=IDATx1@^uG&%Y%Y%Y

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This package was debianized by Christopher L Cheney <ccheney@debian.org> on
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It was downloaded from http://www.ece.uvic.ca/~mdadams/jasper/

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1.62 cryptsetup 2.1.0

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Also, for each distributor's protection, we want to make certain that everyone understands that there is no warranty for this free library. If the library is modified by someone else and passed on, we want its recipients to know that what they have is not the original version, so that any problems introduced by others will not reflect on the original authors' reputations.

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.

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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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<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

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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.

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(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.

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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
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clear directions next to the object code saying where to find the

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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.

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1.90 libva 1.0.15

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Found in path(s):
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/tree/ElementQNameIterator.java
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* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/tree/AbstractElement.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/util/UserDataDocumentFactory.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/io/XPPReader.java

* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/tree/DefaultAttribute.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/io/OutputFormat.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/datatype/NamedTypeResolver.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/tree/SingleIterator.java
*
 /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/dom/DOMAttribute.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/rule/RuleManager.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/tree/DefaultElement.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/datatype/InvalidSchemaException.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/xpath/DefaultNamespaceContext.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/datatype/DatatypeElement.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/io/DocumentSource.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/tree/ElementNameIterator.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/io/DOMSAXContentHandler.java
*
 /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/dom/DOMElement.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/io/JAXPHelper.java
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* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/io/DOMDocumentResult.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/datatype/SchemaParser.java
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1.100 junixsocket-common 2.3.2

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* /opt/ws_local/PERMITS_SQL/1046144794_1589880088.21/0/junixsocket-common-2-3-2-sources-jar/org/newsclub/net/unix/NativeLibraryLoader.java

* /opt/ws_local/PERMITS_SQL/1046144794_1589880088.21/0/junixsocket-common-2-3-2-sources-jar/org/newsclub/net/unix/AFUNIXSocketCapability.java
* /opt/ws_local/PERMITS_SQL/1046144794_1589880088.21/0/junixsocket-common-2-3-2-sources-jar/org/newsclub/net/unix/AFUNIXSocketImpl.java
* /opt/ws_local/PERMITS_SQL/1046144794_1589880088.21/0/junixsocket-common-2-3-2-sources-jar/org/newsclub/net/unix/SuppressFBWarnings.java
* /opt/ws_local/PERMITS_SQL/1046144794_1589880088.21/0/junixsocket-common-2-3-2-sources-jar/org/newsclub/net/unix/AFUNIXSocketAddress.java
* /opt/ws_local/PERMITS_SQL/1046144794_1589880088.21/0/junixsocket-common-2-3-2-sources-jar/org/newsclub/net/unix/NativeUnixSocket.java
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/opt/ws_local/PERMITS_SQL/1046144794_1589880088.21/0/junixsocket-common-2-3-2-sources-jar/org/newsclub/net/unix/AFUNIXSocketFactory.java

1.101 junixsocket-native-common 2.3.2

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1.102 boost 1.72.0

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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.

RC4 is a registered trademark of RSA Laboratories.

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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.
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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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* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/IndexReaderV1.java
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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
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47. [51]Nick Sayer <mrapple@quack.kfu.com> SunOS streams modules
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52. [56]Harlan Stenn <harlan@pfcs.com> GNU automake/autoconfigure makeover, various other bits (see the ChangeLog)
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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

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1.108 postgre-sql 42.2.14

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* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/websocketx/WebSocket08FrameEncoder.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/websocketx/WebSocket07FrameEncoder.java
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* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/HttpClientUpgradeHandler.java
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* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/websocketx/WebSocket13FrameDecoder.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/websocketx/WebSocket07FrameDecoder.java
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* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/HttpServerKeepAliveHandler.java
*
 /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/websocketx/WebSocketChunkedInput.java
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* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/cookie/ServerCookieEncoder.java
*
/opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/cookie/CookieDecoder.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/cookie/CookieEncoder.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/cookie/Cookie.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/cookie/CookieHeaderNames.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/CombinedHttpHeaders.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/cookie/ClientCookieDecoder.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/HttpExpectationFailedEvent.java
*
/opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/rtsp/RtspEncoder.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/cookie/ServerCookieDecoder.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/HttpScheme.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/cookie/package-info.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/CookieUtil.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/EmptyHttpHeaders.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/HttpUtil.java
*
/opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/cookie/ClientCookieEncoder.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/cookie/CookieUtil.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/rtsp/RtspDecoder.java

1.110 icu 65.1

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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 =

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* /opt/ws_local/PERMITS_SQL/1072948616_1595240775.72/0/netty-buffer-4-1-51-final-sources-jar/io/netty/buffer/PooledDuplicatedByteBuf.java
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* /opt/ws_local/PERMITS_SQL/1072948616_1595240775.72/0/netty-buffer-4-1-51-final-sources-jar/io/netty/buffer/AbstractUnsafeSwappedByteBuf.java
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* /opt/ws_local/PERMITS_SQL/1072948616_1595240775.72/0/netty-buffer-4-1-51-final-sources-jar/io/netty/buffer/ByteBufOutputStream.java
* /opt/ws_local/PERMITS_SQL/1072948616_1595240775.72/0/netty-buffer-4-1-51-final-sources-jar/io/netty/buffer/PoolChunk.java
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* /opt/ws_local/PERMITS_SQL/1072948616_1595240775.72/0/netty-buffer-4-1-51-final-sources-jar/io/netty/buffer/UnpooledByteBufAllocator.java
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* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslTlsv13X509ExtendedTrustManager.java
*
 /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/ExtendedOpenSslSession.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/DefaultOpenSslKeyMaterial.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslCachingKeyMaterialProvider.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslX509KeyManagerFactory.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslX509TrustManagerWrapper.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslPrivateKey.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslKeyMaterial.java
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* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslKeyMaterialProvider.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/SignatureAlgorithmConverter.java
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* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/KeyManagerFactoryWrapper.java
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* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/traffic/package-info.java
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* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/ReferenceCountedOpenSslServerContext.java
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* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/ReferenceCountedOpenSslEngine.java
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* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/util/X509TrustManagerWrapper.java
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* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/Java8SslUtils.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslCertificateException.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/ReferenceCountedOpenSslContext.java
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* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/SslCompletionEvent.java
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* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/SniCompletionEvent.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OptionalSslHandler.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/JdkAlpnSslUtils.java
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*
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* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/ConscryptAlpnSslEngine.java
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* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/util/package-info.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/logging/package-info.java
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* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/util/InsecureTrustManagerFactory.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/PemReader.java
*
 /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/JdkBaseApplicationProtocolNegotiator.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/SniHandler.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslX509Certificate.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/Java7SslParametersUtils.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslSessionStats.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/JdkApplicationProtocolNegotiator.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslServerContext.java
*
 /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/SupportedCipherSuiteFilter.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ipfilter/package-info.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/JettyNpnSslEngine.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslEngineMap.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslContext.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/util/SimpleTrustManagerFactory.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/traffic/GlobalChannelTrafficCounter.java
*
 /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/util/BouncyCastleSelfSignedCertGenerator.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslClientContext.java

* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/CipherSuiteConverter.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslSessionContext.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/CipherSuiteFilter.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslEngine.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/SslContext.java
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 /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslDefaultApplicationProtocolNegotiator.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/ApplicationProtocolNegotiator.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/JdkSslEngine.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ipfilter/RuleBasedIpFilter.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/JdkAlpnApplicationProtocolNegotiator.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/JdkSslServerContext.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/JdkDefaultApplicationProtocolNegotiator.java
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 /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/SslProvider.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/IdentityCipherSuiteFilter.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/util/OpenJdkSelfSignedCertGenerator.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/JdkSslContext.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/util/ThreadLocalInsecureRandom.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/ApplicationProtocolConfig.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ipfilter/UniqueIpFilter.java
*
 /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslApplicationProtocolNegotiator.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslServerSessionContext.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/JdkNpnApplicationProtocolNegotiator.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-

jar/io/netty/handler/ssl/ApplicationProtocolUtil.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ipfilter/IpSubnetFilterRule.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ipfilter/IpFilterRule.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslNpnApplicationProtocolNegotiator.java
*
 /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/SslUtils.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ipfilter/IpFilterRuleType.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ipfilter/AbstractRemoteAddressFilter.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/JdkSslClientContext.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/util/FingerprintTrustManagerFactory.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSsl.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/JettyAlpnSslEngine.java
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* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/address/ResolveAddressHandler.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/logging/ByteBufFormat.java
*
 /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/SslHandshakeTimeoutException.java

1.113 netty-resolver 4.1.51.Final

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* /opt/ws_local/PERMITS_SQL/1072948623_1595240780.88/0/netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/ResolvedAddressTypes.java
* /opt/ws_local/PERMITS_SQL/1072948623_1595240780.88/0/netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/HostsFileEntries.java

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* /opt/ws_local/PERMITS_SQL/1072948623_1595240780.88/0/netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/NoopAddressResolverGroup.java
* /opt/ws_local/PERMITS_SQL/1072948623_1595240780.88/0/netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/SimpleNameResolver.java
*
 /opt/ws_local/PERMITS_SQL/1072948623_1595240780.88/0/netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/NoopAddressResolver.java
* /opt/ws_local/PERMITS_SQL/1072948623_1595240780.88/0/netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/NameResolver.java
* /opt/ws_local/PERMITS_SQL/1072948623_1595240780.88/0/netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/AddressResolverGroup.java
* /opt/ws_local/PERMITS_SQL/1072948623_1595240780.88/0/netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/package-info.java
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* /opt/ws_local/PERMITS_SQL/1072948623_1595240780.88/0/netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/DefaultAddressResolverGroup.java
* /opt/ws_local/PERMITS_SQL/1072948623_1595240780.88/0/netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/DefaultNameResolver.java
*
 /opt/ws_local/PERMITS_SQL/1072948623_1595240780.88/0/netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/AbstractAddressResolver.java
* /opt/ws_local/PERMITS_SQL/1072948623_1595240780.88/0/netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/HostsFileEntriesResolver.java
* /opt/ws_local/PERMITS_SQL/1072948623_1595240780.88/0/netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/InetNameResolver.java
* /opt/ws_local/PERMITS_SQL/1072948623_1595240780.88/0/netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/DefaultHostsFileEntriesResolver.java
* /opt/ws_local/PERMITS_SQL/1072948623_1595240780.88/0/netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/HostsFileParser.java
* /opt/ws_local/PERMITS_SQL/1072948623_1595240780.88/0/netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/InetSocketAddressResolver.java
* /opt/ws_local/PERMITS_SQL/1072948623_1595240780.88/0/netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/CompositeNameResolver.java
* /opt/ws_local/PERMITS_SQL/1072948623_1595240780.88/0/netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/AddressResolver.java
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1.114 netty-transport 4.1.51.Final

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* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/oio/AbstractOioMessageChannel.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/bootstrap/Bootstrap.java
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 /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/MultithreadEventLoopGroup.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/ChannelInboundHandlerAdapter.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/local/LocalAddress.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/ChannelConfig.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/socket/DefaultSocketChannelConfig.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/nio/AbstractNioMessageChannel.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/socket/oio/package-info.java
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* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/socket/DatagramPacket.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/DefaultEventLoopGroup.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/Channel.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/oio/AbstractOioChannel.java
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* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/SingleThreadEventLoop.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/EventLoopGroup.java
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* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/ChannelFuture.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/local/LocalChannelRegistry.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/socket/nio/package-info.java
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* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/ChannelFlushPromiseNotifier.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/ChannelPromiseAggregator.java
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*
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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:
* <ul>
* <li>{@link
 ChannelInboundHandler} to handle inbound I/O events, and</li>
* <li>{@link ChannelOutboundHandler} to handle outbound I/O operations.</li>
* </ul>
* </p>
* <p>
* Alternatively, the following adapter classes are provided for your convenience:
* <ul>
* <li>{@link ChannelInboundHandlerAdapter} to handle inbound I/O events,</li>
* <li>{@link ChannelOutboundHandlerAdapter} to handle outbound I/O operations, and</li>
* <li>{@link ChannelDuplexHandler} to handle both inbound and outbound events</li>
* </ul>
* </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}&lt;Message&gt; {
*
*     <b>private boolean loggedIn;</b>
*
*     {@code @Override}
*     public void channelRead0({@link ChannelHandlerContext} ctx, Message message) {
```

```
*         if (message instanceof LoginMessage) {
*             authenticate((LoginMessage) message);
*             <b>loggedIn = true;</b>
*         } 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>
*
*
* <h4>The {@code @Sharable} annotation</h4>
* <p>
* In the example above which used an {@link AttributeKey},
* you might have noticed the {@code @Sharable} annotation.
* <p>
* 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.
* <p>
* 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.
* <p>
* This annotation is provided for documentation purpose, just like
* <a href="http://www.javaconcurrencyinpractice.com/annotations/doc/">the JCIP annotations</a>.
```

*
* <h3>Additional resources worth reading</h3>
* <p>
* 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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* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/group/ChannelGroupException.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/ChannelOutboundBuffer.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/ChannelId.java

* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/MessageSizeEstimator.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/AbstractEventLoopGroup.java
*
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* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/DefaultChannelId.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/group/ChannelMatcher.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/socket/oio/DefaultOioSocketChannelConfig.java
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* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/ConnectTimeoutException.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/bootstrap/ChannelFactory.java
*
 /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/socket/oio/OioServerSocketChannelConfig.java
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* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/ChannelProgressiveFutureListener.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/socket/oio/OioSocketChannelConfig.java
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* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/pool/ChannelPoolHandler.java
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* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/pool/FixedChannelPool.java
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* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/MaxBytesRecvByteBufAllocator.java
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* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/WriteBufferWaterMark.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/DefaultSelectStrategyFactory.java
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* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/SelectStrategyFactory.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/ChannelInboundInvoker.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/bootstrap/BootstrapConfig.java
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* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/SelectStrategy.java

1.115 netty-codec 4.1.51.Final

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* /opt/ws_local/PERMITS_SQL/1072948336_1595240763.12/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/ProtocolDetectionResult.java
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* /opt/ws_local/PERMITS_SQL/1072948336_1595240763.12/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/compression/DecompressionException.java
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* /opt/ws_local/PERMITS_SQL/1072948336_1595240763.12/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/ReplayingDecoder.java
* /opt/ws_local/PERMITS_SQL/1072948336_1595240763.12/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/MessageToMessageEncoder.java
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*/
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*/
/**
* Enumeration of supported Base64 dialects.
* <p>
* The internal lookup tables in this class has been derived from
* Robert
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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>
* <b>lengthFieldOffset</b>   = <b>0</b>
* <b>lengthFieldLength</b>   = <b>2</b>
* 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
* <b>initialBytesToStrip</b> = <b>2</b> (= 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
*/
```

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* /opt/ws_local/PERMITS_SQL/1072948336_1595240763.12/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/LengthFieldBasedFrameDecoder.java
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```
/**
* Utility class for {@link ByteBuf} that encodes and decodes to and from
* <a href="http://en.wikipedia.org/wiki/Base64">Base64</a> notation.
* <p>
*
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1.116 coturn 4.5.1.3

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* /opt/ws_local/PERMITS_SQL/1075084041_1596044813.39/0/netty-transport-native-epoll-4-1-51-final-sources-jar/netty_epoll_linuxsocket.c
* /opt/ws_local/PERMITS_SQL/1075084041_1596044813.39/0/netty-transport-native-epoll-4-1-51-final-sources-jar/netty_epoll_linuxsocket.h
* /opt/ws_local/PERMITS_SQL/1075084041_1596044813.39/0/netty-transport-native-epoll-4-1-51-final-sources-jar/io/netty/channel/epoll/LinuxSocket.java
*
 /opt/ws_local/PERMITS_SQL/1075084041_1596044813.39/0/netty-transport-native-epoll-4-1-51-final-sources-jar/io/netty/channel/epoll/NativeStaticallyReferencedJniMethods.java

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* /opt/ws_local/PERMITS_SQL/1075084041_1596044813.39/0/netty-transport-native-epoll-4-1-51-final-sources-jar/netty_epoll_native.c

1.119 netty-transport-native-unix-common 4.1.51.Final

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* /opt/ws_local/PERMITS_SQL/1075084034_1596044782.67/0/netty-transport-native-unix-common-4-1-51-final-sources-jar/io/netty/channel/unix/Buffer.java
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* /opt/ws_local/PERMITS_SQL/1075084034_1596044782.67/0/netty-transport-native-unix-common-4-1-51-final-sources-jar/io/netty/channel/unix/ServerDomainSocketChannel.java
*
/opt/ws_local/PERMITS_SQL/1075084034_1596044782.67/0/netty-transport-native-unix-common-4-1-51-final-sources-jar/netty_unix_socket.c
* /opt/ws_local/PERMITS_SQL/1075084034_1596044782.67/0/netty-transport-native-unix-common-4-1-51-final-sources-jar/io/netty/channel/unix/DomainSocketAddress.java
* /opt/ws_local/PERMITS_SQL/1075084034_1596044782.67/0/netty-transport-native-unix-common-4-1-51-final-sources-jar/io/netty/channel/unix/DatagramSocketAddress.java
* /opt/ws_local/PERMITS_SQL/1075084034_1596044782.67/0/netty-transport-native-unix-common-4-1-51-final-sources-jar/netty_unix_filedescriptor.h
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* /opt/ws_local/PERMITS_SQL/1075084034_1596044782.67/0/netty-transport-native-unix-common-4-1-51-final-sources-jar/io/netty/channel/unix/NativeInetAddress.java
* /opt/ws_local/PERMITS_SQL/1075084034_1596044782.67/0/netty-transport-native-unix-common-4-1-51-final-sources-jar/io/netty/channel/unix/DomainSocketChannelConfig.java
*
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* /opt/ws_local/PERMITS_SQL/1075084034_1596044782.67/0/netty-transport-native-unix-common-4-1-51-final-sources-jar/netty_unix_errors.h
* /opt/ws_local/PERMITS_SQL/1075084034_1596044782.67/0/netty-transport-native-unix-common-4-1-51-final-sources-jar/io/netty/channel/unix/Socket.java
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* /opt/ws_local/PERMITS_SQL/1075084034_1596044782.67/0/netty-transport-native-unix-common-4-1-51-final-sources-jar/io/netty/channel/unix/FileDescriptor.java
* /opt/ws_local/PERMITS_SQL/1075084034_1596044782.67/0/netty-transport-native-unix-common-4-1-51-final-sources-jar/io/netty/channel/unix/DomainSocketReadMode.java
*
/opt/ws_local/PERMITS_SQL/1075084034_1596044782.67/0/netty-transport-native-unix-common-4-1-51-final-sources-jar/io/netty/channel/unix/Errors.java
* /opt/ws_local/PERMITS_SQL/1075084034_1596044782.67/0/netty-transport-native-unix-common-4-1-51-final-sources-jar/io/netty/channel/unix/UnixChannel.java
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 /opt/ws_local/PERMITS_SQL/1075084034_1596044782.67/0/netty-transport-native-unix-common-4-1-51-final-sources-jar/io/netty/channel/unix/package-info.java
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*
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* /opt/ws_local/PERMITS_SQL/1075084034_1596044782.67/0/netty-transport-native-unix-common-4-1-51-final-sources-jar/netty_unix_util.h
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* /opt/ws_local/PERMITS_SQL/1075084034_1596044782.67/0/netty-transport-native-unix-common-4-1-51-final-sources-jar/netty_unix_limits.c
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* /opt/ws_local/PERMITS_SQL/1075084034_1596044782.67/0/netty-transport-native-unix-common-4-1-51-final-sources-jar/io/netty/channel/unix/LimitsStaticallyReferencedJniMethods.java

1.120 jackson-annotations 2.11.2

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1.121 netty-handler-proxy 4.1.51.Final

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*
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* /opt/ws_local/PERMITS_SQL/1077639653_1597066896.9/0/netty-handler-proxy-4-1-51-final-sources-

jar/io/netty/handler/proxy/Socks4ProxyHandler.java
* /opt/ws_local/PERMITS_SQL/1077639653_1597066896.9/0/netty-handler-proxy-4-1-51-final-sources-jar/io/netty/handler/proxy/ProxyConnectionEvent.java
* /opt/ws_local/PERMITS_SQL/1077639653_1597066896.9/0/netty-handler-proxy-4-1-51-final-sources-jar/io/netty/handler/proxy/Socks5ProxyHandler.java
* /opt/ws_local/PERMITS_SQL/1077639653_1597066896.9/0/netty-handler-proxy-4-1-51-final-sources-jar/io/netty/handler/proxy/ProxyConnectException.java

1.122 netty-codec-socks 4.1.51.Final

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 /opt/ws_local/PERMITS_SQL/1077639554_1597066895.65/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksCmdStatus.java
* /opt/ws_local/PERMITS_SQL/1077639554_1597066895.65/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksRequestType.java
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* /opt/ws_local/PERMITS_SQL/1077639554_1597066895.65/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v5/Socks5InitialRequestDecoder.java
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* /opt/ws_local/PERMITS_SQL/1077639554_1597066895.65/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v4/Socks4Message.java
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* /opt/ws_local/PERMITS_SQL/1077639554_1597066895.65/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksInitRequestDecoder.java
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 /opt/ws_local/PERMITS_SQL/1077639554_1597066895.65/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v5/DefaultSocks5PasswordAuthResponse.java
* /opt/ws_local/PERMITS_SQL/1077639554_1597066895.65/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/UnknownSocksRequest.java
* /opt/ws_local/PERMITS_SQL/1077639554_1597066895.65/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v5/DefaultSocks5InitialResponse.java
* /opt/ws_local/PERMITS_SQL/1077639554_1597066895.65/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v4/Socks4CommandRequest.java
* /opt/ws_local/PERMITS_SQL/1077639554_1597066895.65/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v5/DefaultSocks5CommandResponse.java
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 /opt/ws_local/PERMITS_SQL/1077639554_1597066895.65/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksMessage.java
* /opt/ws_local/PERMITS_SQL/1077639554_1597066895.65/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v5/DefaultSocks5PasswordAuthRequest.java
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* /opt/ws_local/PERMITS_SQL/1077639554_1597066895.65/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksCmdRequestDecoder.java
* /opt/ws_local/PERMITS_SQL/1077639554_1597066895.65/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v5/Socks5InitialRequest.java
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* /opt/ws_local/PERMITS_SQL/1077639554_1597066895.65/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v4/Socks4ClientDecoder.java

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* /opt/ws_local/PERMITS_SQL/1077639554_1597066895.65/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksCommonUtils.java
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* /opt/ws_local/PERMITS_SQL/1077639554_1597066895.65/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksRequest.java
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 /opt/ws_local/PERMITS_SQL/1077639554_1597066895.65/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksAuthRequestDecoder.java
* /opt/ws_local/PERMITS_SQL/1077639554_1597066895.65/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksCmdRequest.java
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* /opt/ws_local/PERMITS_SQL/1077639554_1597066895.65/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v4/Socks4CommandStatus.java
*
 /opt/ws_local/PERMITS_SQL/1077639554_1597066895.65/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/package-info.java
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* /opt/ws_local/PERMITS_SQL/1077639554_1597066895.65/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/SocksPortUnificationServerHandler.java
*
 /opt/ws_local/PERMITS_SQL/1077639554_1597066895.65/0/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v5/Socks5AddressDecoder.java

1.123 jackson-databind 2.11.2

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1.125 jackson-datatype-jdk8 2.11.2

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*
 /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/jackson2/BadCredentialsExceptionMixin.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/password/Pbkdf2PasswordEncoder.java
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* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/authentication/jaas/DefaultJaasAuthenticationProvider.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/authentication/jaas/AbstractJaasAuthenticationProvider.java
*
 /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/authentication/jaas/memory/InMemoryConfiguration.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):
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/PermissionEvaluator.java
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*/
/**
* 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/
for more information.
* <p>
* For internal use only.
*
* @author
 Luke Taylor
* @since 3.0
* @deprecated Use java.util.Base64
*/

Found in path(s):
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/codec/Base64.java
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* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/authentication/DefaultAuthenticationEventPublisher.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/expression/method/MethodSecurityEvaluationContext.java
*

/opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/authentication/ProviderManager.java
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* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/context/ReactiveSecurityContextHolder.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/authorization/AuthorizationDecision.java
*

/opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/password/PasswordEncoderUtils.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/authentication/ReactiveAuthenticationManager.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/userdetails/ReactiveUserDetailsService.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/authorization/AuthenticatedReactiveAuthorizationManager.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/password/Md4.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/factory/PasswordEncoderFactories.java
*
/opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/SpringSecurityCoreVersion.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/authorization/ReactiveAuthorizationManager.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/AuthenticatedPrincipal.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/parameters/P.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/userdetails/MapReactiveUserDetailsService.java
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* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/jackson2/UsernamePasswordAuthenticationTokenDeserializer.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/jackson2/UserDeserializer.java
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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):
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
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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
  */
```

Found in path(s):
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/expression/SecurityExpressionOperations.java
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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
* <code>Collection</code> elements.
* <p>
```

* Special consideration should be given to using an <code>AfterInvocationManager</code>
* on bean methods that modify a database. Typically an
* <code>AfterInvocationManager</code> is used with read-only methods, such as
* <code>public DomainObject getById(id)</code>. If used with methods that modify a
* database, a transaction manager should be used to ensure any
* <code>AccessDeniedException</code> will cause a rollback of the changes made by the
* transaction.
* </p>
*
* @author Ben Alex
*/

Found in path(s):
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/intercept/AfterInvocationManager.java
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* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/converter/RsaKeyConverters.java
*
 /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/userdetails/UserDetailsPasswordService.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/argon2/Argon2PasswordEncoder.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/authentication/ReactiveAuthenticationManagerResolver.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/authentication/AbstractUserDetailsReactiveAuthenticationManager.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-

jar/org/springframework/security/crypto/argon2/Argon2EncodingUtils.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/token/SecureRandomFactoryBean.java
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 /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/expression/method/ExpressionBasedPreInvocationAdvice.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/authentication/event/LogoutSuccessEvent.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/authentication/UserDetailsRepositoryReactiveAuthenticationManager.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/annotation/CurrentSecurityContext.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/hierarchicalroles/RoleHierarchyImpl.java
*
 /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/authentication/ReactiveAuthenticationManagerAdapter.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/authentication/AuthenticationManagerResolver.java
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* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/keygen/SecureRandomBytesKeyGenerator.java
*
 /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/util/EncodingUtils.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/encrypt/HexEncodingTextEncryptor.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-

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* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/keygen/HexEncodingStringKeyGenerator.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/password/StandardPasswordEncoder.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/password/NoOpPasswordEncoder.java
*
/opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/encrypt/BouncyCastleAesCbcBytesEncryptor.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/encrypt/CipherUtils.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/keygen/SharedKeyGenerator.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/encrypt/BouncyCastleAesBytesEncryptor.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/keygen/StringKeyGenerator.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/keygen/KeyGenerators.java
*
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* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/encrypt/BytesEncryptor.java
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* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/keygen/BytesKeyGenerator.java
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* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/jackson2/CoreJackson2Module.java
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/opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/prepost/package-info.java
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* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/expression/method/ExpressionBasedPostInvocationAdvice.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/token/TokenService.java

1.130 hibernate-validator 6.1.5.Final

1.130.1 Available under license :

No license file was found, but licenses were detected in source scan.

/*

```
* Hibernate Validator, declare and validate application constraints
*
* License: Apache License, Version 2.0
* See the license.txt file in the root directory or <http://www.apache.org/licenses/LICENSE-2.0>.
*/
/**
  * Retrieves constraint related meta data for the parameters of the given
  * executable.
  *
  * @param javaBeanExecutable The executable of interest.
  *
  * @return A list with parameter meta data for the given executable.
  */
```

Found in path(s):
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/metadata/provider/AnnotationMetaDataProvider.java
No license file was found, but licenses were detected in source scan.

```
~ Hibernate Validator, declare and validate application constraints
 ~
 ~ License: Apache License, Version 2.0
 ~ See the license.txt file in the root directory or <http://www.apache.org/licenses/LICENSE
```

Found in path(s):
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/META-INF/validation-mapping-1.0.xsd
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/META-INF/maven/org.hibernate.validator/hibernate-validator/pom.xml
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/META-INF/validation-configuration-1.1.xsd
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/META-INF/validation-configuration-1.0.xsd
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/overview.html
*
 /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/META-INF/validation-mapping-1.1.xsd
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/META-INF/validation-mapping-2.0.xsd
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/META-INF/validation-configuration-2.0.xsd
No license file was found, but licenses were detected in source scan.

```
/*
* Hibernate Validator, declare and validate application constraints
*
* License: Apache License, Version 2.0
```

```
* See the license.txt file in the root directory or <http://www.apache.org/licenses/LICENSE-2.0>.
*/
/**
* <p>
* A method-level constraint, that evaluates a script expression against the
* annotated method or constructor. This constraint can be used to implement
* validation routines that depend on several parameters of the annotated
* executable.
* </p>
* <p>
* Script expressions can be written in any scripting or expression language,
* for which a <a href="http://jcp.org/en/jsr/detail?id=223">JSR 223</a>
* ("Scripting for the Java<sup>TM</sup> Platform") compatible engine can be
* found on the classpath. To refer to a parameter within the scripting
* expression, use its name as obtained by the active
* {@link javax.validation.ParameterNameProvider}. The default provider will
* return the
 actual parameter names, if the -parameters compiler option
* has been enabled, and {@code arg0}, {@code arg1} etc. otherwise.
* </p>
* <p>
* The following listing shows an example using the JavaScript engine which
* comes with the JDK:
* </p>
* <pre>
* {@code @ParameterScriptAssert(script = "start.before(end)", lang = "javascript")
* public void createEvent(Date start, Date end) { ... }
* }
* </pre>
* <p>
* Can be specified on any method or constructor.
* </p>
*
* @author Gunnar Morling
*/
```

Found in path(s):
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/constraints/ParameterScriptAssert.java
No license file was found, but licenses were detected in source scan.

```
/*
* Hibernate Validator, declare and validate application constraints
*
* License: Apache License, Version 2.0
* See the license.txt file in the root directory or <http://www.apache.org/licenses/LICENSE-2.0>.
*/
/*
```

* Written by Doug Lea with assistance from members of JCP JSR-166
* Expert Group and released to the public domain, as explained at
* http://creativecommons.org/licenses/publicdomain
*/

Found in path(s):
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/util/ConcurrentReferenceHashMap.java
No license file was found, but licenses were detected in source scan.

/*
* Hibernate Validator, declare and validate application constraints
*
* License: Apache License, Version 2.0
* See the license.txt file in the root directory or <http://www.apache.org/licenses/LICENSE-2.0>.
*/

Found in path(s):
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/constraintvalidators/hv/br/CPFValidator.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/constraintvalidators/bv/time/package-info.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/constraints/URL.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/engine/ConfigurationImpl.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/constraints/Length.java
*
 /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/xml/mapping/AbstractOneLineStringStaxBuilder.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/cfg/context/ReturnValueTarget.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/metadata/location/BeanConstraintLocation.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/xml/package-info.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/constraintvalidators/bv/number/sign/NegativeValidatorForLong.java
*
 /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/constraintvalidators/bv/number/sign/PositiveValidatorForBigInteger.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/util/privilegedactions/GetClassLoader.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/metadata/location/AbstractPropertyConstraintLocation.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/HibernateValidatorContext.java

* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/util/logging/Log.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/util/privilegedactions/GetMethod.java
*
 /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/util/TypeVariables.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/spi/nodenameprovider/PropertyNodeNameProvider.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/cfg/context/TypeConstraintMappingContext.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/xml/mapping/ContainerElementTypeConfigurationBuilder.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/xml/mapping/ContainerElementTypePath.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/constraints/br/CNPJ.java
*
 /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/util/privilegedactions/NewProxyInstance.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/cfg/defs/br/TituloEleitoralDef.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/cfg/context/MethodConstraintMappingContextImpl.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/constraintvalidators/hv/time/DurationMinValidator.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/properties/Property.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/util/privilegedactions/GetInstancesFromServiceLoader.java
*
 /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/constraintvalidators/bv/number/InfinityNumberComparatorHelper.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/resourceloading/DelegatingResourceBundleLocator.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/messageinterpolation/HibernateMessageInterpolatorContext.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/constraintvalidators/bv/time/pastorpresent/PastOrPresentValidatorForDate.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/constraintvalidators/bv/money/NegativeOrZeroValidatorForMonetaryAmount.java
*
 /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/engine/valueextraction/ByteArrayValueExtractor.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/engine/constraintvalidation/HibernateConstraintValidatorInitializationContextImpl.java

* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/constraintvalidators/bv/time/future/FutureValidatorForYearMonth.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/constraintvalidators/bv/number/sign/NegativeOrZeroValidatorForBigInteger.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/constraintvalidators/bv/time/pastorpresent/PastOrPresentValidatorForOffsetDateTime.java
*
 /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/metadata/raw/BeanConfiguration.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/constraintvalidators/bv/NotBlankValidator.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/Incubating.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/spi/group/DefaultGroupSequenceProvider.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/engine/messageinterpolation/parser/Token.java
*
 /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/engine/valueextraction/OptionalLongValueExtractor.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/constraintvalidators/bv/size/SizeValidatorForArraysOfLong.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/cfg/defs/SizeDef.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/cfg/context/ContainerElementConstraintMappingContextImpl.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/engine/valuecontext/BeanValueContext.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/util/privilegedactions/IsClassPresent.java
*
 /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/engine/messageinterpolation/parser/MessageState.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/constraintvalidators/bv/number/sign/PositiveOrZeroValidatorForBigInteger.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/constraintvalidators/bv/time/future/FutureValidatorForReadableInstant.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/util/stereotypes/Lazy.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/constraintvalidators/bv/time/future/FutureValidatorForCalendar.java
*
 /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/constraints/UniqueElements.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/properties/Callable.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-

jar/org/hibernate/validator/cfg/defs/CodePointLengthDef.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/constraintvalidators/hv/br/CNPJValidator.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/util/annotation/package-info.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/metadata/aggregated/package-info.java
*
/opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/constraintvalidators/bv/size/SizeValidatorForCollection.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/constraints/time/DurationMax.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/metadata/core/AnnotationProcessingOptions.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/spi/cfg/ConstraintMappingContributor.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/util/TypeResolutionHelper.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/engine/ValidatorFactoryImpl.java
*
/opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/cfg/defs/NotBlankDef.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/constraintvalidation/HibernateConstraintValidator.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/constraintvalidators/bv/time/pastorpresent/PastOrPresentValidatorForOffsetTime.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/spi/properties/package-info.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/constraintvalidators/bv/number/sign/PositiveValidatorForBigDecimal.java
*
/opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/constraintvalidators/RegexpURLValidator.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/engine/valueextraction/ValueExtractorHelper.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/metadata/PredefinedScopeBeanMetaDataManager.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/constraintvalidators/bv/number/sign/NegativeOrZeroValidatorForLong.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/metadata/aggregated/rule/ParallelMethodsMustNotDefineParameterConstraints.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/util/privilegedactions/SetContextClassLoader.java
*

/opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/spi/scripting/ScriptEvaluatorFactory.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/engine/PredefinedScopeValidatorContextImpl.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/constraintvalidators/bv/number/bound/decimal/DecimalMinValidatorForBigInteger.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/constraintvalidators/bv/number/package-info.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/engine/DefaultClockProvider.java
*
/opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/constraintvalidators/hv/pl/REGONValidator.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/util/logging/package-info.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/constraintvalidators/bv/notempty/NotEmptyValidatorForArraysOfInt.java
* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/internal/metadata/core/package-info.java
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* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/constraints/SafeHtml.java
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* /opt/ws_local/PERMITS_SQL/1082167578_1597877588.44/0/hibernate-validator-6-1-5-final-sources-2-jar/org/hibernate/validator/constraints/ConstraintComposition.java
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1.131 classgraph 4.8.69

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1.132 byte-buddy 1.10.14

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1.133 ical4j 3.0.19

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1.134 oniguruma 6.9.4-1

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* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/httpcomponents/PoolingHttpClientConnectionManagerMetricsBinder.java
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* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/logging/LoggingRegistryConfig.java
* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/ipc/http/ReactorNettySender.java

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* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/push/PushRegistryConfig.java
* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/StrongReferenceGaugeFunction.java
* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/ipc/http/HttpSender.java
* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/kafka/KafkaConsumerMetrics.java
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* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/noop/NoopTimeGauge.java
* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/simple/CountingMode.java
* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/composite/CompositeMeterRegistry.java
* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/distribution/AbstractTimeWindowHistogram.java
* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/step/StepRegistryConfig.java
* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/Meter.java
*
 /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/config/package-info.java
* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/composite/CompositeCustomMeter.java
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* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/cumulative/CumulativeFunctionCounter.java
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* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/simple/SimpleConfig.java
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* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/jvm/JvmThreadMetrics.java
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* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/AbstractTimer.java
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* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/search/MeterNotFoundException.java
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* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/cumulative/CumulativeDistributionSummary.java
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* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/distribution/TimeWindowPercentileHistogram.java
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* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/util/internal/logging/InternalLoggerFactory.java
*
/opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/util/internal/logging/JdkLoggerFactory.java

1.136 lcms 2.11

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1.138 hdrhistogram 2.1.12

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Manifest-Version: 1.0
Bnd-LastModified: 1575980548657
Build-Jdk: 1.8.0_232
Built-By: gil
Bundle-Description: HdrHistogram supports the recording and analyzing sa
mpled data value counts across a configurable integer value rang
e with configurable value precision within the range. Value prec
ision is expressed as the number of significant digits in the va
lue recording, and provides control over value quantization beha
vior across the value range and the subsequent value resolution
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Bundle-ManifestVersion: 2
Bundle-Name: HdrHistogram
Bundle-SymbolicName: org.hdrhistogram.HdrHistogram
Bundle-Version: 2.1.12

Created-By: Apache Maven Bundle Plugin
Export-Package: org.HdrHistogram;version="2.1.12",org.HdrHistogram.packe
darray;version="2.1.12"
Implementation-Title:
HdrHistogram
Implementation-Vendor-Id: org.hdrhistogram
Implementation-Version: 2.1.12
Require-Capability: osgi.ee;filter:="(&(osgi.ee=JavaSE)(version=1.7))"
Specification-Title: HdrHistogram
Specification-Version: 2.1.12
Tool: Bnd-2.3.0.201405100607

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* /opt/cola/permits/1097979485_1602212177.99/0/hdrhistogram-2-1-12-1-jar/META-INF/MANIFEST.MF

1.139 hikaricp 3.4.5

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jar/com/zaxxer/hikari/pool/ProxyResultSet.java
* /opt/cola/permits/1097982284_1602212316.23/0/hikaricp-3-4-5-sources-1-
jar/com/zaxxer/hikari/pool/ProxyLeakTaskFactory.java
* /opt/cola/permits/1097982284_1602212316.23/0/hikaricp-3-4-5-sources-1-
jar/com/zaxxer/hikari/pool/ProxyConnection.java
*
/opt/cola/permits/1097982284_1602212316.23/0/hikaricp-3-4-5-sources-1-
jar/com/zaxxer/hikari/util/JavassistProxyFactory.java
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* /opt/cola/permits/1097982284_1602212316.23/0/hikaricp-3-4-5-sources-1-jar/com/zaxxer/hikari/util/DriverDataSource.java
* /opt/cola/permits/1097982284_1602212316.23/0/hikaricp-3-4-5-sources-1-jar/com/zaxxer/hikari/metrics/prometheus/HikariCPCollector.java
* /opt/cola/permits/1097982284_1602212316.23/0/hikaricp-3-4-5-sources-1-jar/com/zaxxer/hikari/pool/ProxyLeakTask.java
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* /opt/cola/permits/1097982284_1602212316.23/0/hikaricp-3-4-5-sources-1-jar/com/zaxxer/hikari/pool/ProxyFactory.java
* /opt/cola/permits/1097982284_1602212316.23/0/hikaricp-3-4-5-sources-1-jar/com/zaxxer/hikari/util/SuspendResumeLock.java
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/opt/cola/permits/1097982284_1602212316.23/0/hikaricp-3-4-5-sources-1-jar/com/zaxxer/hikari/util/ConcurrentBag.java
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* /opt/cola/permits/1097982284_1602212316.23/0/hikaricp-3-4-5-sources-1-jar/com/zaxxer/hikari/metrics/MetricsTrackerFactory.java
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 /opt/cola/permits/1097982284_1602212316.23/0/hikaricp-3-4-5-sources-1-jar/com/zaxxer/hikari/HikariJNDIFactory.java
* /opt/cola/permits/1097982284_1602212316.23/0/hikaricp-3-4-5-sources-1-jar/com/zaxxer/hikari/metrics/dropwizard/CodaHaleMetricsTracker.java
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* /opt/cola/permits/1097982284_1602212316.23/0/hikaricp-3-4-5-sources-1-jar/com/zaxxer/hikari/metrics/PoolStats.java
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* /opt/cola/permits/1097982284_1602212316.23/0/hikaricp-3-4-5-sources-1-jar/com/zaxxer/hikari/metrics/dropwizard/CodahaleHealthChecker.java
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1.140 fdisk 1.1.0

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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/META-INF/maven/org.flywaydb/flyway-core/pom.xml
No license file was found, but licenses were detected in source scan.

```
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```

Found in path(s):
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/resource/filesystem/package-info.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/oracle/OracleDatabase.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-

jar/org/flywaydb/core/internal/util/TimeFormat.java
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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/api/migration/package-info.java
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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/logging/android/AndroidLogCreator.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/h2/H2Schema.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/scanner/classpath/JarFileClassPathLocationScanner.java
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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/command/DbClean.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/firebird/package-info.java
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1.142 docker-engine 19.03.5

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1.143 syslinux 4.07

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1.146 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)'

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its purpose remains meaningful.

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a purpose that is entirely well-defined independent of the
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Section 6 states terms for distribution of such executables.

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Whether this is true is especially significant if the work can be
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If such an object file uses only numerical parameters, data
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functions (ten lines or less in length), then the use of the object
file is unrestricted, regardless of whether it is legally a derivative
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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,
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@item
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@subheading END OF TERMS AND CONDITIONS

@page
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`Frob' (a library for tweaking knobs) written by James Random Hacker.

@var{signature of Ty Coon}, 1 April 1990
Ty Coon, President of Vice
@end smallexample

That's all there is to it!

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Version 3, 29 June 2007

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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:
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Maintainer:
Jim Meyering
$Id: COPYING,v 1.3 2006-10-26 16:20:28 eggert Exp $
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@page
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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

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useful published information such as software, because we are in the
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* Assign the copyright to the Free Software Foundation.
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* Keep the copyright and release the program yourself under the GNU
GPL. (This alternative is too impractical for contributions to a
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* 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.

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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.)

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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.

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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
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you don't copy anything in particular from them. However, referring
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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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this service if you wish), that you receive source code or can get it
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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
The files in this directory describe the gnulib modules.
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changes, but it will not cover other unrelated future changes to the
same program.

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[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?]
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)
Please email the following information to assign@gnu.org, and we will
send you the disclaimer form for your changes. This form is preferred
when your changes are small, they do not add any nontrivial new
files, and you are finished making them (aside perhaps from small bug
fixes).

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and you would like to avoid the need to sign more papers when you
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being disclaimed.]
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:
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Maintainer:
all
Description:
Extract specific portions of filenames.

Files:
lib/dirname.h
lib/dirname-lgpl.c
lib/basename-lgpl.c
lib/stripslash.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 stripslash.c

Include:
"dirname.h"

License:
LGPLv2+

Maintainer:
Jim Meyering, Eric Blake

1.147 hd-parm 9.38

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1.148 libjpeg 8d

1.148.1 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.ucalgary.ca> and later maintained by Mark Mickan.

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To avoid entanglement with the Unisys LZW patent, GIF reading support has
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resulting GIF files are larger than usual, but are readable by all standard
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1.149 libjpeg 9b

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*
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* is executed per IDCT step, only during output pass setup.
*
* Note that the IDCT routines are responsible for performing coefficient
* dequantization as well as the IDCT proper. This module sets up the
* dequantization multiplier table needed by the IDCT routine.
*/

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jddctmgr.c

No license file was found, but licenses were detected in source scan.

/*
* jdapistd.c
*
* This file was part of the Independent JPEG Group's software:
* Copyright (C) 1994-1996, Thomas G. Lane.
* Modifications:
* Copyright (C) 2010, D. R. Commander.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains application interface code for the decompression half
* of the JPEG library. These are the "standard" API routines that are
* used in the normal full-decompression case. They are not used by a
* transcoding-only application. Note that if an application links in
* jpeg_start_decompress, it will end up linking in the entire decompressor.
* We thus must separate this file from jdapimin.c to avoid linking the
* whole decompression library into a transcoder.
*/

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdapistd.c
No license file was found, but licenses were detected in source scan.

/*
* jcmaster.c
*
* This file was part of the Independent JPEG Group's software:
* Copyright (C) 1991-1997, Thomas G. Lane.
* Modified 2003-2010 by Guido Vollbeding.
* Modifications:
* Copyright (C) 2010, D. R. Commander.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains master control logic for the JPEG compressor.
* These routines are concerned with parameter validation, initial setup,
* and inter-pass control (determining the number of passes and the work
* to be done in each pass).
*/

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jcmaster.c
No license file was found, but licenses were detected in source scan.

/*
* jsimd_i386.c

*
* Copyright 2009 Pierre Ossman <ossman@cendio.se> for Cendio AB
* Copyright 2009-2011 D. R. Commander
*
* Based on the x86 SIMD extension for IJG JPEG library,
* Copyright (C) 1999-2006, MIYASAKA Masaru.
* For conditions of distribution and use, see copyright notice in jsimdext.inc
*
* This file contains the interface between the "normal" portions
* of the library and the SIMD implementations when running on a
* 32-bit x86 architecture.
*/

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jsimd_i386.c
No license file was found, but licenses were detected in source scan.

; For conditions of distribution and use, see copyright notice in jsimdext.inc
; for more details.

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jfss2fst-64.asm
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jimmxfst.asm
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jfmmxfst.asm
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jfss2fst.asm
*
 /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jiss2fst.asm
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jiss2fst-64.asm
No license file was found, but licenses were detected in source scan.

/*
* jsimd_none.c
*
* Copyright 2009 Pierre Ossman <ossman@cendio.se> for Cendio AB
* Copyright 2009-2011 D. R. Commander
*
* Based on the x86 SIMD extension for IJG JPEG library,
* Copyright (C) 1999-2006, MIYASAKA Masaru.
* For conditions of distribution and use, see copyright notice in jsimdext.inc
*
* This file contains stubs for when there is no SIMD support available.

```
*/

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jsimd_none.c
No license file was found, but licenses were detected in source scan.

/*
* wrrle.c
*
* Copyright (C) 1991-1996, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains routines to write output images in RLE format.
* The Utah Raster Toolkit library is required (version 3.1 or later).
*
* These routines may need modification for non-Unix environments or
* specialized applications.  As they stand, they assume output to
* an ordinary stdio stream.
*
* Based on code contributed by Mike Lijewski,
* with updates from Robert Hutchinson.
*/

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-
UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/wrrle.c
No license file was found, but licenses were detected in source scan.

/*
* rdgif.c
*
* Copyright (C) 1991-1997, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains routines to read input images in GIF format.
*
**************************************************************************
* NOTE: to avoid entanglements with Unisys' patent on LZW compression,   *
* the ability to read GIF files has been removed from the IJG distribution. *
* Sorry about that.                                                      *
**************************************************************************
*
* We are required to state that
*    "The Graphics Interchange Format(c) is the Copyright property of
*    CompuServe Incorporated. GIF(sm) is a Service Mark property of
```

*   CompuServe Incorporated."
*/

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/rdgif.c
No license file was found, but licenses were detected in source scan.

/*
* jdtrans.c
*
* Copyright (C) 1995-1997, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains library routines for transcoding decompression,
* that is, reading raw DCT coefficient arrays from an input JPEG file.
* The routines in jdapimin.c will also be needed by a transcoder.
*/

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdtrans.c
No license file was found, but licenses were detected in source scan.

libjpeg-turbo note: This image was extracted from the 8-bit nightshot_iso_100
image. The original can be downloaded at the link below.

The New Image Compression Test Set - Jan 2008
http://www.imagecompression.info/test_images

The images historically used for compression research (lena, barbra, pepper etc...) have outlived their useful life and its about time they become a part of history only. They are too small, come from data sources too old and are available in only 8-bit precision.

These images have been carefully selected to aid in image compression algorithm research and evaluation. These are photographic images chosen to come from a wide variety of sources and each one picked to stress different aspects of algorithms. Images are available in 8-bit, 16-bit and 16-bit linear variations, RGB and gray.

Images are available without any prohibitive copyright restrictions.

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3. No payment is required for distribution this material, it must be available freely under the conditions stated here.

That is, it is prohibited to sell the material.
4. This notice may not be removed or altered from any distribution.

Acknowledgments: A lot of people contributed a lot of time and effort in making this test set possible. Thanks to everyone who voiced their opinion in any of the discussions online. Thanks to Axel Becker, Thomas Richter and Niels Frhling for their extensive help in picking images, running all the various tests etc... Thanks to Pete Fraser, Tony
Story, Wayne J. Cosshall, David Coffin, Bruce Lindbloom and raw.fotosite.pl for the images which make up this set.

Sachin Garg [India]
sachingarg@c10n.info

www.sachingarg.com | www.c10n.info | www.imagecompression.info

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/testimages/nightshot_iso_100.txt
No license file was found, but licenses were detected in source scan.

```
/*
* jmorecfg.h
*
* This file was part of the Independent JPEG Group's software:
* Copyright (C) 1991-1997, Thomas G. Lane.
* Modifications:
* Copyright (C) 2009, 2011, D. R. Commander.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains additional configuration options that customize the
* JPEG software for special applications or support machine-dependent
* optimizations.  Most users will not need to touch this file.
*/
```

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jmorecfg.h
No license file was found, but licenses were detected in source scan.

```
/*
* jdcolor.c
*
* This file was part of the Independent JPEG Group's software:
* Copyright (C) 1991-1997, Thomas G. Lane.
* Modified 2011 by Guido Vollbeding.
* Modifications:
* Copyright 2009 Pierre Ossman <ossman@cendio.se> for Cendio AB
```

* Copyright (C) 2009, 2011-2012, D. R. Commander.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains output colorspace conversion routines.
*/

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdcolor.c
No license file was found, but licenses were detected in source scan.

/*
* wrbmp.c
*
* Copyright (C) 1994-1996, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains routines to write output images in Microsoft "BMP"
* format (MS Windows 3.x and OS/2 1.x flavors).
* Either 8-bit colormapped or 24-bit full-color format can be written.
* No compression is supported.
*
* These routines may need modification for non-Unix environments or
* specialized applications. As they stand, they assume output to
* an ordinary stdio stream.
*
* This code contributed by James Arthur Boucher.
*/

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/wrbmp.c
No license file was found, but licenses were detected in source scan.

Package: {__PKGNAME}
Version: {__VERSION}-{__BUILD}
Section: misc
Priority: optional
Architecture: {__ARCH}
Essential: no
Maintainer: The libjpeg-turbo Project [http://www.libjpeg-turbo.org]
Description: A SIMD-accelerated JPEG codec that provides both the libjpeg and TurboJPEG APIs
libjpeg-turbo is a JPEG image codec that uses SIMD instructions (MMX, SSE2,
NEON) to accelerate baseline JPEG compression and decompression on x86,
x86-64, and ARM systems. On such systems, libjpeg-turbo is generally 2-4x as
fast as libjpeg, all else being equal. On other types of systems,
libjpeg-turbo can still outperform libjpeg by a significant amount, by virtue

of its highly-optimized Huffman coding routines. In many cases, the
performance of libjpeg-turbo rivals that of proprietary high-speed JPEG
codecs.
.
libjpeg-turbo implements both the traditional libjpeg API as well as the less
powerful but more straightforward TurboJPEG
 API. libjpeg-turbo also features
colorspace extensions that allow it to compress from/decompress to 32-bit and
big-endian pixel buffers (RGBX, XBGR, etc.), as well as a full-featured Java
interface.
.
libjpeg-turbo was originally based on libjpeg/SIMD, an MMX-accelerated
derivative of libjpeg v6b developed by Miyasaka Masaru. The TigerVNC and
VirtualGL projects made numerous enhancements to the codec in 2009, and in
early 2010, libjpeg-turbo spun off into an independent project, with the goal
of making high-speed JPEG compression/decompression technology available to a
broader range of users and developers.

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/release/deb-control.tmpl
No license file was found, but licenses were detected in source scan.

/*
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*
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*
* - Redistributions of source code must retain the above copyright notice,
*   this list of conditions and the following disclaimer.
* - Redistributions in binary form must reproduce the above copyright notice,
*   this list of conditions and the following disclaimer in the documentation
*   and/or other materials provided with the distribution.
* - Neither the name of the libjpeg-turbo Project nor the names of its
*   contributors may be used to endorse or promote products derived from this
*   software without specific prior written permission.
*
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* POSSIBILITY OF SUCH DAMAGE.
*/

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/java/org/libjpegturbo/turbojpeg/TJLoader.java
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/java/TJUnitTest.java
*
 /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/java/org/libjpegturbo/turbojpeg/TJCompressor.java
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/java/org/libjpegturbo/turbojpeg/TJ.java
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/turbojpeg-jni.c
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/java/TJExample.java
*
 /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/java/org/libjpegturbo/turbojpeg/TJDecompressor.java
No license file was found, but licenses were detected in source scan.

/*
* jdatasrc-tj.c
*
* This file was part of the Independent JPEG Group's software:
* Copyright (C) 1994-1996, Thomas G. Lane.
* Modified 2009-2011 by Guido Vollbeding.
* Modifications:
* Copyright (C) 2011, D. R. Commander.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains decompression data source routines for the case of
* reading JPEG data from memory or from a file (or any stdio stream).
* While these routines are sufficient for most applications,
* some will want to use a different source manager.
* IMPORTANT: we assume that fread() will correctly transcribe an array of
* JOCTETs from 8-bit-wide elements on external storage. If char is wider
* than 8 bits on your machine, you may need to do some tweaking.
*/

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-

UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdatasrc-tj.c
No license file was found, but licenses were detected in source scan.

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{\fonttbl\f0\fswiss\fcharset0 Helvetica;}
{\colortbl;\red255\green255\blue255;}
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;}{\levelnumbers;}\fi-360\li720\lin720 }{\listname ;}\listid1}}
{*\listoverridetable{\listoverride\listid1\listoverridecount0\ls1}}
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\deftab720
\pard\pardeftab720

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}

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/release/License.rtf
No license file was found, but licenses were detected in source scan.

/*
* jdcoefct.c
*

* This file was part of the Independent JPEG Group's software:
* Copyright (C) 1994-1997, Thomas G. Lane.
* Modifications:
* Copyright (C) 2010, D. R. Commander.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains the coefficient buffer controller for decompression.
* This controller is the top level of the JPEG decompressor proper.
* The coefficient buffer lies between entropy decoding and inverse-DCT steps.
*
* In buffered-image mode, this controller is the interface between
* input-oriented processing and output-oriented processing.
* Also, the input side (only) is used when reading a file for transcoding.
*/

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdcoefct.c
No license file was found, but licenses were detected in source scan.

/*
* jcinit.c
*
* Copyright (C) 1991-1997, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains initialization logic for the JPEG compressor.
* This routine is in charge of selecting the modules to be executed and
* making an initialization call to each one.
*
* Logically, this code belongs in jcmaster.c. It's split out because
* linking this routine implies linking the entire compression library.
* For a transcoding-only application, we want to be able to use jcmaster.c
* without linking in the whole library.
*/

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jcinit.c
No license file was found, but licenses were detected in source scan.

****
** Background
****

libjpeg-turbo is a JPEG image codec that uses SIMD instructions (MMX, SSE2,
NEON) to accelerate baseline JPEG compression and decompression on x86, x86-64,

and ARM systems. On such systems, libjpeg-turbo is generally 2-4x as fast as
libjpeg, all else being equal. On other types of systems, libjpeg-turbo can
still outperform libjpeg by a significant amount, by virtue of its
highly-optimized Huffman coding routines. In many cases, the performance of
libjpeg-turbo rivals that of proprietary high-speed JPEG codecs.

libjpeg-turbo implements both the traditional libjpeg API as well as the less
powerful but more straightforward TurboJPEG API. libjpeg-turbo also features
colorspace extensions that allow it to compress from/decompress to 32-bit
 and
big-endian pixel buffers (RGBX, XBGR, etc.), as well as a full-featured Java
interface.

libjpeg-turbo was originally based on libjpeg/SIMD, an MMX-accelerated
derivative of libjpeg v6b developed by Miyasaka Masaru. The TigerVNC and
VirtualGL projects made numerous enhancements to the codec in 2009, and in
early 2010, libjpeg-turbo spun off into an independent project, with the goal
of making high-speed JPEG compression/decompression technology available to a
broader range of users and developers.

****
** License
****

Most of libjpeg-turbo inherits the non-restrictive, BSD-style license used by
libjpeg (see README.) The TurboJPEG wrapper (both C and Java versions) and
associated test programs bear a similar license, which is reproduced below:

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****
** Using libjpeg-turbo
****

libjpeg-turbo includes two APIs that can be used to compress and decompress JPEG images:

TurboJPEG API: This API provides an easy-to-use interface for compressing and decompressing JPEG images in memory. It also provides some functionality that would not be straightforward to achieve using the underlying libjpeg API, such as generating planar YUV images and performing multiple simultaneous lossless transforms on an image. The Java interface for
libjpeg-turbo is written on top of the TurboJPEG API.

libjpeg API: This is the de facto industry-standard API for compressing and decompressing JPEG images. It is more difficult to use than the TurboJPEG API but also more powerful. The libjpeg API implementation in libjpeg-turbo is both API/ABI-compatible and mathematically compatible with libjpeg v6b. It can also optionally be configured to be API/ABI-compatible with libjpeg v7 and v8 (see below.)

There is no significant performance advantage to either API when both are used to perform similar operations.

==========
Installation Directory
==========

This document assumes that libjpeg-turbo will be installed in the default directory (/opt/libjpeg-turbo on Un*x and Mac systems and c:\libjpeg-turbo[-gcc][64] on Windows systems. If your installation of libjpeg-turbo resides in a different directory, then adjust the instructions accordingly.

==========
Replacing libjpeg
at Run Time
==========

Un*x

If a Un*x application is dynamically linked with libjpeg, then you can replace
libjpeg with libjpeg-turbo at run time by manipulating LD_LIBRARY_PATH.
For instance:

```
 [Using libjpeg]
 > time cjpeg <vgl_5674_0098.ppm >vgl_5674_0098.jpg
 real  0m0.392s
 user  0m0.074s
 sys   0m0.020s

 [Using libjpeg-turbo]
 > export LD_LIBRARY_PATH=/opt/libjpeg-turbo/{lib}:$LD_LIBRARY_PATH
 > time cjpeg <vgl_5674_0098.ppm >vgl_5674_0098.jpg
 real  0m0.109s
 user  0m0.029s
 sys   0m0.010s
```

({lib} = lib32 or lib64, depending on whether you wish to use the 32-bit or the
64-bit version of libjpeg-turbo.)

System administrators can also replace the libjpeg symlinks in /usr/lib* with
links to the libjpeg-turbo dynamic library located in /opt/libjpeg-turbo/{lib}.
This will effectively accelerate every application that uses the libjpeg
dynamic library on the system.

Windows

If a Windows application is dynamically linked with libjpeg,
 then you can
replace libjpeg with libjpeg-turbo at run time by backing up the application's
copy of jpeg62.dll, jpeg7.dll, or jpeg8.dll (assuming the application has its
own local copy of this library) and copying the corresponding DLL from
libjpeg-turbo into the application's install directory. The official
libjpeg-turbo binary packages only provide jpeg62.dll. If the application uses
jpeg7.dll or jpeg8.dll instead, then it will be necessary to build
libjpeg-turbo from source (see "libjpeg v7 and v8 API/ABI Emulation" below.)

The following information is specific to the official libjpeg-turbo binary
packages for Visual C++:

-- jpeg62.dll requires the Visual C++ 2008 C run-time DLL (msvcr90.dll).
msvcr90.dll ships with more recent versions of Windows, but users of older
Windows releases can obtain it from the Visual C++ 2008 Redistributable
Package, which is available as a free download from Microsoft's web site.

-- Features of the libjpeg API that require passing a C run-time
 structure,
such as a file handle, from an application to the library will probably not
work with jpeg62.dll, unless the application is also built to use the Visual
C++ 2008 C run-time DLL. In particular, this affects jpeg_stdio_dest() and
jpeg_stdio_src().

Mac

Mac applications typically embed their own copies of the libjpeg dylib inside
the (hidden) application bundle, so it is not possible to globally replace
libjpeg on OS X systems. Replacing the application's version of the libjpeg
dylib would generally involve copying libjpeg.*.dylib from libjpeg-turbo into
the appropriate place in the application bundle and using install_name_tool to
repoint the libjpeg-turbo dylib to its new directory. This requires an
advanced knowledge of OS X and would not survive an upgrade or a re-install of
the application. Thus, it is not recommended for most users.

==========
Using libjpeg-turbo in Your Own Programs
==========

For the
 most part, libjpeg-turbo should work identically to libjpeg, so in
most cases, an application can be built against libjpeg and then run against
libjpeg-turbo. On Un*x systems and Cygwin, you can build against libjpeg-turbo
instead of libjpeg by setting

 CPATH=/opt/libjpeg-turbo/include
 and
 LIBRARY_PATH=/opt/libjpeg-turbo/{lib}

({lib} = lib32 or lib64, depending on whether you are building a 32-bit or a
64-bit application.)

If using MinGW, then set

 CPATH=/c/libjpeg-turbo-gcc[64]/include
 and
 LIBRARY_PATH=/c/libjpeg-turbo-gcc[64]/lib

Building against libjpeg-turbo is useful, for instance, if you want to build an
application that leverages the libjpeg-turbo colorspace extensions (see below.)
On Un*x systems, you would still need to manipulate LD_LIBRARY_PATH or create
appropriate symlinks to use libjpeg-turbo at run time. On such systems, you
can pass -R /opt/libjpeg-turbo/{lib} to the linker to force the use of

libjpeg-turbo at run time rather than libjpeg (also useful
if you want to
leverage the colorspace extensions), or you can link against the libjpeg-turbo
static library.

To force a Un*x or MinGW application to link against the static version of
libjpeg-turbo, you can use the following linker options:

-Wl,-Bstatic -ljpeg -Wl,-Bdynamic

On OS X, simply add /opt/libjpeg-turbo/lib/libjpeg.a to the linker command
line.

To build Visual C++ applications using libjpeg-turbo, add
c:\libjpeg-turbo[64]\include to the system or user INCLUDE environment
variable and c:\libjpeg-turbo[64]\lib to the system or user LIB environment
variable, and then link against either jpeg.lib (to use the DLL version of
libjpeg-turbo) or jpeg-static.lib (to use the static version of libjpeg-turbo.)

==========
Colorspace Extensions
==========

libjpeg-turbo includes extensions that allow JPEG images to be compressed
directly from (and decompressed directly to) buffers that use BGR, BGRX,
RGBX, XBGR, and XRGB pixel ordering. This is implemented with
ten new
colorspace constants:

```
JCS_EXT_RGB   /* red/green/blue */
JCS_EXT_RGBX  /* red/green/blue/x */
JCS_EXT_BGR   /* blue/green/red */
JCS_EXT_BGRX  /* blue/green/red/x */
JCS_EXT_XBGR  /* x/blue/green/red */
JCS_EXT_XRGB  /* x/red/green/blue */
JCS_EXT_RGBA  /* red/green/blue/alpha */
JCS_EXT_BGRA  /* blue/green/red/alpha */
JCS_EXT_ABGR  /* alpha/blue/green/red */
JCS_EXT_ARGB  /* alpha/red/green/blue */
```

Setting cinfo.in_color_space (compression) or cinfo.out_color_space
(decompression) to one of these values will cause libjpeg-turbo to read the
red, green, and blue values from (or write them to) the appropriate position in
the pixel when compressing from/decompressing to an RGB buffer.

Your application can check for the existence of these extensions at compile
time with:

#ifdef JCS_EXTENSIONS

At run time, attempting to use these extensions with a libjpeg implementation
that does not support them will result in a "Bogus input colorspace" error.
Applications
can trap this error in order to test whether run-time support is
available for the colorspace extensions.

When using the RGBX, BGRX, XBGR, and XRGB colorspaces during decompression, the
X byte is undefined, and in order to ensure the best performance, libjpeg-turbo
can set that byte to whatever value it wishes. If an application expects the X
byte to be used as an alpha channel, then it should specify JCS_EXT_RGBA,
JCS_EXT_BGRA, JCS_EXT_ABGR, or JCS_EXT_ARGB. When these colorspace constants
are used, the X byte is guaranteed to be 0xFF, which is interpreted as opaque.

Your application can check for the existence of the alpha channel colorspace
extensions at compile time with:

#ifdef JCS_ALPHA_EXTENSIONS

jcstest.c, located in the libjpeg-turbo source tree, demonstrates how to check
for the existence of the colorspace extensions at compile time and run time.

==========
libjpeg v7 and v8 API/ABI Emulation
==========

With libjpeg
v7 and v8, new features were added that necessitated extending the
compression and decompression structures. Unfortunately, due to the exposed
nature of those structures, extending them also necessitated breaking backward
ABI compatibility with previous libjpeg releases. Thus, programs that were
built to use libjpeg v7 or v8 did not work with libjpeg-turbo, since it is
based on the libjpeg v6b code base. Although libjpeg v7 and v8 are still not
as widely used as v6b, enough programs (including a few Linux distros) made
the switch that there was a demand to emulate the libjpeg v7 and v8 ABIs
in libjpeg-turbo. It should be noted, however, that this feature was added
primarily so that applications that had already been compiled to use libjpeg
v7+ could take advantage of accelerated baseline JPEG encoding/decoding
without recompiling. libjpeg-turbo does not claim to support all of the
libjpeg v7+ features, nor to produce identical output to libjpeg v7+ in all
cases (see below.)

By
passing an argument of --with-jpeg7 or --with-jpeg8 to configure, or an
argument of -DWITH_JPEG7=1 or -DWITH_JPEG8=1 to cmake, you can build a version
of libjpeg-turbo that emulates the libjpeg v7 or v8 ABI, so that programs
that are built against libjpeg v7 or v8 can be run with libjpeg-turbo. The

following section describes which libjpeg v7+ features are supported and which aren't.

Support for libjpeg v7 and v8 Features:

Fully supported:

-- libjpeg: IDCT scaling extensions in decompressor
libjpeg-turbo supports IDCT scaling with scaling factors of 1/8, 1/4, 3/8, 1/2, 5/8, 3/4, 7/8, 9/8, 5/4, 11/8, 3/2, 13/8, 7/4, 15/8, and 2/1 (only 1/4 and 1/2 are SIMD-accelerated.)

-- libjpeg: arithmetic coding

-- libjpeg: In-memory source and destination managers
See notes below.

-- cjpeg: Separate quality settings for luminance and chrominance
Note that the libpjeg v7+ API was extended to accommodate this feature only for convenience
purposes. It has always been possible to implement this feature with libjpeg v6b (see rdswitch.c for an example.)

-- cjpeg: 32-bit BMP support

-- cjpeg: -rgb option

-- jpegtran: lossless cropping

-- jpegtran: -perfect option

-- jpegtran: forcing width/height when performing lossless crop

-- rdjpgcom: -raw option

-- rdjpgcom: locale awareness

Not supported:

NOTE: As of this writing, extensive research has been conducted into the usefulness of DCT scaling as a means of data reduction and SmartScale as a means of quality improvement. The reader is invited to peruse the research at http://www.libjpeg-turbo.org/About/SmartScale and draw his/her own conclusions, but it is the general belief of our project that these features have not demonstrated sufficient usefulness to justify inclusion in libjpeg-turbo.

-- libjpeg: DCT scaling in compressor
 cinfo.scale_num and cinfo.scale_denom are silently ignored.
 There is no technical reason why DCT scaling could not be supported
when
 emulating the libjpeg v7+ API/ABI, but without the SmartScale extension (see
 below), only scaling factors of 1/2, 8/15, 4/7, 8/13, 2/3, 8/11, 4/5, and
 8/9 would be available, which is of limited usefulness.

-- libjpeg: SmartScale
 cinfo.block_size is silently ignored.
 SmartScale is an extension to the JPEG format that allows for DCT block
 sizes other than 8x8. Providing support for this new format would be
 feasible (particularly without full acceleration.) However, until/unless
 the format becomes either an official industry standard or, at minimum, an
 accepted solution in the community, we are hesitant to implement it, as
 there is no sense of whether or how it might change in the future. It is
 our belief that SmartScale has not demonstrated sufficient usefulness as a
 lossless format nor as a means of quality enhancement, and thus, our primary
 interest in providing this feature would be as a means of supporting
 additional DCT scaling
factors.

-- libjpeg: Fancy downsampling in compressor
 cinfo.do_fancy_downsampling is silently ignored.
 This requires the DCT scaling feature, which is not supported.

-- jpegtran: Scaling
 This requires both the DCT scaling and SmartScale features, which are not
 supported.

-- Lossless RGB JPEG files
 This requires the SmartScale feature, which is not supported.

What About libjpeg v9?
---

libjpeg v9 introduced yet another field to the JPEG compression structure
(color_transform), thus making the ABI backward incompatible with that of
libjpeg v8. This new field was introduced solely for the purpose of supporting
lossless SmartScale encoding. Further, there was actually no reason to extend
the API in this manner, as the color transform could have just as easily been
activated by way of a new JPEG colorspace constant, thus preserving backward
ABI compatibility.

Our research (see link above) has shown that lossless SmartScale does not
generally accomplish
 anything that can't already be accomplished better with
existing, standard lossless formats. Thus, at this time, it is our belief that

there is not sufficient technical justification for software to upgrade from
libjpeg v8 to libjpeg v9, and therefore, not sufficient technical justification
for us to emulate the libjpeg v9 ABI.

==========
In-Memory Source/Destination Managers
==========

By default, libjpeg-turbo 1.3 and later includes the jpeg_mem_src() and
jpeg_mem_dest() functions, even when not emulating the libjpeg v8 API/ABI.
Previously, it was necessary to build libjpeg-turbo from source with libjpeg v8
API/ABI emulation in order to use the in-memory source/destination managers,
but several projects requested that those functions be included when emulating
the libjpeg v6b API/ABI as well. This allows the use of those functions by
programs that need them without breaking ABI compatibility for programs that
don't, and
it allows those functions to be provided in the "official"
libjpeg-turbo binaries.

Those who are concerned about maintaining strict conformance with the libjpeg
v6b or v7 API can pass an argument of --without-mem-srcdst to configure or
an argument of -DWITH_MEM_SRCDST=0 to CMake prior to building libjpeg-turbo.
This will restore the pre-1.3 behavior, in which jpeg_mem_src() and
jpeg_mem_dest() are only included when emulating the libjpeg v8 API/ABI.

On Un*x systems, including the in-memory source/destination managers changes
the dynamic library version from 62.0.0 to 62.1.0 if using libjpeg v6b API/ABI
emulation and from 7.0.0 to 7.1.0 if using libjpeg v7 API/ABI emulation.

Note that, on most Un*x systems, the dynamic linker will not look for a
function in a library until that function is actually used. Thus, if a program
is built against libjpeg-turbo 1.3+ and uses jpeg_mem_src() or jpeg_mem_dest(),
that program will not fail if run against an older version of libjpeg-turbo or
against
libjpeg v7- until the program actually tries to call jpeg_mem_src() or
jpeg_mem_dest(). Such is not the case on Windows. If a program is built
against the libjpeg-turbo 1.3+ DLL and uses jpeg_mem_src() or jpeg_mem_dest(),
then it must use the libjpeg-turbo 1.3+ DLL at run time.

Both cjpeg and djpeg have been extended to allow testing the in-memory
source/destination manager functions. See their respective man pages for more
details.

****
** Mathematical Compatibility
****

For the most part, libjpeg-turbo should produce identical output to libjpeg
v6b. The one exception to this is when using the floating point DCT/IDCT, in
which case the outputs of libjpeg v6b and libjpeg-turbo are not guaranteed to
be identical (the accuracy of the floating point DCT/IDCT is constant when
using libjpeg-turbo's SIMD extensions, but otherwise,
 it can depend heavily on
the compiler and compiler settings.)

While libjpeg-turbo does emulate the libjpeg v8 API/ABI, under the hood, it is
still using the same algorithms as libjpeg v6b, so there are several specific
cases in which libjpeg-turbo cannot be expected to produce the same output as
libjpeg v8:

-- When decompressing using scaling factors of 1/2 and 1/4, because libjpeg v8
  implements those scaling algorithms a bit differently than libjpeg v6b does,
  and libjpeg-turbo's SIMD extensions are based on the libjpeg v6b behavior.

-- When using chrominance subsampling, because libjpeg v8 implements this
  with its DCT/IDCT scaling algorithms rather than with a separate
  downsampling/upsampling algorithm.

-- When using the floating point IDCT, for the reasons stated above and also
  because the floating point IDCT algorithm was modified in libjpeg v8a to
  improve accuracy.

-- When decompressing using a scaling factor > 1 and merged (AKA "non-fancy" or
  "non-smooth")
 chrominance upsampling, because libjpeg v8 does not support
  merged upsampling with scaling factors > 1.

****
** Performance Pitfalls
****

==========
Restart Markers
==========

The optimized Huffman decoder in libjpeg-turbo does not handle restart markers
in a way that makes the rest of the libjpeg infrastructure happy, so it is
necessary to use the slow Huffman decoder when decompressing a JPEG image that
has restart markers. This can cause the decompression performance to drop by
as much as 20%, but the performance will still be much greater than that of
libjpeg. Many consumer packages, such as PhotoShop, use restart markers when
generating JPEG images, so images generated by those programs will experience
this issue.

==========
Fast Integer Forward DCT at High Quality Levels
==========

The
 algorithm used by the SIMD-accelerated quantization function cannot produce
correct results whenever the fast integer forward DCT is used along with a JPEG
quality of 98-100. Thus, libjpeg-turbo must use the non-SIMD quantization
function in those cases. This causes performance to drop by as much as 40%.
It is therefore strongly advised that you use the slow integer forward DCT
whenever encoding images with a JPEG quality of 98 or higher.

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/README-turbo.txt
No license file was found, but licenses were detected in source scan.

```
/*
* jsimddct.h
*
* Copyright 2009 Pierre Ossman <ossman@cendio.se> for Cendio AB
*
* Based on the x86 SIMD extension for IJG JPEG library,
* Copyright (C) 1999-2006, MIYASAKA Masaru.
* For conditions of distribution and use, see copyright notice in jsimdext.inc
*
*/
```

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jsimddct.h
No license file was found, but licenses were detected in source scan.

```
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#
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#
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```

```
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# CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE)
# ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE
# POSSIBILITY OF SUCH DAMAGE.

#!/bin/sh

if [ ! "`id -u`" = "0" ]; then
 echo "ERROR: This script must be executed as root"
 exit -1
fi

PACKAGE=@PACKAGE_NAME@
MACPACKAGE=com.$PACKAGE.$PACKAGE
RECEIPT=/Library/Receipts/$PACKAGE.pkg

LSBOM=
if [ -d $RECEIPT ]; then
 LSBOM='lsbom -s -f -l '$RECEIPT'/Contents/Archive.bom'
else
 LSBOM='pkgutil --files '$MACPACKAGE
fi

mylsbom()
{
 $LSBOM || (echo "ERROR: Could
 not list package contents"; exit -1)
}

echo Removing package files ...
EXITSTATUS=0
pushd /
mylsbom | while read file; do
 if [ ! -d "$file" ]; then rm "$file" 2>&1 || EXITSTATUS=-1; fi
done
popd

echo Removing package directories ...
if [ -d /opt/$PACKAGE/bin ]; then
 rmdir /opt/$PACKAGE/bin 2>&1 || EXITSTATUS=-1
fi
```

```
if [ -d /opt/$PACKAGE/lib ]; then
 rmdir /opt/$PACKAGE/lib 2>&1 || EXITSTATUS=-1
fi
if [ -d /opt/$PACKAGE/include ]; then
 rmdir /opt/$PACKAGE/include 2>&1 || EXITSTATUS=-1
fi
rm /opt/$PACKAGE/lib32 2>&1 || EXITSTATUS=-1
rm /opt/$PACKAGE/lib64 2>&1 || EXITSTATUS=-1
if [ -d /opt/$PACKAGE/man/man1 ]; then
 rmdir /opt/$PACKAGE/man/man1 2>&1 || EXITSTATUS=-1
fi
if [ -d /opt/$PACKAGE/man ]; then
 rmdir /opt/$PACKAGE/man 2>&1 || EXITSTATUS=-1
fi
if [ -d /opt/$PACKAGE/classes ]; then
 rmdir /opt/$PACKAGE/classes 2>&1 || EXITSTATUS=-1
fi
rmdir /opt/$PACKAGE 2>&1 || EXITSTATUS=-1
rmdir /Library/Documentation/$PACKAGE 2>&1 || EXITSTATUS=-1

if [ -d $RECEIPT ]; then
 echo Removing
 package receipt ...
 rm -r $RECEIPT 2>&1 || EXITSTATUS=-1
else
 echo Forgetting package $MACPACKAGE ...
 pkgutil --forget $MACPACKAGE
fi

exit $EXITSTATUS
```

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/release/uninstall.in
No license file was found, but licenses were detected in source scan.

```
/*
* jdapimin.c
*
* Copyright (C) 1994-1998, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains application interface code for the decompression half
* of the JPEG library.  These are the "minimum" API routines that may be
* needed in either the normal full-decompression case or the
* transcoding-only case.
*
```

* Most of the routines intended to be called directly by an application
* are in this file or in jdapistd.c. But also see jcomapi.c for routines
* shared by compression and decompression, and jdtrans.c for the transcoding
* case.
*/

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdapimin.c
No license file was found, but licenses were detected in source scan.

IJG JPEG LIBRARY: SYSTEM ARCHITECTURE

Copyright (C) 1991-2012, Thomas G. Lane, Guido Vollbeding.
This file was part of the Independent JPEG Group's software.
It was modified by The libjpeg-turbo Project to include only information
relevant to libjpeg-turbo.
For conditions of distribution and use, see the accompanying README file.

This file provides an overview of the architecture of the IJG JPEG software;
that is, the functions of the various modules in the system and the interfaces
between modules. For more precise details about any data structure or calling
convention, see the include files and comments in the source code.

We assume that the reader is already somewhat familiar with the JPEG standard.
The README file includes references for learning about JPEG. The file
libjpeg.txt describes the library from the viewpoint of an application
programmer using the library; it's best to read that file before this
 one.
Also, the file coderules.txt describes the coding style conventions we use.

In this document, JPEG-specific terminology follows the JPEG standard:
 A "component" means a color channel, e.g., Red or Luminance.
 A "sample" is a single component value (i.e., one number in the image data).
 A "coefficient" is a frequency coefficient (a DCT transform output number).
 A "block" is an 8x8 group of samples or coefficients.
 An "MCU" (minimum coded unit) is an interleaved set of blocks of size
 determined by the sampling factors, or a single block in a
 noninterleaved scan.
We do not use the terms "pixel" and "sample" interchangeably. When we say
pixel, we mean an element of the full-size image, while a sample is an element
of the downsampled image. Thus the number of samples may vary across
components while the number of pixels does not. (This terminology is not used
rigorously throughout the code, but it is used in places where confusion would
otherwise result.)

*** System features
***

The IJG distribution contains two parts:
* A subroutine library for JPEG compression and decompression.
* cjpeg/djpeg, two sample applications that use the library to transform
JFIF JPEG files to and from several other image formats.
cjpeg/djpeg are of no great intellectual complexity: they merely add a simple
command-line user interface and I/O routines for several uncompressed image
formats. This document concentrates on the library itself.

We desire the library to be capable of supporting all JPEG baseline, extended
sequential, and progressive DCT processes. Hierarchical processes are not
supported.

The library does not support the lossless (spatial) JPEG process. Lossless
JPEG shares little or no code with lossy JPEG, and would normally be used
without the extensive pre- and post-processing provided by this library.
We feel that lossless JPEG is better handled by a separate library.

Within these limits, any set of compression parameters allowed by the JPEG
spec
should be readable for decompression. (We can be more restrictive about
what formats we can generate.) Although the system design allows for all
parameter values, some uncommon settings are not yet implemented and may
never be; nonintegral sampling ratios are the prime example. Furthermore,
we treat 8-bit vs. 12-bit data precision as a compile-time switch, not a
run-time option, because most machines can store 8-bit pixels much more
compactly than 12-bit.

By itself, the library handles only interchange JPEG datastreams --- in
particular the widely used JFIF file format. The library can be used by
surrounding code to process interchange or abbreviated JPEG datastreams that
are embedded in more complex file formats. (For example, libtiff uses this
library to implement JPEG compression within the TIFF file format.)

The library includes a substantial amount of code that is not covered by the
JPEG standard but is necessary for typical applications of JPEG. These
functions preprocess
the image before JPEG compression or postprocess it after
decompression. They include colorspace conversion, downsampling/upsampling,
and color quantization. This code can be omitted if not needed.

A wide range of quality vs. speed tradeoffs are possible in JPEG processing,
and even more so in decompression postprocessing. The decompression library
provides multiple implementations that cover most of the useful tradeoffs,
ranging from very-high-quality down to fast-preview operation. On the
compression side we have generally not provided low-quality choices, since

compression is normally less time-critical. It should be understood that the low-quality modes may not meet the JPEG standard's accuracy requirements; nonetheless, they are useful for viewers.

*** Portability issues ***

Portability is an essential requirement for the library. The key portability issues that show up at the level of system architecture are:

1. Memory usage. We want the code to be able to run
on PC-class machines
with limited memory. Images should therefore be processed sequentially (in strips), to avoid holding the whole image in memory at once. Where a full-image buffer is necessary, we should be able to use either virtual memory or temporary files.

2. Near/far pointer distinction. To run efficiently on 80x86 machines, the code should distinguish "small" objects (kept in near data space) from "large" ones (kept in far data space). This is an annoying restriction, but fortunately it does not impact code quality for less brain-damaged machines, and the source code clutter turns out to be minimal with sufficient use of pointer typedefs.

3. Data precision. We assume that "char" is at least 8 bits, "short" and "int" at least 16, "long" at least 32. The code will work fine with larger data sizes, although memory may be used inefficiently in some cases. However, the JPEG compressed datastream must ultimately appear on external storage as a sequence of 8-bit bytes if it
is to conform to the standard. This may pose a
problem on machines where char is wider than 8 bits. The library represents compressed data as an array of values of typedef JOCTET. If no data type exactly 8 bits wide is available, custom data source and data destination modules must be written to unpack and pack the chosen JOCTET datatype into 8-bit external representation.

*** System overview ***

The compressor and decompressor are each divided into two main sections: the JPEG compressor or decompressor proper, and the preprocessing or postprocessing functions. The interface between these two sections is the image data that the official JPEG spec regards as its input or output: this data is in the colorspace to be used for compression, and it is downsampled to the sampling factors to be used. The preprocessing and postprocessing steps are responsible for converting a normal image representation to or from this form. (Those few applications that want to deal with YCbCr downsampled data

can skip the preprocessing or postprocessing step.)

Looking more closely, the compressor library contains the following main elements:

Preprocessing:
* Color space conversion (e.g., RGB to YCbCr).
* Edge expansion and downsampling. Optionally, this step can do simple smoothing --- this is often helpful for low-quality source data.

JPEG proper:
* MCU assembly, DCT, quantization.
* Entropy coding (sequential or progressive, Huffman or arithmetic).

In addition to these modules we need overall control, marker generation, and support code (memory management & error handling). There is also a module responsible for physically writing the output data --- typically this is just an interface to fwrite(), but some applications may need to do something else with the data.

The decompressor library contains the following main elements:

JPEG proper:
* Entropy decoding (sequential or progressive, Huffman or arithmetic).
* Dequantization, inverse DCT,

MCU disassembly.

Postprocessing:
* Upsampling. Optionally, this step may be able to do more general rescaling of the image.
* Color space conversion (e.g., YCbCr to RGB). This step may also provide gamma adjustment [currently it does not].
* Optional color quantization (e.g., reduction to 256 colors).
* Optional color precision reduction (e.g., 24-bit to 15-bit color). [This feature is not currently implemented.]

We also need overall control, marker parsing, and a data source module. The support code (memory management & error handling) can be shared with the compression half of the library.

There may be several implementations of each of these elements, particularly in the decompressor, where a wide range of speed/quality tradeoffs is very useful. It must be understood that some of the best speedups involve merging adjacent steps in the pipeline. For example, upsampling, color space conversion, and color quantization might all be done at once when using a low-quality ordered-dither technique. The system architecture is designed to allow such merging where appropriate.

Note: it is convenient to regard edge expansion (padding to block boundaries)
as a preprocessing/postprocessing function, even though the JPEG spec includes
it in compression/decompression. We do this because downsampling/upsampling
can be simplified a little if they work on padded data: it's not necessary to
have special cases at the right and bottom edges. Therefore the interface
buffer is always an integral number of blocks wide and high, and we expect
compression preprocessing to pad the source data properly. Padding will occur
only to the next block (8-sample) boundary. In an interleaved-scan situation,
additional dummy blocks may be used to fill out MCUs, but the MCU assembly and
disassembly logic will create or discard these blocks internally. (This is
advantageous for speed reasons, since we avoid DCTing the dummy blocks.
It also permits a
small reduction in file size, because the compressor can
choose dummy block contents so as to minimize their size in compressed form.
Finally, it makes the interface buffer specification independent of whether
the file is actually interleaved or not.) Applications that wish to deal
directly with the downsampled data must provide similar buffering and padding
for odd-sized images.

*** Poor man's object-oriented programming ***

It should be clear by now that we have a lot of quasi-independent processing
steps, many of which have several possible behaviors. To avoid cluttering the
code with lots of switch statements, we use a simple form of object-style
programming to separate out the different possibilities.

For example, two different color quantization algorithms could be implemented
as two separate modules that present the same external interface; at runtime,
the calling code will access the proper module indirectly through an "object".

We can get the limited features we need while
staying within portable C.
The basic tool is a function pointer. An "object" is just a struct
containing one or more function pointer fields, each of which corresponds to
a method name in real object-oriented languages. During initialization we
fill in the function pointers with references to whichever module we have
determined we need to use in this run. Then invocation of the module is done
by indirecting through a function pointer; on most machines this is no more
expensive than a switch statement, which would be the only other way of
making the required run-time choice. The really significant benefit, of
course, is keeping the source code clean and well structured.

We can also arrange to have private storage that varies between different
implementations of the same kind of object. We do this by making all the
module-specific object structs be separately allocated entities, which will
be accessed via pointers in the master compression or decompression struct.
The "public"

fields or methods for a given kind of object are specified by
a commonly known struct. But a module's initialization code can allocate
a larger struct that contains the common struct as its first member, plus
additional private fields. With appropriate pointer casting, the module's
internal functions can access these private fields. (For a simple example,
see jdatadst.c, which implements the external interface specified by struct
jpeg_destination_mgr, but adds extra fields.)

(Of course this would all be a lot easier if we were using C++, but we are
not yet prepared to assume that everyone has a C++ compiler.)

An important benefit of this scheme is that it is easy to provide multiple
versions of any method, each tuned to a particular case. While a lot of
precalculation might be done to select an optimal implementation of a method,
the cost per invocation is constant. For example, the upsampling step might
have a "generic" method, plus one or more "hardwired" methods for the most
popular
sampling factors; the hardwired methods would be faster because they'd
use straight-line code instead of for-loops. The cost to determine which
method to use is paid only once, at startup, and the selection criteria are
hidden from the callers of the method.

This plan differs a little bit from usual object-oriented structures, in that
only one instance of each object class will exist during execution. The
reason for having the class structure is that on different runs we may create
different instances (choose to execute different modules). You can think of
the term "method" as denoting the common interface presented by a particular
set of interchangeable functions, and "object" as denoting a group of related
methods, or the total shared interface behavior of a group of modules.

*** Overall control structure ***

We previously mentioned the need for overall control logic in the compression
and decompression libraries. In IJG implementations prior to v5, overall
control was
mostly provided by "pipeline control" modules, which proved to be
large, unwieldy, and hard to understand. To improve the situation, the
control logic has been subdivided into multiple modules. The control modules
consist of:

1. Master control for module selection and initialization. This has two
responsibilities:

1A. Startup initialization at the beginning of image processing.
The individual processing modules to be used in this run are selected
and given initialization calls.

1B. Per-pass control. This determines how many passes will be performed and calls each active processing module to configure itself appropriately at the beginning of each pass. End-of-pass processing, where necessary, is also invoked from the master control module.

Method selection is partially distributed, in that a particular processing module may contain several possible implementations of a particular method, which it will select among when given its initialization call. The master control code need only be concerned with decisions that affect more than one module.

2. Data buffering control. A separate control module exists for each inter-processing-step data buffer. This module is responsible for invoking the processing steps that write or read that data buffer.

Each buffer controller sees the world as follows:

```
input data => processing step A => buffer => processing step B => output data
                  |            |            |
            ------------------ controller ------------------
```

The controller knows the dataflow requirements of steps A and B: how much data they want to accept in one chunk and how much they output in one chunk. Its function is to manage its buffer and call A and B at the proper times.

A data buffer control module may itself be viewed as a processing step by a higher-level control module; thus the control modules form a binary tree with elementary processing steps at the leaves of the tree.

The control modules are objects. A considerable amount of flexibility can be had by replacing implementations of a control module. For example:

* Merging of adjacent steps in the pipeline is done by replacing a control module and its pair of processing-step modules with a single processing-step module. (Hence the possible merges are determined by the tree of control modules.)
* In some processing modes, a given interstep buffer need only be a "strip" buffer large enough to accommodate the desired data chunk sizes. In other modes, a full-image buffer is needed and several passes are required. The control module determines which kind of buffer is used and manipulates virtual array buffers as needed. One or both processing steps may be unaware of the multi-pass behavior.

In theory, we might be able to make all of the data buffer controllers interchangeable and provide just one set of implementations for all. In practice, each one contains

considerable special-case processing for its
particular job. The buffer controller concept should be regarded as an
overall system structuring principle, not as a complete description of the
task performed by any one controller.

*** Compression object structure ***

Here is a sketch of the logical structure of the JPEG compression library:

```
                              |-- Colorspace conversion
            |-- Preprocessing controller --|
            |                 |-- Downsampling
Main controller --|
            |                 |-- Forward DCT, quantize
            |-- Coefficient controller --|
                              |-- Entropy encoding
```

This sketch also describes the flow of control (subroutine calls) during
typical image data processing. Each of the components shown in the diagram is
an "object" which may have several different implementations available. One
or more source code files
contain the actual implementation(s) of each object.

The objects shown above are:

* Main controller: buffer controller for the subsampled-data buffer, which
holds the preprocessed input data. This controller invokes preprocessing to
fill the subsampled-data buffer, and JPEG compression to empty it. There is
usually no need for a full-image buffer here; a strip buffer is adequate.

* Preprocessing controller: buffer controller for the downsampling input data
buffer, which lies between colorspace conversion and downsampling. Note
that a unified conversion/downsampling module would probably replace this
controller entirely.

* Colorspace conversion: converts application image data into the desired
JPEG color space; also changes the data from pixel-interleaved layout to
separate component planes. Processes one pixel row at a time.

* Downsampling: performs reduction of chroma components as required.
Optionally may perform pixel-level smoothing as well. Processes
a "row
group" at a time, where a row group is defined as Vmax pixel rows of each
component before downsampling, and Vk sample rows afterwards (remember Vk
differs across components). Some downsampling or smoothing algorithms may
require context rows above and below the current row group; the
preprocessing controller is responsible for supplying these rows via proper

buffering. The downsampler is responsible for edge expansion at the right edge (i.e., extending each sample row to a multiple of 8 samples); but the preprocessing controller is responsible for vertical edge expansion (i.e., duplicating the bottom sample row as needed to make a multiple of 8 rows).

* Coefficient controller: buffer controller for the DCT-coefficient data. This controller handles MCU assembly, including insertion of dummy DCT blocks when needed at the right or bottom edge. When performing Huffman-code optimization or emitting a multiscan JPEG file, this controller is responsible
for buffering the full image. The equivalent of
one fully interleaved MCU row of subsampled data is processed per call, even when the JPEG file is noninterleaved.

* Forward DCT and quantization: Perform DCT, quantize, and emit coefficients. Works on one or more DCT blocks at a time. (Note: the coefficients are now emitted in normal array order, which the entropy encoder is expected to convert to zigzag order as necessary. Prior versions of the IJG code did the conversion to zigzag order within the quantization step.)

* Entropy encoding: Perform Huffman or arithmetic entropy coding and emit the coded data to the data destination module. Works on one MCU per call. For progressive JPEG, the same DCT blocks are fed to the entropy coder during each pass, and the coder must emit the appropriate subset of coefficients.

In addition to the above objects, the compression library includes these objects:

* Master control: determines the number of passes required, controls
overall
and per-pass initialization of the other modules.

* Marker writing: generates JPEG markers (except for RSTn, which is emitted by the entropy encoder when needed).

* Data destination manager: writes the output JPEG datastream to its final destination (e.g., a file). The destination manager supplied with the library knows how to write to a stdio stream or to a memory buffer; for other behaviors, the surrounding application may provide its own destination manager.

* Memory manager: allocates and releases memory, controls virtual arrays (with backing store management, where required).

* Error handler: performs formatting and output of error and trace messages; determines handling of nonfatal errors. The surrounding application may override some or all of this object's methods to change error handling.

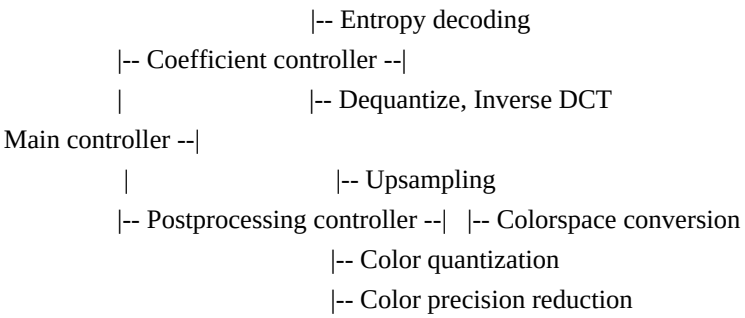
* Progress monitor: supports output of "percent-done" progress reports.
 This object represents an optional callback to the surrounding application:
 if
 wanted, it must be supplied by the application.

The error handler, destination manager, and progress monitor objects are
defined as separate objects in order to simplify application-specific
customization of the JPEG library. A surrounding application may override
individual methods or supply its own all-new implementation of one of these
objects. The object interfaces for these objects are therefore treated as
part of the application interface of the library, whereas the other objects
are internal to the library.

The error handler and memory manager are shared by JPEG compression and
decompression; the progress monitor, if used, may be shared as well.

*** Decompression object structure ***

Here is a sketch of the logical structure of the JPEG decompression library:



As before, this diagram also represents typical control flow. The objects
shown are:

* Main controller: buffer controller for the subsampled-data buffer, which
 holds the output of JPEG decompression proper. This controller's primary
 task is to feed the postprocessing procedure. Some upsampling algorithms
 may require context rows above and below the current row group; when this
 is true, the main controller is responsible for managing its buffer so as
 to make context rows available. In the current design, the main buffer is
 always a strip buffer; a full-image buffer is never required.

* Coefficient controller: buffer controller for the DCT-coefficient data.
 This controller handles
 MCU disassembly, including deletion of any dummy
 DCT blocks at the right or bottom edge. When reading a multiscan JPEG
 file, this controller is responsible for buffering the full image.
 (Buffering DCT coefficients, rather than samples, is necessary to support

progressive JPEG.) The equivalent of one fully interleaved MCU row of subsampled data is processed per call, even when the source JPEG file is noninterleaved.

* Entropy decoding: Read coded data from the data source module and perform Huffman or arithmetic entropy decoding. Works on one MCU per call. For progressive JPEG decoding, the coefficient controller supplies the prior coefficients of each MCU (initially all zeroes), which the entropy decoder modifies in each scan.

* Dequantization and inverse DCT: like it says. Note that the coefficients buffered by the coefficient controller have NOT been dequantized; we merge dequantization and inverse DCT into a single step for speed reasons. When scaled-down
output is asked for, simplified DCT algorithms may be used
that emit fewer samples per DCT block, not the full 8x8. Works on one DCT block at a time.

* Postprocessing controller: buffer controller for the color quantization input buffer, when quantization is in use. (Without quantization, this controller just calls the upsampler.) For two-pass quantization, this controller is responsible for buffering the full-image data.

* Upsampling: restores chroma components to full size. (May support more general output rescaling, too. Note that if undersized DCT outputs have been emitted by the DCT module, this module must adjust so that properly sized outputs are created.) Works on one row group at a time. This module also calls the color conversion module, so its top level is effectively a buffer controller for the upsampling->color conversion buffer. However, in all but the highest-quality operating modes, upsampling and color conversion are likely
to be merged into a single step.

* Colorspace conversion: convert from JPEG color space to output color space, and change data layout from separate component planes to pixel-interleaved. Works on one pixel row at a time.

* Color quantization: reduce the data to colormapped form, using either an externally specified colormap or an internally generated one. This module is not used for full-color output. Works on one pixel row at a time; may require two passes to generate a color map. Note that the output will always be a single component representing colormap indexes. In the current design, the output values are JSAMPLEs, so an 8-bit compilation cannot quantize to more than 256 colors. This is unlikely to be a problem in practice.

* Color reduction: this module handles color precision reduction, e.g., generating 15-bit color (5 bits/primary) from JPEG's 24-bit output.

Not quite clear yet how this should be handled... should we merge it with colorspace conversion???

Note that some high-speed operating modes might condense the entire postprocessing sequence to a single module (upsample, color convert, and quantize in one step).

In addition to the above objects, the decompression library includes these objects:

* Master control: determines the number of passes required, controls overall and per-pass initialization of the other modules. This is subdivided into input and output control: jdinput.c controls only input-side processing, while jdmaster.c handles overall initialization and output-side control.

* Marker reading: decodes JPEG markers (except for RSTn).

* Data source manager: supplies the input JPEG datastream. The source manager supplied with the library knows how to read from a stdio stream or from a memory buffer; for other behaviors, the surrounding application may provide its own source manager.

* Memory manager: same as for compression library.

* Error handler: same as for compression library.

* Progress monitor: same as for compression library.

As with compression, the data source manager, error handler, and progress monitor are candidates for replacement by a surrounding application.

*** Decompression input and output separation ***

To support efficient incremental display of progressive JPEG files, the decompressor is divided into two sections that can run independently:

1. Data input includes marker parsing, entropy decoding, and input into the coefficient controller's DCT coefficient buffer. Note that this processing is relatively cheap and fast.

2. Data output reads from the DCT coefficient buffer and performs the IDCT and all postprocessing steps.

For a progressive JPEG file, the data input processing is allowed to get arbitrarily far ahead of the data output processing. (This occurs only

if the application calls jpeg_consume_input(); otherwise input and output
run in lockstep, since the input section is called only when the output
section needs more data.) In
this way the application can avoid making
extra display passes when data is arriving faster than the display pass
can run. Furthermore, it is possible to abort an output pass without
losing anything, since the coefficient buffer is read-only as far as the
output section is concerned. See libjpeg.txt for more detail.

A full-image coefficient array is only created if the JPEG file has multiple
scans (or if the application specifies buffered-image mode anyway). When
reading a single-scan file, the coefficient controller normally creates only
a one-MCU buffer, so input and output processing must run in lockstep in this
case. jpeg_consume_input() is effectively a no-op in this situation.

The main impact of dividing the decompressor in this fashion is that we must
be very careful with shared variables in the cinfo data structure. Each
variable that can change during the course of decompression must be
classified as belonging to data input or data output, and each section must
look only
at its own variables. For example, the data output section may not
depend on any of the variables that describe the current scan in the JPEG
file, because these may change as the data input section advances into a new
scan.

The progress monitor is (somewhat arbitrarily) defined to treat input of the
file as one pass when buffered-image mode is not used, and to ignore data
input work completely when buffered-image mode is used. Note that the
library has no reliable way to predict the number of passes when dealing
with a progressive JPEG file, nor can it predict the number of output passes
in buffered-image mode. So the work estimate is inherently bogus anyway.

No comparable division is currently made in the compression library, because
there isn't any real need for it.

*** Data formats ***

Arrays of pixel sample values use the following data structure:

```
typedef something JSAMPLE;  a pixel component value, 0..MAXJSAMPLE
typedef JSAMPLE *JSAMPROW;  ptr to a row of samples
 typedef JSAMPROW *JSAMPARRAY; ptr to a list of rows
typedef JSAMPARRAY *JSAMPIMAGE; ptr to a list of color-component arrays
```

The basic element type JSAMPLE will typically be one of unsigned char,
(signed) char, or short. Short will be used if samples wider than 8 bits are
to be supported (this is a compile-time option). Otherwise, unsigned char is

used if possible. If the compiler only supports signed chars, then it is
necessary to mask off the value when reading. Thus, all reads of JSAMPLE
values must be coded as "GETJSAMPLE(value)", where the macro will be defined
as "((value) & 0xFF)" on signed-char machines and "((int) (value))" elsewhere.

With these conventions, JSAMPLE values can be assumed to be >= 0. This helps
simplify correct rounding during downsampling, etc. The JPEG standard's
specification that sample values run from -128..127 is accommodated by
subtracting 128 from the sample value in the DCT step. Similarly, during
decompression the output of the IDCT
 step will be immediately shifted back to
0..255. (NB: different values are required when 12-bit samples are in use.
The code is written in terms of MAXJSAMPLE and CENTERJSAMPLE, which will be
defined as 255 and 128 respectively in an 8-bit implementation, and as 4095
and 2048 in a 12-bit implementation.)

We use a pointer per row, rather than a two-dimensional JSAMPLE array. This
choice costs only a small amount of memory and has several benefits:
* Code using the data structure doesn't need to know the allocated width of
 the rows. This simplifies edge expansion/compression, since we can work
 in an array that's wider than the logical picture width.
* Indexing doesn't require multiplication; this is a performance win on many
 machines.
* Arrays with more than 64K total elements can be supported even on machines
 where malloc() cannot allocate chunks larger than 64K.
* The rows forming a component array may be allocated at different times
 without extra copying. This trick allows
 some speedups in smoothing steps
 that need access to the previous and next rows.

Note that each color component is stored in a separate array; we don't use the
traditional layout in which the components of a pixel are stored together.
This simplifies coding of modules that work on each component independently,
because they don't need to know how many components there are. Furthermore,
we can read or write each component to a temporary file independently, which
is helpful when dealing with noninterleaved JPEG files.

In general, a specific sample value is accessed by code such as
 GETJSAMPLE(image[colorcomponent][row][col])
where col is measured from the image left edge, but row is measured from the
first sample row currently in memory. Either of the first two indexings can
be precomputed by copying the relevant pointer.

Since most image-processing applications prefer to work on images in which
the components of a pixel are stored together, the data passed to or from the
surrounding

application uses the traditional convention: a single pixel is
represented by N consecutive JSAMPLE values, and an image row is an array of
(# of color components)*(image width) JSAMPLEs. One or more rows of data can
be represented by a pointer of type JSAMPARRAY in this scheme. This scheme is
converted to component-wise storage inside the JPEG library. (Applications
that want to skip JPEG preprocessing or postprocessing will have to contend
with component-wise storage.)

Arrays of DCT-coefficient values use the following data structure:

```
typedef short JCOEF;  a 16-bit signed integer
typedef JCOEF JBLOCK[DCTSIZE2]; an 8x8 block of coefficients
typedef JBLOCK *JBLOCKROW;  ptr to one horizontal row of 8x8 blocks
typedef JBLOCKROW *JBLOCKARRAY; ptr to a list of such rows
typedef JBLOCKARRAY *JBLOCKIMAGE; ptr to a list of color component arrays
```

The underlying type is at least a 16-bit signed integer; while "short" is big
enough on all machines of interest,
on some machines it is preferable to use
"int" for speed reasons, despite the storage cost. Coefficients are grouped
into 8x8 blocks (but we always use #defines DCTSIZE and DCTSIZE2 rather than
"8" and "64").

The contents of a coefficient block may be in either "natural" or zigzagged
order, and may be true values or divided by the quantization coefficients,
depending on where the block is in the processing pipeline. In the current
library, coefficient blocks are kept in natural order everywhere; the entropy
codecs zigzag or dezigzag the data as it is written or read. The blocks
contain quantized coefficients everywhere outside the DCT/IDCT subsystems.
(This latter decision may need to be revisited to support variable
quantization a la JPEG Part 3.)

Notice that the allocation unit is now a row of 8x8 blocks, corresponding to
eight rows of samples. Otherwise the structure is much the same as for
samples, and for the same reasons.

On machines where malloc() can't handle a request
bigger than 64Kb, this data
structure limits us to rows of less than 512 JBLOCKs, or a picture width of
4000+ pixels. This seems an acceptable restriction.

On 80x86 machines, the bottom-level pointer types (JSAMPROW and JBLOCKROW)
must be declared as "far" pointers, but the upper levels can be "near"
(implying that the pointer lists are allocated in the DS segment).
We use a #define symbol FAR, which expands to the "far" keyword when
compiling on 80x86 machines and to nothing elsewhere.

*** Suspendable processing ***

In some applications it is desirable to use the JPEG library as an
incremental, memory-to-memory filter. In this situation the data source or
destination may be a limited-size buffer, and we can't rely on being able to
empty or refill the buffer at arbitrary times. Instead the application would
like to have control return from the library at buffer overflow/underrun, and
then resume compression or decompression at a later time.

This scenario is supported for simple
cases. (For anything more complex, we
recommend that the application "bite the bullet" and develop real multitasking
capability.) The libjpeg.txt file goes into more detail about the usage and
limitations of this capability; here we address the implications for library
structure.

The essence of the problem is that the entropy codec (coder or decoder) must
be prepared to stop at arbitrary times. In turn, the controllers that call
the entropy codec must be able to stop before having produced or consumed all
the data that they normally would handle in one call. That part is reasonably
straightforward: we make the controller call interfaces include "progress
counters" which indicate the number of data chunks successfully processed, and
we require callers to test the counter rather than just assume all of the data
was processed.

Rather than trying to restart at an arbitrary point, the current Huffman
codecs are designed to restart at the beginning of the current MCU after a
suspension
due to buffer overflow/underrun. At the start of each call, the
codec's internal state is loaded from permanent storage (in the JPEG object
structures) into local variables. On successful completion of the MCU, the
permanent state is updated. (This copying is not very expensive, and may even
lead to *improved* performance if the local variables can be registerized.)
If a suspension occurs, the codec simply returns without updating the state,
thus effectively reverting to the start of the MCU. Note that this implies
leaving some data unprocessed in the source/destination buffer (ie, the
compressed partial MCU). The data source/destination module interfaces are
specified so as to make this possible. This also implies that the data buffer
must be large enough to hold a worst-case compressed MCU; a couple thousand
bytes should be enough.

In a successive-approximation AC refinement scan, the progressive Huffman
decoder has to be able to undo assignments of newly nonzero coefficients
if it
suspends before the MCU is complete, since decoding requires distinguishing
previously-zero and previously-nonzero coefficients. This is a bit tedious

but probably won't have much effect on performance. Other variants of Huffman
decoding need not worry about this, since they will just store the same values
again if forced to repeat the MCU.

This approach would probably not work for an arithmetic codec, since its
modifiable state is quite large and couldn't be copied cheaply. Instead it
would have to suspend and resume exactly at the point of the buffer end.

The JPEG marker reader is designed to cope with suspension at an arbitrary
point. It does so by backing up to the start of the marker parameter segment,
so the data buffer must be big enough to hold the largest marker of interest.
Again, a couple KB should be adequate. (A special "skip" convention is used
to bypass COM and APPn markers, so these can be larger than the buffer size
without causing problems; otherwise a
 64K buffer would be needed in the worst
case.)

The JPEG marker writer currently does *not* cope with suspension.
We feel that this is not necessary; it is much easier simply to require
the application to ensure there is enough buffer space before starting. (An
empty 2K buffer is more than sufficient for the header markers; and ensuring
there are a dozen or two bytes available before calling jpeg_finish_compress()
will suffice for the trailer.) This would not work for writing multi-scan
JPEG files, but we simply do not intend to support that capability with
suspension.

*** Memory manager services ***

The JPEG library's memory manager controls allocation and deallocation of
memory, and it manages large "virtual" data arrays on machines where the
operating system does not provide virtual memory. Note that the same
memory manager serves both compression and decompression operations.

In all cases, allocated objects are tied to a particular compression or
decompression master record,
 and they will be released when that master
record is destroyed.

The memory manager does not provide explicit deallocation of objects.
Instead, objects are created in "pools" of free storage, and a whole pool
can be freed at once. This approach helps prevent storage-leak bugs, and
it speeds up operations whenever malloc/free are slow (as they often are).
The pools can be regarded as lifetime identifiers for objects. Two
pools/lifetimes are defined:
 * JPOOL_PERMANENT lasts until master record is destroyed
 * JPOOL_IMAGE lasts until done with image (JPEG datastream)
Permanent lifetime is used for parameters and tables that should be carried

across from one datastream to another; this includes all application-visible
parameters. Image lifetime is used for everything else. (A third lifetime,
JPOOL_PASS = one processing pass, was originally planned. However it was
dropped as not being worthwhile. The actual usage patterns are such that the
peak memory usage would be about the same
 anyway; and having per-pass storage
substantially complicates the virtual memory allocation rules --- see below.)

The memory manager deals with three kinds of object:
1. "Small" objects. Typically these require no more than 10K-20K total.
2. "Large" objects. These may require tens to hundreds of K depending on
  image size. Semantically they behave the same as small objects, but we
  distinguish them for two reasons:
    * On MS-DOS machines, large objects are referenced by FAR pointers,
      small objects by NEAR pointers.
    * Pool allocation heuristics may differ for large and small objects.
  Note that individual "large" objects cannot exceed the size allowed by
  type size_t, which may be 64K or less on some machines.
3. "Virtual" objects. These are large 2-D arrays of JSAMPLEs or JBLOCKs
  (typically large enough for the entire image being processed). The
  memory manager provides stripwise access to these arrays. On machines
  without virtual memory, the rest
 of the array may be swapped out to a
  temporary file.

(Note: JSAMPARRAY and JBLOCKARRAY data structures are a combination of large
objects for the data proper and small objects for the row pointers. For
convenience and speed, the memory manager provides single routines to create
these structures. Similarly, virtual arrays include a small control block
and a JSAMPARRAY or JBLOCKARRAY working buffer, all created with one call.)

In the present implementation, virtual arrays are only permitted to have image
lifespan. (Permanent lifespan would not be reasonable, and pass lifespan is
not very useful since a virtual array's raison d'etre is to store data for
multiple passes through the image.) We also expect that only "small" objects
will be given permanent lifespan, though this restriction is not required by
the memory manager.

In a non-virtual-memory machine, some performance benefit can be gained by
making the in-memory buffers for virtual arrays be as large as possible.
(For small
 images, the buffers might fit entirely in memory, so blind
swapping would be very wasteful.) The memory manager will adjust the height
of the buffers to fit within a prespecified maximum memory usage. In order
to do this in a reasonably optimal fashion, the manager needs to allocate all
of the virtual arrays at once. Therefore, there isn't a one-step allocation
routine for virtual arrays; instead, there is a "request" routine that simply
allocates the control block, and a "realize" routine (called just once) that

determines space allocation and creates all of the actual buffers. The
realize routine must allow for space occupied by non-virtual large objects.
(We don't bother to factor in the space needed for small objects, on the
grounds that it isn't worth the trouble.)

To support all this, we establish the following protocol for doing business
with the memory manager:
1. Modules must request virtual arrays (which may have only image lifespan)
during the initial setup
phase, i.e., in their jinit_xxx routines.
2. All "large" objects (including JSAMPARRAYs and JBLOCKARRAYs) must also be
allocated during initial setup.
3. realize_virt_arrays will be called at the completion of initial setup.
The above conventions ensure that sufficient information is available
for it to choose a good size for virtual array buffers.
Small objects of any lifespan may be allocated at any time. We expect that
the total space used for small objects will be small enough to be negligible
in the realize_virt_arrays computation.

In a virtual-memory machine, we simply pretend that the available space is
infinite, thus causing realize_virt_arrays to decide that it can allocate all
the virtual arrays as full-size in-memory buffers. The overhead of the
virtual-array access protocol is very small when no swapping occurs.

A virtual array can be specified to be "pre-zeroed"; when this flag is set,
never-yet-written sections of the array are set to zero before being
made
available to the caller. If this flag is not set, never-written sections
of the array contain garbage. (This feature exists primarily because the
equivalent logic would otherwise be needed in jdcoefct.c for progressive
JPEG mode; we may as well make it available for possible other uses.)

The first write pass on a virtual array is required to occur in top-to-bottom
order; read passes, as well as any write passes after the first one, may
access the array in any order. This restriction exists partly to simplify
the virtual array control logic, and partly because some file systems may not
support seeking beyond the current end-of-file in a temporary file. The main
implication of this restriction is that rearrangement of rows (such as
converting top-to-bottom data order to bottom-to-top) must be handled while
reading data out of the virtual array, not while putting it in.

*** Memory manager internal structure ***

To isolate system dependencies as much as possible, we have broken
the
memory manager into two parts. There is a reasonably system-independent
"front end" (jmemmgr.c) and a "back end" that contains only the code

likely to change across systems. All of the memory management methods
outlined above are implemented by the front end. The back end provides
the following routines for use by the front end (none of these routines
are known to the rest of the JPEG code):

jpeg_mem_init, jpeg_mem_term system-dependent initialization/shutdown

jpeg_get_small, jpeg_free_small interface to malloc and free library routines
   (or their equivalents)

jpeg_get_large, jpeg_free_large interface to FAR malloc/free in MSDOS machines;
   else usually the same as
   jpeg_get_small/jpeg_free_small

jpeg_mem_available estimate available memory

jpeg_open_backing_store create a backing-store object

read_backing_store, manipulate a backing-store object
write_backing_store,
close_backing_store

On some systems there will be more than one type of backing-store object
(specifically,
 in MS-DOS a backing store file might be an area of extended
memory as well as a disk file). jpeg_open_backing_store is responsible for
choosing how to implement a given object. The read/write/close routines
are method pointers in the structure that describes a given object; this
lets them be different for different object types.

It may be necessary to ensure that backing store objects are explicitly
released upon abnormal program termination. For example, MS-DOS won't free
extended memory by itself. To support this, we will expect the main program
or surrounding application to arrange to call self_destruct (typically via
jpeg_destroy) upon abnormal termination. This may require a SIGINT signal
handler or equivalent. We don't want to have the back end module install its
own signal handler, because that would pre-empt the surrounding application's
ability to control signal handling.

The IJG distribution includes several memory manager back end implementations.
Usually
 the same back end should be suitable for all applications on a given
system, but it is possible for an application to supply its own back end at
need.

*** Implications of DNL marker ***

Some JPEG files may use a DNL marker to postpone definition of the image height (this would be useful for a fax-like scanner's output, for instance). In these files the SOF marker claims the image height is 0, and you only find out the true image height at the end of the first scan.

We could read these files as follows:
1. Upon seeing zero image height, replace it by 65535 (the maximum allowed).
2. When the DNL is found, update the image height in the global image descriptor.

This implies that control modules must avoid making copies of the image height, and must re-test for termination after each MCU row. This would be easy enough to do.

In cases where image-size data structures are allocated, this approach will result in very inefficient use of virtual memory or much-larger-than-necessary temporary files. This seems acceptable for something that probably won't be a mainstream usage. People might have to forgo use of memory-hogging options (such as two-pass color quantization or noninterleaved JPEG files) if they want efficient conversion of such files. (One could improve efficiency by demanding a user-supplied upper bound for the height, less than 65536; in most cases it could be much less.)

The standard also permits the SOF marker to overestimate the image height, with a DNL to give the true, smaller height at the end of the first scan. This would solve the space problems if the overestimate wasn't too great. However, it implies that you don't even know whether DNL will be used.

This leads to a couple of very serious objections:
1. Testing for a DNL marker must occur in the inner loop of the decompressor's Huffman decoder; this implies a speed penalty whether the feature is used or not.
2. There is no way to hide the last-minute change in image height from an application using the decoder. Thus *every* application using the IJG library would suffer a complexity penalty whether it cared about DNL or not.

We currently do not support DNL because of these problems.

A different approach is to insist that DNL-using files be preprocessed by a separate program that reads ahead to the DNL, then goes back and fixes the SOF marker. This is a much simpler solution and is probably far more efficient. Even if one wants piped input, buffering the first scan of the JPEG file needs a lot smaller temp file than is implied by the maximum-height method. For this approach we'd simply treat DNL as a no-op in the decompressor (at most, check that it matches the SOF image height).

We will not worry about making the compressor capable of outputting DNL.

Something similar to the first scheme above could be applied if anyone ever
wants to make that work.

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/structure.txt
No license file was found, but licenses were detected in source scan.

```
/*
* jmemnobs.c
*
* Copyright (C) 1992-1996, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file provides a really simple implementation of the system-
* dependent portion of the JPEG memory manager.  This implementation
* assumes that no backing-store files are needed: all required space
* can be obtained from malloc().
* This is very portable in the sense that it'll compile on almost anything,
* but you'd better have lots of main memory (or virtual memory) if you want
* to process big images.
* Note that the max_memory_to_use option is ignored by this implementation.
*/
```

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jmemnobs.c
No license file was found, but licenses were detected in source scan.

```
/*
* rdrle.c
*
* Copyright (C) 1991-1996, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains routines to read input images in Utah RLE format.
* The Utah Raster Toolkit library is required (version 3.1 or later).
*
* These routines may need modification for non-Unix environments or
* specialized applications.  As they stand, they assume input from
* an ordinary stdio stream.  They further assume that reading begins
* at the start of the file; start_input may need work if the
* user interface has already read some data (e.g., to determine that
* the file is indeed RLE format).
*
* Based on code contributed by Mike Lijewski,
```

* with updates from Robert Hutchinson.
*/

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/rdrle.c
No license file was found, but licenses were detected in source scan.

libjpeg-turbo note: This file has been modified by The libjpeg-turbo Project
to include only information relevant to libjpeg-turbo, to wordsmith certain
sections, and to remove impolitic language that existed in the libjpeg v8
README. It is included only for reference. Please see README-turbo.txt for
information specific to libjpeg-turbo.

The Independent JPEG Group's JPEG software
==

This distribution contains a release of the Independent JPEG Group's free JPEG
software. You are welcome to redistribute this software and to use it for any
purpose, subject to the conditions under LEGAL ISSUES, below.

This software is the work of Tom Lane, Guido Vollbeding, Philip Gladstone,
Bill Allombert, Jim Boucher, Lee Crocker, Bob Friesenhahn, Ben Jackson,
Julian Minguillon, Luis Ortiz, George Phillips, Davide Rossi, Ge' Weijers,
and other members of the Independent JPEG Group.

IJG
is not affiliated with the ISO/IEC JTC1/SC29/WG1 standards committee
(also known as JPEG, together with ITU-T SG16).

DOCUMENTATION ROADMAP
=====================

This file contains the following sections:

OVERVIEW General description of JPEG and the IJG software.
LEGAL ISSUES Copyright, lack of warranty, terms of distribution.
REFERENCES Where to learn more about JPEG.
ARCHIVE LOCATIONS Where to find newer versions of this software.
FILE FORMAT WARS Software *not* to get.
TO DO Plans for future IJG releases.

Other documentation files in the distribution are:

User documentation:
install.txt How to configure and install the IJG software.

usage.txt Usage instructions for cjpeg, djpeg, jpegtran,
rdjpgcom, and wrjpgcom.
*.1 Unix-style man pages for programs (same info as usage.txt).
wizard.txt Advanced usage instructions for JPEG wizards only.
change.log Version-to-version
change highlights.
Programmer and internal documentation:
libjpeg.txt How to use the JPEG library in your own programs.
example.c Sample code for calling the JPEG library.
structure.txt Overview of the JPEG library's internal structure.
coderules.txt Coding style rules --- please read if you contribute code.

Please read at least the files install.txt and usage.txt. Some information
can also be found in the JPEG FAQ (Frequently Asked Questions) article. See
ARCHIVE LOCATIONS below to find out where to obtain the FAQ article.

If you want to understand how the JPEG code works, we suggest reading one or
more of the REFERENCES, then looking at the documentation files (in roughly
the order listed) before diving into the code.

OVERVIEW
========

This package contains C software to implement JPEG image encoding, decoding,
and transcoding. JPEG (pronounced "jay-peg") is a standardized compression
method for full-color and gray-scale images. JPEG's strong
suit is compressing
photographic images or other types of images that have smooth color and
brightness transitions between neighboring pixels. Images with sharp lines or
other abrupt features may not compress well with JPEG, and a higher JPEG
quality may have to be used to avoid visible compression artifacts with such
images.

JPEG is lossy, meaning that the output pixels are not necessarily identical to
the input pixels. However, on photographic content and other "smooth" images,
very good compression ratios can be obtained with no visible compression
artifacts, and extremely high compression ratios are possible if you are
willing to sacrifice image quality (by reducing the "quality" setting in the
compressor.)

This software implements JPEG baseline, extended-sequential, and progressive
compression processes. Provision is made for supporting all variants of these
processes, although some uncommon parameter settings aren't implemented yet.
We have made no provision for supporting
the hierarchical or lossless
processes defined in the standard.

We provide a set of library routines for reading and writing JPEG image files,
plus two sample applications "cjpeg" and "djpeg", which use the library to
perform conversion between JPEG and some other popular image file formats.
The library is intended to be reused in other applications.

In order to support file conversion and viewing software, we have included
considerable functionality beyond the bare JPEG coding/decoding capability;
for example, the color quantization modules are not strictly part of JPEG
decoding, but they are essential for output to colormapped file formats or
colormapped displays. These extra functions can be compiled out of the
library if not required for a particular application.

We have also included "jpegtran", a utility for lossless transcoding between
different JPEG processes, and "rdjpgcom" and "wrjpgcom", two simple
applications for inserting and extracting textual comments in JFIF files.

The
 emphasis in designing this software has been on achieving portability and
flexibility, while also making it fast enough to be useful. In particular,
the software is not intended to be read as a tutorial on JPEG. (See the
REFERENCES section for introductory material.) Rather, it is intended to
be reliable, portable, industrial-strength code. We do not claim to have
achieved that goal in every aspect of the software, but we strive for it.

We welcome the use of this software as a component of commercial products.
No royalty is required, but we do ask for an acknowledgement in product
documentation, as described under LEGAL ISSUES.

LEGAL ISSUES
============

In plain English:

1. We don't promise that this software works. (But if you find any bugs,
  please let us know!)
2. You can use this software for whatever you want. You don't have to pay us.
3. You may not pretend that you wrote this software. If you use it in a
  program, you must acknowledge somewhere in your documentation
 that
  you've used the IJG code.

In legalese:

The authors make NO WARRANTY or representation, either express or implied,
with respect to this software, its quality, accuracy, merchantability, or
fitness for a particular purpose. This software is provided "AS IS", and you,
its user, assume the entire risk as to its quality and accuracy.

This software is copyright (C) 1991-2012, Thomas G. Lane, Guido Vollbeding.
All Rights Reserved except as specified below.

Permission is hereby granted to use, copy, modify, and distribute this
software (or portions thereof) for any purpose, without fee, subject to these
conditions:
(1) If any part of the source code for this software is distributed, then this
README file must be included, with this copyright and no-warranty notice
unaltered; and any additions, deletions, or changes to the original files
must be clearly indicated in accompanying documentation.
(2) If only executable code is distributed, then the accompanying
documentation
must state that "this software is based in part on the work of
the Independent JPEG Group".
(3) Permission for use of this software is granted only if the user accepts
full responsibility for any undesirable consequences; the authors accept
NO LIABILITY for damages of any kind.

These conditions apply to any software derived from or based on the IJG code,
not just to the unmodified library. If you use our work, you ought to
acknowledge us.

Permission is NOT granted for the use of any IJG author's name or company name
in advertising or publicity relating to this software or products derived from
it. This software may be referred to only as "the Independent JPEG Group's
software".

We specifically permit and encourage the use of this software as the basis of
commercial products, provided that all warranty or liability claims are
assumed by the product vendor.

The Unix configuration script "configure" was produced with GNU Autoconf.
It is copyright by the Free Software Foundation but
is freely distributable.
The same holds for its supporting scripts (config.guess, config.sub,
ltmain.sh). Another support script, install-sh, is copyright by X Consortium
but is also freely distributable.

The IJG distribution formerly included code to read and write GIF files.
To avoid entanglement with the Unisys LZW patent, GIF reading support has
been removed altogether, and the GIF writer has been simplified to produce
"uncompressed GIFs". This technique does not use the LZW algorithm; the
resulting GIF files are larger than usual, but are readable by all standard
GIF decoders.

We are required to state that

"The Graphics Interchange Format(c) is the Copyright property of
CompuServe Incorporated. GIF(sm) is a Service Mark property of
CompuServe Incorporated."

REFERENCES
==========

We recommend reading one or more of these references before trying to
understand the innards of the JPEG software.

The best short technical introduction to the JPEG compression algorithm
is
Wallace, Gregory K. "The JPEG Still Picture Compression Standard",
Communications of the ACM, April 1991 (vol. 34 no. 4), pp. 30-44.
(Adjacent articles in that issue discuss MPEG motion picture compression,
applications of JPEG, and related topics.) If you don't have the CACM issue
handy, a PostScript file containing a revised version of Wallace's article is
available at http://www.ijg.org/files/wallace.ps.gz. The file (actually
a preprint for an article that appeared in IEEE Trans. Consumer Electronics)
omits the sample images that appeared in CACM, but it includes corrections
and some added material. Note: the Wallace article is copyright ACM and IEEE,
and it may not be used for commercial purposes.

A somewhat less technical, more leisurely introduction to JPEG can be found in
"The Data Compression Book" by Mark Nelson and Jean-loup Gailly, published by
M&T Books (New York), 2nd ed. 1996, ISBN 1-55851-434-1. This book provides
good explanations and example C code for
a multitude of compression methods
including JPEG. It is an excellent source if you are comfortable reading C
code but don't know much about data compression in general. The book's JPEG
sample code is far from industrial-strength, but when you are ready to look
at a full implementation, you've got one here...

The best currently available description of JPEG is the textbook "JPEG Still
Image Data Compression Standard" by William B. Pennebaker and Joan L.
Mitchell, published by Van Nostrand Reinhold, 1993, ISBN 0-442-01272-1.
Price US$59.95, 638 pp. The book includes the complete text of the ISO JPEG
standards (DIS 10918-1 and draft DIS 10918-2).

The original JPEG standard is divided into two parts, Part 1 being the actual
specification, while Part 2 covers compliance testing methods. Part 1 is
titled "Digital Compression and Coding of Continuous-tone Still Images,
Part 1: Requirements and guidelines" and has document numbers ISO/IEC IS
10918-1, ITU-T T.81. Part 2 is titled "Digital
Compression and Coding of
Continuous-tone Still Images, Part 2: Compliance testing" and has document
numbers ISO/IEC IS 10918-2, ITU-T T.83.

The JPEG standard does not specify all details of an interchangeable file
format. For the omitted details we follow the "JFIF" conventions, revision
1.02. JFIF 1.02 has been adopted as an Ecma International Technical Report
and thus received a formal publication status. It is available as a free
download in PDF format from
http://www.ecma-international.org/publications/techreports/E-TR-098.htm.
A PostScript version of the JFIF document is available at
http://www.ijg.org/files/jfif.ps.gz. There is also a plain text version at
http://www.ijg.org/files/jfif.txt.gz, but it is missing the figures.

The TIFF 6.0 file format specification can be obtained by FTP from
ftp://ftp.sgi.com/graphics/tiff/TIFF6.ps.gz. The JPEG incorporation scheme
found in the TIFF 6.0 spec of 3-June-92 has a number of serious problems.
IJG does not recommend use of the
 TIFF 6.0 design (TIFF Compression tag 6).
Instead, we recommend the JPEG design proposed by TIFF Technical Note #2
(Compression tag 7). Copies of this Note can be obtained from
http://www.ijg.org/files/. It is expected that the next revision
of the TIFF spec will replace the 6.0 JPEG design with the Note's design.
Although IJG's own code does not support TIFF/JPEG, the free libtiff library
uses our library to implement TIFF/JPEG per the Note.

ARCHIVE LOCATIONS
=================

The "official" archive site for this software is www.ijg.org.
The most recent released version can always be found there in
directory "files". This particular version will be archived as
http://www.ijg.org/files/jpegsrc.v8d.tar.gz, and in Windows-compatible
"zip" archive format as http://www.ijg.org/files/jpegsr8d.zip.

The JPEG FAQ (Frequently Asked Questions) article is a source of some
general information about JPEG.
It is available on the World Wide Web at http://www.faqs.org/faqs/jpeg-faq/
and other
 news.answers archive sites, including the official news.answers
archive at rtfm.mit.edu: ftp://rtfm.mit.edu/pub/usenet/news.answers/jpeg-faq/.
If you don't have Web or FTP access, send e-mail to mail-server@rtfm.mit.edu
with body
 send usenet/news.answers/jpeg-faq/part1
 send usenet/news.answers/jpeg-faq/part2

FILE FORMAT WARS
================

The ISO/IEC JTC1/SC29/WG1 standards committee (also known as JPEG, together
with ITU-T SG16) currently promotes different formats containing the name
"JPEG" which are incompatible with original DCT-based JPEG. IJG therefore does
not support these formats (see REFERENCES). Indeed, one of the original
reasons for developing this free software was to help force convergence on
common, interoperable format standards for JPEG files.
Don't use an incompatible file format!
(In any case, our decoder will remain capable of reading existing JPEG
image files indefinitely.)

TO DO
=====

Please send bug reports, offers of help, etc. to jpeg-info@jpegclub.org.

Found
 in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/README
No license file was found, but licenses were detected in source scan.

```
/*
* jutils.c
*
* Copyright (C) 1991-1996, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains tables and miscellaneous utility routines needed
* for both compression and decompression.
* Note we prefix all global names with "j" to minimize conflicts with
* a surrounding application.
*/
```

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jutils.c
No license file was found, but licenses were detected in source scan.

```
/*
* jccolext.c
*
* This file was part of the Independent JPEG Group's software:
* Copyright (C) 1991-1996, Thomas G. Lane.
* Modifications:
* Copyright (C) 2009-2012, D. R. Commander.
* For conditions of distribution and use, see the accompanying README file.
```

*
* This file contains input colorspace conversion routines.
*/

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jccolext.c
No license file was found, but licenses were detected in source scan.

/*
* jdpostct.c
*
* Copyright (C) 1994-1996, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains the decompression postprocessing controller.
* This controller manages the upsampling, color conversion, and color
* quantization/reduction steps; specifically, it controls the buffering
* between upsample/color conversion and color quantization/reduction.
*
* If no color quantization/reduction is required, then this module has no
* work to do, and it just hands off to the upsample/color conversion code.
* An integrated upsample/convert/quantize process would replace this module
* entirely.
*/

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdpostct.c
No license file was found, but licenses were detected in source scan.

/*
* jcapimin.c
*
* Copyright (C) 1994-1998, Thomas G. Lane.
* Modified 2003-2010 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains application interface code for the compression half
* of the JPEG library. These are the "minimum" API routines that may be
* needed in either the normal full-compression case or the transcoding-only
* case.
*
* Most of the routines intended to be called directly by an application
* are in this file or in jcapistd.c. But also see jcparam.c for
* parameter-setup helper routines, jcomapi.c for routines shared by

* compression and decompression, and jctrans.c for the transcoding case.
*/

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jcapimin.c
No license file was found, but licenses were detected in source scan.

/*
* jidctflt.c
*
* Copyright (C) 1994-1998, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains a floating-point implementation of the
* inverse DCT (Discrete Cosine Transform). In the IJG code, this routine
* must also perform dequantization of the input coefficients.
*
* This implementation should be more accurate than either of the integer
* IDCT implementations. However, it may not give the same results on all
* machines because of differences in roundoff behavior. Speed will depend
* on the hardware's floating point capacity.
*
* A 2-D IDCT can be done by 1-D IDCT on each column followed by 1-D IDCT
* on each row (or vice versa, but it's more convenient to emit a row at
* a time). Direct algorithms are also available, but they are much more
* complex and seem not to
be any faster when reduced to code.
*
* This implementation is based on Arai, Agui, and Nakajima's algorithm for
* scaled DCT. Their original paper (Trans. IEICE E-71(11):1095) is in
* Japanese, but the algorithm is described in the Pennebaker & Mitchell
* JPEG textbook (see REFERENCES section in file README). The following code
* is based directly on figure 4-8 in P&M.
* While an 8-point DCT cannot be done in less than 11 multiplies, it is
* possible to arrange the computation so that many of the multiplies are
* simple scalings of the final outputs. These multiplies can then be
* folded into the multiplications or divisions by the JPEG quantization
* table entries. The AA&N method leaves only 5 multiplies and 29 adds
* to be done in the DCT itself.
* The primary disadvantage of this method is that with a fixed-point
* implementation, accuracy is lost due to imprecise representation of the
* scaled quantization values. However, that problem does not arise if
* we
use floating point arithmetic.
*/

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jidctflt.c
No license file was found, but licenses were detected in source scan.

```
/*
* simd/jsimd.h
*
* Copyright 2009 Pierre Ossman <ossman@cendio.se> for Cendio AB
* Copyright 2011 D. R. Commander
*
* Based on the x86 SIMD extension for IJG JPEG library,
* Copyright (C) 1999-2006, MIYASAKA Masaru.
* For conditions of distribution and use, see copyright notice in jsimdext.inc
*
*/
```

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jsimd.h
No license file was found, but licenses were detected in source scan.

```
/*
* jfdctint.c
*
* Copyright (C) 1991-1996, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains a slow-but-accurate integer implementation of the
* forward DCT (Discrete Cosine Transform).
*
* A 2-D DCT can be done by 1-D DCT on each row followed by 1-D DCT
* on each column.  Direct algorithms are also available, but they are
* much more complex and seem not to be any faster when reduced to code.
*
* This implementation is based on an algorithm described in
*   C. Loeffler, A. Ligtenberg and G. Moschytz, "Practical Fast 1-D DCT
*   Algorithms with 11 Multiplications", Proc. Int'l. Conf. on Acoustics,
*   Speech, and Signal Processing 1989 (ICASSP '89), pp. 988-991.
* The primary algorithm described there uses 11 multiplies and 29 adds.
* We use their alternate method with 12
 multiplies and 32 adds.
* The advantage of this method is that no data path contains more than one
* multiplication; this allows a very simple and accurate implementation in
* scaled fixed-point arithmetic, with a minimal number of shifts.
*/
```

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jfdctint.c
No license file was found, but licenses were detected in source scan.

```
/*
* rdtarga.c
*
* Copyright (C) 1991-1996, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains routines to read input images in Targa format.
*
* These routines may need modification for non-Unix environments or
* specialized applications.  As they stand, they assume input from
* an ordinary stdio stream.  They further assume that reading begins
* at the start of the file; start_input may need work if the
* user interface has already read some data (e.g., to determine that
* the file is indeed Targa format).
*
* Based on code contributed by Lee Daniel Crocker.
*/
```

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/rdtarga.c
No license file was found, but licenses were detected in source scan.

```
; For conditions of distribution and use, see copyright notice in jsimdext.inc
; more details.
```

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jfss2int-64.asm
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jfss2int.asm
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jiss2int.asm
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jiss2int-64.asm
*
 /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jimmxint.asm
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jfmmxint.asm
No license file was found, but licenses were detected in source scan.

```
/*
* jdmarker.c
*
* This file was part of the Independent JPEG Group's software:
* Copyright (C) 1991-1998, Thomas G. Lane.
* Modifications:
* Copyright (C) 2012, D. R. Commander.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains routines to decode JPEG datastream markers.
* Most of the complexity arises from our desire to support input
* suspension: if not all of the data for a marker is available,
* we must exit back to the application.  On resumption, we reprocess
* the marker.
*/
```

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdmarker.c
No license file was found, but licenses were detected in source scan.

IJG JPEG LIBRARY: CODING RULES

Copyright (C) 1991-1996, Thomas G. Lane.
This file is part of the Independent JPEG Group's software.
For conditions of distribution and use, see the accompanying README file.

Since numerous people will be contributing code and bug fixes, it's important
to establish a common coding style. The goal of using similar coding styles
is much more important than the details of just what that style is.

In general we follow the recommendations of "Recommended C Style and Coding
Standards" revision 6.1 (Cannon et al. as modified by Spencer, Keppel and
Brader). This document is available in the IJG FTP archive (see
jpeg/doc/cstyle.ms.tbl.Z, or cstyle.txt.Z for those without nroff/tbl).

Block comments should be laid out thusly:

```
/*
*  Block comments in this style.
*/
```

We indent statements in K&R style, e.g.,
```
 if (test) {
   then-part;
 } else {
   else-part;
```

```
 }
```
with two spaces per indentation
level. (This indentation convention is
handled automatically by GNU Emacs and many other text editors.)

Multi-word names should be written in lower case with underscores, e.g.,
multi_word_name (not multiWordName). Preprocessor symbols and enum constants
are similar but upper case (MULTI_WORD_NAME). Names should be unique within
the first fifteen characters. (On some older systems, global names must be
unique within six characters. We accommodate this without cluttering the
source code by using macros to substitute shorter names.)

We use function prototypes everywhere; we rely on automatic source code
transformation to feed prototype-less C compilers. Transformation is done
by the simple and portable tool 'ansi2knr.c' (courtesy of Ghostscript).
ansi2knr is not very bright, so it imposes a format requirement on function
declarations: the function name MUST BEGIN IN COLUMN 1. Thus all functions
should be written in the following style:

```
LOCAL(int *)
function_name (int a, char
 *b)
{
  code...
}
```

Note that each function definition must begin with GLOBAL(type), LOCAL(type),
or METHODDEF(type). These macros expand to "static type" or just "type" as
appropriate. They provide a readable indication of the routine's usage and
can readily be changed for special needs. (For instance, special linkage
keywords can be inserted for use in Windows DLLs.)

ansi2knr does not transform method declarations (function pointers in
structs). We handle these with a macro JMETHOD, defined as

```
 #ifdef HAVE_PROTOTYPES
 #define JMETHOD(type,methodname,arglist)  type (*methodname) arglist
 #else
 #define JMETHOD(type,methodname,arglist)  type (*methodname) ()
 #endif
```

which is used like this:

```
 struct function_pointers {
   JMETHOD(void, init_entropy_encoder, (int somearg, jparms *jp));
   JMETHOD(void, term_entropy_encoder, (void));
 };
```

Note the set of parentheses surrounding the parameter list.

A similar solution is used for forward and external function declarations
(see the EXTERN

and JPP macros).

If the code is to work on non-ANSI compilers, we cannot rely on a prototype declaration to coerce actual parameters into the right types. Therefore, use explicit casts on actual parameters whenever the actual parameter type is not identical to the formal parameter. Beware of implicit conversions to "int".

It seems there are some non-ANSI compilers in which the sizeof() operator is defined to return int, yet size_t is defined as long. Needless to say, this is brain-damaged. Always use the SIZEOF() macro in place of sizeof(), so that the result is guaranteed to be of type size_t.

The JPEG library is intended to be used within larger programs. Furthermore, we want it to be reentrant so that it can be used by applications that process multiple images concurrently. The following rules support these requirements:

1. Avoid direct use of file I/O, "malloc", error report printouts, etc; pass these through the common routines provided.

2. Minimize global namespace pollution. Functions should be declared static wherever possible. (Note that our method-based calling conventions help this a lot: in many modules only the initialization function will ever need to be called directly, so only that function need be externally visible.) All global function names should begin with "jpeg_", and should have an abbreviated name (unique in the first six characters) substituted by macro when NEED_SHORT_EXTERNAL_NAMES is set.

3. Don't use global variables; anything that must be used in another module should be in the common data structures.

4. Don't use static variables except for read-only constant tables. Variables that should be private to a module can be placed into private structures (see the system architecture document, structure.txt).

5. Source file names should begin with "j" for files that are part of the library proper; source files that are not part of the library, such as cjpeg.c and djpeg.c, do not begin with "j". Keep source file names to eight characters (plus ".c" or ".h", etc) to make life easy for MS-DOSers. Keep compression and decompression code in separate source files --- some applications may want only one half of the library.

Note: these rules (particularly #4) are not followed religiously in the modules that are used in cjpeg/djpeg but are not part of the JPEG library proper. Those modules are not really intended to be used in other applications.

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/coderules.txt
No license file was found, but licenses were detected in source scan.

```
/*
* wrppm.c
*
* Copyright (C) 1991-1996, Thomas G. Lane.
* Modified 2009 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains routines to write output images in PPM/PGM format.
* The extended 2-byte-per-sample raw PPM/PGM formats are supported.
* The PBMPLUS library is NOT required to compile this software
* (but it is highly useful as a set of PPM image manipulation programs).
*
* These routines may need modification for non-Unix environments or
* specialized applications.  As they stand, they assume output to
* an ordinary stdio stream.
*/
```

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/wrppm.c
No license file was found, but licenses were detected in source scan.

```
/*
* jdcolext.c
*
* This file was part of the Independent JPEG Group's software:
* Copyright (C) 1991-1997, Thomas G. Lane.
* Modifications:
* Copyright (C) 2009, 2011, D. R. Commander.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains output colorspace conversion routines.
*/
```

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdcolext.c
No license file was found, but licenses were detected in source scan.

```
/*
* jsimd.h
```

```
*
* Copyright 2009 Pierre Ossman <ossman@cendio.se> for Cendio AB
* Copyright 2011 D. R. Commander
*
* Based on the x86 SIMD extension for IJG JPEG library,
* Copyright (C) 1999-2006, MIYASAKA Masaru.
* For conditions of distribution and use, see copyright notice in jsimdext.inc
*
*/
```

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jsimd.h
No license file was found, but licenses were detected in source scan.

```
/*
* jversion.h
*
* This file was part of the Independent JPEG Group's software:
* Copyright (C) 1991-2012, Thomas G. Lane, Guido Vollbeding.
* Modifications:
* Copyright (C) 2010, 2012-2013, D. R. Commander.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains software version identification.
*/
```

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jversion.h
No license file was found, but licenses were detected in source scan.

```
/*
* jsimd_x86_64.c
*
* Copyright 2009 Pierre Ossman <ossman@cendio.se> for Cendio AB
* Copyright 2009-2011 D. R. Commander
*
* Based on the x86 SIMD extension for IJG JPEG library,
* Copyright (C) 1999-2006, MIYASAKA Masaru.
* For conditions of distribution and use, see copyright notice in jsimdext.inc
*
* This file contains the interface between the "normal" portions
* of the library and the SIMD implementations when running on a
* x86_64 architecture.
*/
```

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jsimd_x86_64.c
No license file was found, but licenses were detected in source scan.

```
/*
* jfdctflt.c
*
* Copyright (C) 1994-1996, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains a floating-point implementation of the
* forward DCT (Discrete Cosine Transform).
*
* This implementation should be more accurate than either of the integer
* DCT implementations.  However, it may not give the same results on all
* machines because of differences in roundoff behavior.  Speed will depend
* on the hardware's floating point capacity.
*
* A 2-D DCT can be done by 1-D DCT on each row followed by 1-D DCT
* on each column.  Direct algorithms are also available, but they are
* much more complex and seem not to be any faster when reduced to code.
*
* This implementation is based on Arai, Agui, and Nakajima's algorithm for
* scaled DCT.  Their original paper (Trans. IEICE
 E-71(11):1095) is in
* Japanese, but the algorithm is described in the Pennebaker & Mitchell
* JPEG textbook (see REFERENCES section in file README).  The following code
* is based directly on figure 4-8 in P&M.
* While an 8-point DCT cannot be done in less than 11 multiplies, it is
* possible to arrange the computation so that many of the multiplies are
* simple scalings of the final outputs.  These multiplies can then be
* folded into the multiplications or divisions by the JPEG quantization
* table entries.  The AA&N method leaves only 5 multiplies and 29 adds
* to be done in the DCT itself.
* The primary disadvantage of this method is that with a fixed-point
* implementation, accuracy is lost due to imprecise representation of the
* scaled quantization values.  However, that problem does not arise if
* we use floating point arithmetic.
*/
```

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jfdctflt.c
No license file was found, but licenses were detected in source scan.

```
/*
* rdppm.c
```

```
*
* Copyright (C) 1991-1997, Thomas G. Lane.
* Modified 2009 by Bill Allombert, Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains routines to read input images in PPM/PGM format.
* The extended 2-byte-per-sample raw PPM/PGM formats are supported.
* The PBMPLUS library is NOT required to compile this software
* (but it is highly useful as a set of PPM image manipulation programs).
*
* These routines may need modification for non-Unix environments or
* specialized applications.  As they stand, they assume input from
* an ordinary stdio stream.  They further assume that reading begins
* at the start of the file; start_input may need work if the
* user interface has already read some data (e.g., to determine that
* the file is indeed PPM format).
*/
/* Portions of
 this code are based on the PBMPLUS library, which is:
**
** Copyright (C) 1988 by Jef Poskanzer.
**
** Permission to use, copy, modify, and distribute this software and its
** documentation for any purpose and without fee is hereby granted, provided
** that the above copyright notice appear in all copies and that both that
** copyright notice and this permission notice appear in supporting
** documentation.  This software is provided "as is" without express or
** implied warranty.
*/
```

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/rdppm.c
No license file was found, but licenses were detected in source scan.

```
/*
* jinclude.h
*
* Copyright (C) 1991-1994, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file exists to provide a single place to fix any problems with
* including the wrong system include files.  (Common problems are taken
* care of by the standard jconfig symbols, but on really weird systems
* you may have to edit this file.)
*
```

```
* NOTE: this file is NOT intended to be included by applications using the
* JPEG library.  Most applications need only include jpeglib.h.
*/
```

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jinclude.h
No license file was found, but licenses were detected in source scan.

```
/*
* jcprepct.c
*
* Copyright (C) 1994-1996, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains the compression preprocessing controller.
* This controller manages the color conversion, downsampling,
* and edge expansion steps.
*
* Most of the complexity here is associated with buffering input rows
* as required by the downsampler.  See the comments at the head of
* jcsample.c for the downsampler's needs.
*/
```

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jcprepct.c
No license file was found, but licenses were detected in source scan.

```
/*
* jpegtran.c
*
* This file was part of the Independent JPEG Group's software:
* Copyright (C) 1995-2010, Thomas G. Lane, Guido Vollbeding.
* Modifications:
* Copyright (C) 2010, D. R. Commander.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains a command-line user interface for JPEG transcoding.
* It is very similar to cjpeg.c, and partly to djpeg.c, but provides
* lossless transcoding between different JPEG file formats.  It also
* provides some lossless and sort-of-lossless transformations of JPEG data.
*/
```

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jpegtran.c

No license file was found, but licenses were detected in source scan.

```
/*
* rdjpgcom.c
*
* Copyright (C) 1994-1997, Thomas G. Lane.
* Modified 2009 by Bill Allombert, Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains a very simple stand-alone application that displays
* the text in COM (comment) markers in a JFIF file.
* This may be useful as an example of the minimum logic needed to parse
* JPEG markers.
*/
```

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/rdjpgcom.c
No license file was found, but licenses were detected in source scan.

```
/*
* jccoefct.c
*
* Copyright (C) 1994-1997, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains the coefficient buffer controller for compression.
* This controller is the top level of the JPEG compressor proper.
* The coefficient buffer lies between forward-DCT and entropy encoding steps.
*/
```

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jccoefct.c
No license file was found, but licenses were detected in source scan.

```
/*
* cderror.h
*
* Copyright (C) 1994-1997, Thomas G. Lane.
* Modified 2009 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file defines the error and message codes for the cjpeg/djpeg
* applications.  These strings are not needed as part of the JPEG library
```

* proper.
* Edit this file to add new codes, or to translate the message strings to
* some other language.
*/

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/cderror.h
No license file was found, but licenses were detected in source scan.

/*
* jidctint.c
*
* Copyright (C) 1991-1998, Thomas G. Lane.
* Modification developed 2002-2009 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains a slow-but-accurate integer implementation of the
* inverse DCT (Discrete Cosine Transform). In the IJG code, this routine
* must also perform dequantization of the input coefficients.
*
* A 2-D IDCT can be done by 1-D IDCT on each column followed by 1-D IDCT
* on each row (or vice versa, but it's more convenient to emit a row at
* a time). Direct algorithms are also available, but they are much more
* complex and seem not to be any faster when reduced to code.
*
* This implementation is based on an algorithm described in
*   C. Loeffler, A. Ligtenberg and G. Moschytz, "Practical Fast 1-D DCT
*   Algorithms with 11 Multiplications",
 Proc. Int'l. Conf. on Acoustics,
*   Speech, and Signal Processing 1989 (ICASSP '89), pp. 988-991.
* The primary algorithm described there uses 11 multiplies and 29 adds.
* We use their alternate method with 12 multiplies and 32 adds.
* The advantage of this method is that no data path contains more than one
* multiplication; this allows a very simple and accurate implementation in
* scaled fixed-point arithmetic, with a minimal number of shifts.
*
* We also provide IDCT routines with various output sample block sizes for
* direct resolution reduction or enlargement without additional resampling:
* NxN (N=1...16) pixels for one 8x8 input DCT block.
*
* For N<8 we simply take the corresponding low-frequency coefficients of
* the 8x8 input DCT block and apply an NxN point IDCT on the sub-block
* to yield the downscaled outputs.
* This can be seen as direct low-pass downsampling from the DCT domain
* point of view rather than the usual spatial domain point of view,

```
 * yielding significant computational savings and results at least
* as good as common bilinear (averaging) spatial downsampling.
*
* For N>8 we apply a partial NxN IDCT on the 8 input coefficients as
* lower frequencies and higher frequencies assumed to be zero.
* It turns out that the computational effort is similar to the 8x8 IDCT
* regarding the output size.
* Furthermore, the scaling and descaling is the same for all IDCT sizes.
*
* CAUTION: We rely on the FIX() macro except for the N=1,2,4,8 cases
* since there would be too many additional constants to pre-calculate.
*/
```

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jidctint.c
No license file was found, but licenses were detected in source scan.

```
/*
* jcmainct.c
*
* Copyright (C) 1994-1996, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains the main buffer controller for compression.
* The main buffer lies between the pre-processor and the JPEG
* compressor proper; it holds downsampled data in the JPEG colorspace.
*/
```

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jcmainct.c
No license file was found, but licenses were detected in source scan.

```
/*
* jcmarker.c
*
* This file was part of the Independent JPEG Group's software:
* Copyright (C) 1991-1998, Thomas G. Lane.
* Modifications:
* Copyright (C) 2010, D. R. Commander.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains routines to write JPEG datastream markers.
*/
```

Found in path(s):

* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jcmarker.c
No license file was found, but licenses were detected in source scan.

USING THE IJG JPEG LIBRARY

This file was part of the Independent JPEG Group's software:
Copyright (C) 1994-2011, Thomas G. Lane, Guido Vollbeding.
Modifications:
Copyright (C) 2010, D. R. Commander.
For conditions of distribution and use, see the accompanying README file.

This file describes how to use the IJG JPEG library within an application program. Read it if you want to write a program that uses the library.

The file example.c provides heavily commented skeleton code for calling the JPEG library. Also see jpeglib.h (the include file to be used by application programs) for full details about data structures and function parameter lists. The library source code, of course, is the ultimate reference.

Note that there have been *major* changes from the application interface presented by IJG version 4 and earlier versions. The old design had several inherent limitations, and it had accumulated a lot of cruft as we added features while trying to minimize application-interface changes. We have sacrificed backward compatibility in the version 5 rewrite, but we think the improvements justify this.

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You should read at least the overview and basic usage sections before trying to program with the library. The sections on advanced features can be read if and when you need them.

OVERVIEW

Functions provided by the library

The IJG JPEG library provides C code to read and write JPEG-compressed image files. The surrounding application program receives or supplies image data a scanline at a time, using a straightforward uncompressed image format. All details of color conversion and other preprocessing/postprocessing can be handled by the library.

The library includes a substantial amount of code that is not covered by the JPEG standard but is necessary for typical applications of JPEG. These functions preprocess the image before JPEG compression or postprocess it after decompression. They include colorspace conversion, downsampling/upsampling, and color quantization. The application indirectly selects use of this code by specifying the format in which it wishes to supply or receive image data.
For example, if colormapped output is requested, then the decompression library automatically invokes color quantization.

A wide range of quality vs. speed tradeoffs are possible in JPEG processing, and even more so in decompression postprocessing. The decompression library provides multiple implementations that cover most of the useful tradeoffs, ranging from very-high-quality down to fast-preview operation. On the compression side we have generally not provided low-quality choices, since compression is normally less time-critical. It should be understood that the low-quality modes may not meet the JPEG standard's accuracy requirements;

nonetheless, they are useful for viewers.

A word about functions *not* provided by the library. We handle a subset of the ISO JPEG standard; most baseline, extended-sequential, and progressive JPEG processes are supported. (Our subset includes all features now in common use.) Unsupported ISO options include:

* Hierarchical storage
* Lossless JPEG
* DNL marker
* Nonintegral subsampling ratios

We support both 8- and 12-bit data precision, but this is a compile-time choice rather than a run-time choice; hence it is difficult to use both precisions in a single application.

By itself, the library handles only interchange JPEG datastreams --- in particular the widely used JFIF file format. The library can be used by surrounding code to process interchange or abbreviated JPEG datastreams that are embedded in more complex file formats. (For example, this library is used by the free LIBTIFF library to support JPEG compression in TIFF.)

Outline of typical usage

The rough outline of a JPEG compression operation is:

```
Allocate and initialize a JPEG compression object
Specify the destination for the compressed data (eg, a file)
Set parameters for compression, including image size & colorspace
jpeg_start_compress(...);
while (scan lines remain to be written)
  jpeg_write_scanlines(...);
jpeg_finish_compress(...);
Release
the JPEG compression object
```

A JPEG compression object holds parameters and working state for the JPEG library. We make creation/destruction of the object separate from starting or finishing compression of an image; the same object can be re-used for a series of image compression operations. This makes it easy to re-use the same parameter settings for a sequence of images. Re-use of a JPEG object also has important implications for processing abbreviated JPEG datastreams, as discussed later.

The image data to be compressed is supplied to jpeg_write_scanlines() from in-memory buffers. If the application is doing file-to-file compression, reading image data from the source file is the application's responsibility.

The library emits compressed data by calling a "data destination manager", which typically will write the data into a file; but the application can provide its own destination manager to do something else.

Similarly, the rough outline of a JPEG
decompression operation is:

```
Allocate and initialize a JPEG decompression object
Specify the source of the compressed data (eg, a file)
Call jpeg_read_header() to obtain image info
Set parameters for decompression
jpeg_start_decompress(...);
while (scan lines remain to be read)
 jpeg_read_scanlines(...);
jpeg_finish_decompress(...);
Release the JPEG decompression object
```

This is comparable to the compression outline except that reading the datastream header is a separate step. This is helpful because information about the image's size, colorspace, etc is available when the application selects decompression parameters. For example, the application can choose an output scaling ratio that will fit the image into the available screen size.

The decompression library obtains compressed data by calling a data source manager, which typically will read the data from a file; but other behaviors can be obtained with a custom source manager. Decompressed data is delivered into in-memory
buffers passed to jpeg_read_scanlines().

It is possible to abort an incomplete compression or decompression operation by calling jpeg_abort(); or, if you do not need to retain the JPEG object, simply release it by calling jpeg_destroy().

JPEG compression and decompression objects are two separate struct types. However, they share some common fields, and certain routines such as jpeg_destroy() can work on either type of object.

The JPEG library has no static variables: all state is in the compression or decompression object. Therefore it is possible to process multiple compression and decompression operations concurrently, using multiple JPEG objects.

Both compression and decompression can be done in an incremental memory-to-memory fashion, if suitable source/destination managers are used. See the section on "I/O suspension" for more details.

BASIC LIBRARY USAGE

==========

Data formats

Before diving into procedural details, it is helpful to understand
the
image data format that the JPEG library expects or returns.

The standard input image format is a rectangular array of pixels, with each
pixel having the same number of "component" or "sample" values (color
channels). You must specify how many components there are and the colorspace
interpretation of the components. Most applications will use RGB data
(three components per pixel) or grayscale data (one component per pixel).
PLEASE NOTE THAT RGB DATA IS THREE SAMPLES PER PIXEL, GRAYSCALE ONLY ONE.
A remarkable number of people manage to miss this, only to find that their
programs don't work with grayscale JPEG files.

There is no provision for colormapped input. JPEG files are always full-color
or full grayscale (or sometimes another colorspace such as CMYK). You can
feed in a colormapped image by expanding it to full-color format. However
JPEG often doesn't work very well with source data that has been colormapped,
because of dithering noise. This is discussed in more detail
in the JPEG FAQ
and the other references mentioned in the README file.

Pixels are stored by scanlines, with each scanline running from left to
right. The component values for each pixel are adjacent in the row; for
example, R,G,B,R,G,B,R,G,B,... for 24-bit RGB color. Each scanline is an
array of data type JSAMPLE --- which is typically "unsigned char", unless
you've changed jmorecfg.h. (You can also change the RGB pixel layout, say
to B,G,R order, by modifying jmorecfg.h. But see the restrictions listed in
that file before doing so.)

A 2-D array of pixels is formed by making a list of pointers to the starts of
scanlines; so the scanlines need not be physically adjacent in memory. Even
if you process just one scanline at a time, you must make a one-element
pointer array to conform to this structure. Pointers to JSAMPLE rows are of
type JSAMPROW, and the pointer to the pointer array is of type JSAMPARRAY.

The library accepts or supplies one or more complete scanlines per call.
It
is not possible to process part of a row at a time. Scanlines are always
processed top-to-bottom. You can process an entire image in one call if you
have it all in memory, but usually it's simplest to process one scanline at
a time.

For best results, source data values should have the precision specified by

BITS_IN_JSAMPLE (normally 8 bits). For instance, if you choose to compress data that's only 6 bits/channel, you should left-justify each value in a byte before passing it to the compressor. If you need to compress data that has more than 8 bits/channel, compile with BITS_IN_JSAMPLE = 12. (See "Library compile-time options", later.)

The data format returned by the decompressor is the same in all details, except that colormapped output is supported. (Again, a JPEG file is never colormapped. But you can ask the decompressor to perform on-the-fly color quantization to deliver colormapped output.) If you request colormapped output then the returned data array contains a single JSAMPLE per pixel; its value is an index into a color map. The color map is represented as a 2-D JSAMPARRAY in which each row holds the values of one color component, that is, colormap[i][j] is the value of the i'th color component for pixel value (map index) j. Note that since the colormap indexes are stored in JSAMPLEs, the maximum number of colors is limited by the size of JSAMPLE (ie, at most 256 colors for an 8-bit JPEG library).

Compression details

Here we revisit the JPEG compression outline given in the overview.

1. Allocate and initialize a JPEG compression object.

A JPEG compression object is a "struct jpeg_compress_struct". (It also has a bunch of subsidiary structures which are allocated via malloc(), but the application doesn't control those directly.) This struct can be just a local variable in the calling routine, if a single routine is going to execute the whole JPEG compression sequence. Otherwise it can be static or allocated from malloc().

You will also need a structure representing a JPEG error handler. The part of this that the library cares about is a "struct jpeg_error_mgr". If you are providing your own error handler, you'll typically want to embed the jpeg_error_mgr struct in a larger structure; this is discussed later under "Error handling". For now we'll assume you are just using the default error handler. The default error handler will print JPEG error/warning messages on stderr, and it will call exit() if a fatal error occurs.

You must initialize the error handler structure, store a pointer to it into the JPEG object's "err" field, and then call jpeg_create_compress() to initialize the rest of the JPEG object.

Typical code for this step, if you are using the default error handler, is

```
 struct jpeg_compress_struct cinfo;
 struct jpeg_error_mgr jerr;
 ...
 cinfo.err = jpeg_std_error(&jerr);
 jpeg_create_compress(&cinfo);
```

jpeg_create_compress allocates a small amount of memory, so it could fail
if
you are out of memory. In that case it will exit via the error handler;
that's why the error handler must be initialized first.

2. Specify the destination for the compressed data (eg, a file).

As previously mentioned, the JPEG library delivers compressed data to a
"data destination" module. The library includes one data destination
module which knows how to write to a stdio stream. You can use your own
destination module if you want to do something else, as discussed later.

If you use the standard destination module, you must open the target stdio
stream beforehand. Typical code for this step looks like:

```
 FILE * outfile;
 ...
 if ((outfile = fopen(filename, "wb")) == NULL) {
     fprintf(stderr, "can't open %s\n", filename);
     exit(1);
 }
 jpeg_stdio_dest(&cinfo, outfile);
```

where the last line invokes the standard destination module.

WARNING: it is critical that the binary compressed data be delivered to the
output file unchanged. On non-Unix systems the stdio library may
perform
newline translation or otherwise corrupt binary data. To suppress this
behavior, you may need to use a "b" option to fopen (as shown above), or use
setmode() or another routine to put the stdio stream in binary mode. See
cjpeg.c and djpeg.c for code that has been found to work on many systems.

You can select the data destination after setting other parameters (step 3),
if that's more convenient. You may not change the destination between
calling jpeg_start_compress() and jpeg_finish_compress().

3. Set parameters for compression, including image size & colorspace.

You must supply information about the source image by setting the following fields in the JPEG object (cinfo structure):

image_width Width of image, in pixels
image_height Height of image, in pixels
input_components Number of color channels (samples per pixel)
in_color_space Color space of source image

The image dimensions are, hopefully, obvious. JPEG supports image dimensions of 1 to 64K pixels in
either direction. The input color space is typically
RGB or grayscale, and input_components is 3 or 1 accordingly. (See "Special color spaces", later, for more info.) The in_color_space field must be assigned one of the J_COLOR_SPACE enum constants, typically JCS_RGB or JCS_GRAYSCALE.

JPEG has a large number of compression parameters that determine how the image is encoded. Most applications don't need or want to know about all these parameters. You can set all the parameters to reasonable defaults by calling jpeg_set_defaults(); then, if there are particular values you want to change, you can do so after that. The "Compression parameter selection" section tells about all the parameters.

You must set in_color_space correctly before calling jpeg_set_defaults(), because the defaults depend on the source image colorspace. However the other three source image parameters need not be valid until you call jpeg_start_compress(). There's no harm in calling jpeg_set_defaults() more
than
once, if that happens to be convenient.

Typical code for a 24-bit RGB source image is

```
cinfo.image_width = Width;  /* image width and height, in pixels */
cinfo.image_height = Height;
cinfo.input_components = 3; /* # of color components per pixel */
cinfo.in_color_space = JCS_RGB; /* colorspace of input image */

jpeg_set_defaults(&cinfo);
/* Make optional parameter settings here */
```

4. jpeg_start_compress(...);

After you have established the data destination and set all the necessary source image info and other parameters, call jpeg_start_compress() to begin a compression cycle. This will initialize internal state, allocate working storage, and emit the first few bytes of the JPEG datastream header.

Typical code:

```
jpeg_start_compress(&cinfo, TRUE);
```

The "TRUE" parameter ensures that a complete JPEG interchange datastream
will be written. This is appropriate in most cases. If you think you might
want to use an abbreviated datastream, read the section on abbreviated
datastreams,
below.

Once you have called jpeg_start_compress(), you may not alter any JPEG
parameters or other fields of the JPEG object until you have completed
the compression cycle.

5. while (scan lines remain to be written)

```
jpeg_write_scanlines(...);
```

Now write all the required image data by calling jpeg_write_scanlines()
one or more times. You can pass one or more scanlines in each call, up
to the total image height. In most applications it is convenient to pass
just one or a few scanlines at a time. The expected format for the passed
data is discussed under "Data formats", above.

Image data should be written in top-to-bottom scanline order. The JPEG spec
contains some weasel wording about how top and bottom are application-defined
terms (a curious interpretation of the English language...) but if you want
your files to be compatible with everyone else's, you WILL use top-to-bottom
order. If the source data must be read in bottom-to-top order, you can use
the JPEG library's
virtual array mechanism to invert the data efficiently.
Examples of this can be found in the sample application cjpeg.

The library maintains a count of the number of scanlines written so far
in the next_scanline field of the JPEG object. Usually you can just use
this variable as the loop counter, so that the loop test looks like
"while (cinfo.next_scanline < cinfo.image_height)".

Code for this step depends heavily on the way that you store the source data.
example.c shows the following code for the case of a full-size 2-D source
array containing 3-byte RGB pixels:

```
JSAMPROW row_pointer[1]; /* pointer to a single row */
int row_stride;   /* physical row width in buffer */

row_stride = image_width * 3; /* JSAMPLEs per row in image_buffer */
```

```
 while (cinfo.next_scanline < cinfo.image_height) {
    row_pointer[0] = & image_buffer[cinfo.next_scanline * row_stride];
    jpeg_write_scanlines(&cinfo, row_pointer, 1);
 }
```

jpeg_write_scanlines() returns the number of scanlines actually
 written.
This will normally be equal to the number passed in, so you can usually
ignore the return value. It is different in just two cases:
 * If you try to write more scanlines than the declared image height,
   the additional scanlines are ignored.
 * If you use a suspending data destination manager, output buffer overrun
   will cause the compressor to return before accepting all the passed lines.
   This feature is discussed under "I/O suspension", below. The normal
   stdio destination manager will NOT cause this to happen.
In any case, the return value is the same as the change in the value of
next_scanline.

6. jpeg_finish_compress(...);

After all the image data has been written, call jpeg_finish_compress() to
complete the compression cycle. This step is ESSENTIAL to ensure that the
last bufferload of data is written to the data destination.
jpeg_finish_compress() also releases working memory associated with the JPEG
object.

Typical code:

```
 jpeg_finish_compress(&cinfo);
```

If
 using the stdio destination manager, don't forget to close the output
stdio stream (if necessary) afterwards.

If you have requested a multi-pass operating mode, such as Huffman code
optimization, jpeg_finish_compress() will perform the additional passes using
data buffered by the first pass. In this case jpeg_finish_compress() may take
quite a while to complete. With the default compression parameters, this will
not happen.

It is an error to call jpeg_finish_compress() before writing the necessary
total number of scanlines. If you wish to abort compression, call
jpeg_abort() as discussed below.

After completing a compression cycle, you may dispose of the JPEG object
as discussed next, or you may use it to compress another image. In that case
return to step 2, 3, or 4 as appropriate. If you do not change the

destination manager, the new datastream will be written to the same target.
If you do not change any JPEG parameters, the new datastream will be written
with the same
parameters as before. Note that you can change the input image
dimensions freely between cycles, but if you change the input colorspace, you
should call jpeg_set_defaults() to adjust for the new colorspace; and then
you'll need to repeat all of step 3.

7. Release the JPEG compression object.

When you are done with a JPEG compression object, destroy it by calling
jpeg_destroy_compress(). This will free all subsidiary memory (regardless of
the previous state of the object). Or you can call jpeg_destroy(), which
works for either compression or decompression objects --- this may be more
convenient if you are sharing code between compression and decompression
cases. (Actually, these routines are equivalent except for the declared type
of the passed pointer. To avoid gripes from ANSI C compilers, jpeg_destroy()
should be passed a j_common_ptr.)

If you allocated the jpeg_compress_struct structure from malloc(), freeing
it is your responsibility --- jpeg_destroy() won't. Ditto for
the error
handler structure.

Typical code:

```
jpeg_destroy_compress(&cinfo);
```

8. Aborting.

If you decide to abort a compression cycle before finishing, you can clean up
in either of two ways:

* If you don't need the JPEG object any more, just call
jpeg_destroy_compress() or jpeg_destroy() to release memory. This is
legitimate at any point after calling jpeg_create_compress() --- in fact,
it's safe even if jpeg_create_compress() fails.

* If you want to re-use the JPEG object, call jpeg_abort_compress(), or call
jpeg_abort() which works on both compression and decompression objects.
This will return the object to an idle state, releasing any working memory.
jpeg_abort() is allowed at any time after successful object creation.

Note that cleaning up the data destination, if required, is your
responsibility; neither of these routines will call term_destination().
(See "Compressed data handling", below, for more about that.)

jpeg_destroy() and jpeg_abort() are the only safe
 calls to make on a JPEG
object that has reported an error by calling error_exit (see "Error handling"
for more info). The internal state of such an object is likely to be out of
whack. Either of these two routines will return the object to a known state.

Decompression details

Here we revisit the JPEG decompression outline given in the overview.

1. Allocate and initialize a JPEG decompression object.

This is just like initialization for compression, as discussed above,
except that the object is a "struct jpeg_decompress_struct" and you
call jpeg_create_decompress(). Error handling is exactly the same.

Typical code:

```
 struct jpeg_decompress_struct cinfo;
 struct jpeg_error_mgr jerr;
 ...
 cinfo.err = jpeg_std_error(&jerr);
 jpeg_create_decompress(&cinfo);
```

(Both here and in the IJG code, we usually use variable name "cinfo" for
both compression and decompression objects.)

2. Specify the source of the compressed data (eg, a file).

As previously mentioned,
 the JPEG library reads compressed data from a "data
source" module. The library includes one data source module which knows how
to read from a stdio stream. You can use your own source module if you want
to do something else, as discussed later.

If you use the standard source module, you must open the source stdio stream
beforehand. Typical code for this step looks like:

```
 FILE * infile;
 ...
 if ((infile = fopen(filename, "rb")) == NULL) {
    fprintf(stderr, "can't open %s\n", filename);
    exit(1);
 }
```

```
jpeg_stdio_src(&cinfo, infile);
```

where the last line invokes the standard source module.

WARNING: it is critical that the binary compressed data be read unchanged. On non-Unix systems the stdio library may perform newline translation or otherwise corrupt binary data. To suppress this behavior, you may need to use a "b" option to fopen (as shown above), or use setmode() or another routine to put the stdio stream in binary mode. See cjpeg.c and djpeg.c for code that has been
found to work on many systems.

You may not change the data source between calling jpeg_read_header() and jpeg_finish_decompress(). If you wish to read a series of JPEG images from a single source file, you should repeat the jpeg_read_header() to jpeg_finish_decompress() sequence without reinitializing either the JPEG object or the data source module; this prevents buffered input data from being discarded.

3. Call jpeg_read_header() to obtain image info.

Typical code for this step is just

```
jpeg_read_header(&cinfo, TRUE);
```

This will read the source datastream header markers, up to the beginning of the compressed data proper. On return, the image dimensions and other info have been stored in the JPEG object. The application may wish to consult this information before selecting decompression parameters.

More complex code is necessary if

* A suspending data source is used --- in that case jpeg_read_header() may return before it has read all the header data. See "I/O suspension", below. The normal stdio source manager will NOT cause this to happen.
* Abbreviated JPEG files are to be processed --- see the section on abbreviated datastreams. Standard applications that deal only in interchange JPEG files need not be concerned with this case either.

It is permissible to stop at this point if you just wanted to find out the image dimensions and other header info for a JPEG file. In that case, call jpeg_destroy() when you are done with the JPEG object, or call jpeg_abort() to return it to an idle state before selecting a new data source and reading another header.

4. Set parameters for decompression.

jpeg_read_header() sets appropriate default decompression parameters based on
the properties of the image (in particular, its colorspace). However, you
may well want to alter these defaults before beginning the decompression.
For example, the default is to produce full color output from a color file.
If you want colormapped output you must ask
for it. Other options allow the
returned image to be scaled and allow various speed/quality tradeoffs to be
selected. "Decompression parameter selection", below, gives details.

If the defaults are appropriate, nothing need be done at this step.

Note that all default values are set by each call to jpeg_read_header().
If you reuse a decompression object, you cannot expect your parameter
settings to be preserved across cycles, as you can for compression.
You must set desired parameter values each time.

5. jpeg_start_decompress(...);

Once the parameter values are satisfactory, call jpeg_start_decompress() to
begin decompression. This will initialize internal state, allocate working
memory, and prepare for returning data.

Typical code is just

jpeg_start_decompress(&cinfo);

If you have requested a multi-pass operating mode, such as 2-pass color
quantization, jpeg_start_decompress() will do everything needed before data
output can begin. In this case jpeg_start_decompress() may
take quite a while
to complete. With a single-scan (non progressive) JPEG file and default
decompression parameters, this will not happen; jpeg_start_decompress() will
return quickly.

After this call, the final output image dimensions, including any requested
scaling, are available in the JPEG object; so is the selected colormap, if
colormapped output has been requested. Useful fields include

output_width image width and height, as scaled
output_height
out_color_components # of color components in out_color_space
output_components # of color components returned per pixel
colormap the selected colormap, if any
actual_number_of_colors number of entries in colormap

output_components is 1 (a colormap index) when quantizing colors; otherwise it
equals out_color_components. It is the number of JSAMPLE values that will be

emitted per pixel in the output arrays.

Typically you will need to allocate data buffers to hold the incoming image.
You will need output_width * output_components
 JSAMPLEs per scanline in your
output buffer, and a total of output_height scanlines will be returned.

Note: if you are using the JPEG library's internal memory manager to allocate
data buffers (as djpeg does), then the manager's protocol requires that you
request large buffers *before* calling jpeg_start_decompress(). This is a
little tricky since the output_XXX fields are not normally valid then. You
can make them valid by calling jpeg_calc_output_dimensions() after setting the
relevant parameters (scaling, output color space, and quantization flag).

6. while (scan lines remain to be read)
 jpeg_read_scanlines(...);

Now you can read the decompressed image data by calling jpeg_read_scanlines()
one or more times. At each call, you pass in the maximum number of scanlines
to be read (ie, the height of your working buffer); jpeg_read_scanlines()
will return up to that many lines. The return value is the number of lines
actually read. The format of the returned data is discussed
 under "Data
formats", above. Don't forget that grayscale and color JPEGs will return
different data formats!

Image data is returned in top-to-bottom scanline order. If you must write
out the image in bottom-to-top order, you can use the JPEG library's virtual
array mechanism to invert the data efficiently. Examples of this can be
found in the sample application djpeg.

The library maintains a count of the number of scanlines returned so far
in the output_scanline field of the JPEG object. Usually you can just use
this variable as the loop counter, so that the loop test looks like
"while (cinfo.output_scanline < cinfo.output_height)". (Note that the test
should NOT be against image_height, unless you never use scaling. The
image_height field is the height of the original unscaled image.)
The return value always equals the change in the value of output_scanline.

If you don't use a suspending data source, it is safe to assume that
jpeg_read_scanlines() reads at least one scanline
 per call, until the
bottom of the image has been reached.

If you use a buffer larger than one scanline, it is NOT safe to assume that
jpeg_read_scanlines() fills it. (The current implementation returns only a
few scanlines per call, no matter how large a buffer you pass.) So you must

always provide a loop that calls jpeg_read_scanlines() repeatedly until the whole image has been read.

7. jpeg_finish_decompress(...);

After all the image data has been read, call jpeg_finish_decompress() to complete the decompression cycle. This causes working memory associated with the JPEG object to be released.

Typical code:

```
jpeg_finish_decompress(&cinfo);
```

If using the stdio source manager, don't forget to close the source stdio stream if necessary.

It is an error to call jpeg_finish_decompress() before reading the correct total number of scanlines. If you wish to abort decompression, call jpeg_abort() as discussed below.

After completing a decompression cycle, you may dispose of the JPEG object as
discussed next, or you may use it to decompress another image. In that case return to step 2 or 3 as appropriate. If you do not change the source manager, the next image will be read from the same source.

8. Release the JPEG decompression object.

When you are done with a JPEG decompression object, destroy it by calling jpeg_destroy_decompress() or jpeg_destroy(). The previous discussion of destroying compression objects applies here too.

Typical code:

```
jpeg_destroy_decompress(&cinfo);
```

9. Aborting.

You can abort a decompression cycle by calling jpeg_destroy_decompress() or jpeg_destroy() if you don't need the JPEG object any more, or jpeg_abort_decompress() or jpeg_abort() if you want to reuse the object. The previous discussion of aborting compression cycles applies here too.

Mechanics of usage: include files, linking, etc

Applications using the JPEG library should include the header file jpeglib.h to obtain
declarations of data types and routines. Before including
jpeglib.h, include system headers that define at least the typedefs FILE and
size_t. On ANSI-conforming systems, including <stdio.h> is sufficient; on
older Unix systems, you may need <sys/types.h> to define size_t.

If the application needs to refer to individual JPEG library error codes, also
include jerror.h to define those symbols.

jpeglib.h indirectly includes the files jconfig.h and jmorecfg.h. If you are
installing the JPEG header files in a system directory, you will want to
install all four files: jpeglib.h, jerror.h, jconfig.h, jmorecfg.h.

The most convenient way to include the JPEG code into your executable program
is to prepare a library file ("libjpeg.a", or a corresponding name on non-Unix
machines) and reference it at your link step. If you use only half of the
library (only compression or only decompression), only that much code will be
included from the library, unless your linker is hopelessly brain-damaged.
The
supplied makefiles build libjpeg.a automatically (see install.txt).

While you can build the JPEG library as a shared library if the whim strikes
you, we don't really recommend it. The trouble with shared libraries is that
at some point you'll probably try to substitute a new version of the library
without recompiling the calling applications. That generally doesn't work
because the parameter struct declarations usually change with each new
version. In other words, the library's API is *not* guaranteed binary
compatible across versions; we only try to ensure source-code compatibility.
(In hindsight, it might have been smarter to hide the parameter structs from
applications and introduce a ton of access functions instead. Too late now,
however.)

On some systems your application may need to set up a signal handler to ensure
that temporary files are deleted if the program is interrupted. This is most
critical if you are on MS-DOS and use the jmemdos.c memory manager back end;
it
will try to grab extended memory for temp files, and that space will NOT be
freed automatically. See cjpeg.c or djpeg.c for an example signal handler.

It may be worth pointing out that the core JPEG library does not actually
require the stdio library: only the default source/destination managers and
error handler need it. You can use the library in a stdio-less environment
if you replace those modules and use jmemnobs.c (or another memory manager of
your own devising). More info about the minimum system library requirements
may be found in jinclude.h.

ADVANCED FEATURES
==========

Compression parameter selection

This section describes all the optional parameters you can set for JPEG compression, as well as the "helper" routines provided to assist in this task. Proper setting of some parameters requires detailed understanding of the JPEG standard; if you don't know what a parameter is for, it's best not to mess with it! See REFERENCES in the README file for pointers to more info about JPEG.

It's a good idea to call jpeg_set_defaults() first, even if you plan to set all the parameters; that way your code is more likely to work with future JPEG libraries that have additional parameters. For the same reason, we recommend you use a helper routine where one is provided, in preference to twiddling cinfo fields directly.

The helper routines are:

jpeg_set_defaults (j_compress_ptr cinfo)
This routine sets all JPEG parameters to reasonable defaults, using only the input image's color space (field in_color_space, which must already be set in cinfo). Many applications will only need to use this routine and perhaps jpeg_set_quality().

jpeg_set_colorspace (j_compress_ptr cinfo, J_COLOR_SPACE colorspace)
Sets the JPEG file's colorspace (field jpeg_color_space) as specified, and sets other color-space-dependent parameters appropriately. See "Special color spaces", below, before using this. A large number of parameters, including all per-component parameters, are set by this routine; if you want to twiddle individual parameters you should call jpeg_set_colorspace() before rather than after.

jpeg_default_colorspace (j_compress_ptr cinfo)
Selects an appropriate JPEG colorspace based on cinfo->in_color_space, and calls jpeg_set_colorspace(). This is actually a subroutine of jpeg_set_defaults(). It's broken out in case you want to change just the colorspace-dependent JPEG parameters.

jpeg_set_quality (j_compress_ptr cinfo, int quality, boolean force_baseline)
Constructs JPEG quantization tables appropriate for the indicated quality setting. The quality value is expressed on the 0..100 scale

recommended by IJG (cjpeg's "-quality" switch uses this routine).
Note that the exact mapping from quality values to tables may change
in future IJG releases as more is learned about DCT quantization.
If the force_baseline parameter is TRUE, then the quantization table
entries are constrained to
the range 1..255 for full JPEG baseline
compatibility. In the current implementation, this only makes a
difference for quality settings below 25, and it effectively prevents
very small/low quality files from being generated. The IJG decoder
is capable of reading the non-baseline files generated at low quality
settings when force_baseline is FALSE, but other decoders may not be.

jpeg_set_linear_quality (j_compress_ptr cinfo, int scale_factor,
boolean force_baseline)
Same as jpeg_set_quality() except that the generated tables are the
sample tables given in the JPEC spec section K.1, multiplied by the
specified scale factor (which is expressed as a percentage; thus
scale_factor = 100 reproduces the spec's tables). Note that larger
scale factors give lower quality. This entry point is useful for
conforming to the Adobe PostScript DCT conventions, but we do not
recommend linear scaling as a user-visible quality scale otherwise.
force_baseline again constrains the computed
table entries to 1..255.

int jpeg_quality_scaling (int quality)
Converts a value on the IJG-recommended quality scale to a linear
scaling percentage. Note that this routine may change or go away
in future releases --- IJG may choose to adopt a scaling method that
can't be expressed as a simple scalar multiplier, in which case the
premise of this routine collapses. Caveat user.

jpeg_default_qtables (j_compress_ptr cinfo, boolean force_baseline)
[libjpeg v7+ API/ABI emulation only]
Set default quantization tables with linear q_scale_factor[] values
(see below).

jpeg_add_quant_table (j_compress_ptr cinfo, int which_tbl,
const unsigned int *basic_table,
int scale_factor, boolean force_baseline)
Allows an arbitrary quantization table to be created. which_tbl
indicates which table slot to fill. basic_table points to an array
of 64 unsigned ints given in normal array order. These values are
multiplied by scale_factor/100 and then clamped to the range
1..65535
(or to 1..255 if force_baseline is TRUE).
CAUTION: prior to library version 6a, jpeg_add_quant_table expected
the basic table to be given in JPEG zigzag order. If you need to
write code that works with either older or newer versions of this

routine, you must check the library version number. Something like
"#if JPEG_LIB_VERSION >= 61" is the right test.

jpeg_simple_progression (j_compress_ptr cinfo)
Generates a default scan script for writing a progressive-JPEG file.
This is the recommended method of creating a progressive file,
unless you want to make a custom scan sequence. You must ensure that
the JPEG color space is set correctly before calling this routine.

Compression parameters (cinfo fields) include:

J_DCT_METHOD dct_method
Selects the algorithm used for the DCT step. Choices are:
JDCT_ISLOW: slow but accurate integer algorithm
JDCT_IFAST: faster, less accurate integer method
JDCT_FLOAT: floating-point method
JDCT_DEFAULT: default method (normally
JDCT_ISLOW)
JDCT_FASTEST: fastest method (normally JDCT_IFAST)
The FLOAT method is very slightly more accurate than the ISLOW method,
but may give different results on different machines due to varying
roundoff behavior. The integer methods should give the same results
on all machines. On machines with sufficiently fast FP hardware, the
floating-point method may also be the fastest. The IFAST method is
considerably less accurate than the other two; its use is not
recommended if high quality is a concern. JDCT_DEFAULT and
JDCT_FASTEST are macros configurable by each installation.

J_COLOR_SPACE jpeg_color_space
int num_components
The JPEG color space and corresponding number of components; see
"Special color spaces", below, for more info. We recommend using
jpeg_set_color_space() if you want to change these.

boolean optimize_coding
TRUE causes the compressor to compute optimal Huffman coding tables
for the image. This requires an extra pass over the data and
therefore
costs a good deal of space and time. The default is
FALSE, which tells the compressor to use the supplied or default
Huffman tables. In most cases optimal tables save only a few percent
of file size compared to the default tables. Note that when this is
TRUE, you need not supply Huffman tables at all, and any you do
supply will be overwritten.

unsigned int restart_interval
int restart_in_rows

To emit restart markers in the JPEG file, set one of these nonzero.
Set restart_interval to specify the exact interval in MCU blocks.
Set restart_in_rows to specify the interval in MCU rows. (If
restart_in_rows is not 0, then restart_interval is set after the
image width in MCUs is computed.) Defaults are zero (no restarts).
One restart marker per MCU row is often a good choice.
NOTE: the overhead of restart markers is higher in grayscale JPEG
files than in color files, and MUCH higher in progressive JPEGs.
If you use restarts, you may want to use larger intervals in
those
cases.

const jpeg_scan_info * scan_info
int num_scans
By default, scan_info is NULL; this causes the compressor to write a
single-scan sequential JPEG file. If not NULL, scan_info points to
an array of scan definition records of length num_scans. The
compressor will then write a JPEG file having one scan for each scan
definition record. This is used to generate noninterleaved or
progressive JPEG files. The library checks that the scan array
defines a valid JPEG scan sequence. (jpeg_simple_progression creates
a suitable scan definition array for progressive JPEG.) This is
discussed further under "Progressive JPEG support".

int smoothing_factor
If non-zero, the input image is smoothed; the value should be 1 for
minimal smoothing to 100 for maximum smoothing. Consult jcsample.c
for details of the smoothing algorithm. The default is zero.

boolean write_JFIF_header
If TRUE, a JFIF APP0 marker is emitted. jpeg_set_defaults() and
jpeg_set_colorspace() set this
TRUE if a JFIF-legal JPEG color space
(ie, YCbCr or grayscale) is selected, otherwise FALSE.

UINT8 JFIF_major_version
UINT8 JFIF_minor_version
The version number to be written into the JFIF marker.
jpeg_set_defaults() initializes the version to 1.01 (major=minor=1).
You should set it to 1.02 (major=1, minor=2) if you plan to write
any JFIF 1.02 extension markers.

UINT8 density_unit
UINT16 X_density
UINT16 Y_density
The resolution information to be written into the JFIF marker;
not used otherwise. density_unit may be 0 for unknown,
1 for dots/inch, or 2 for dots/cm. The default values are 0,1,1

indicating square pixels of unknown size.

boolean write_Adobe_marker
If TRUE, an Adobe APP14 marker is emitted. jpeg_set_defaults() and
jpeg_set_colorspace() set this TRUE if JPEG color space RGB, CMYK,
or YCCK is selected, otherwise FALSE. It is generally a bad idea
to set both write_JFIF_header and write_Adobe_marker. In fact,
you probably shouldn't change the default settings
at all --- the
default behavior ensures that the JPEG file's color space can be
recognized by the decoder.

JQUANT_TBL * quant_tbl_ptrs[NUM_QUANT_TBLS]
Pointers to coefficient quantization tables, one per table slot,
or NULL if no table is defined for a slot. Usually these should
be set via one of the above helper routines; jpeg_add_quant_table()
is general enough to define any quantization table. The other
routines will set up table slot 0 for luminance quality and table
slot 1 for chrominance.

int q_scale_factor[NUM_QUANT_TBLS]
[libjpeg v7+ API/ABI emulation only]
Linear quantization scaling factors (0-100, default 100)
for use with jpeg_default_qtables().
See rdswitch.c and cjpeg.c for an example of usage.
Note that the q_scale_factor[] values use "linear" scales, so JPEG
quality levels chosen by the user must be converted to these scales
using jpeg_quality_scaling(). Here is an example that corresponds to
cjpeg -quality 90,70:

```
jpeg_set_defaults(cinfo);

/*
Set luminance quality 90. */
cinfo->q_scale_factor[0] = jpeg_quality_scaling(90);
/* Set chrominance quality 70. */
cinfo->q_scale_factor[1] = jpeg_quality_scaling(70);

jpeg_default_qtables(cinfo, force_baseline);
```

CAUTION: Setting separate quality levels for chrominance and luminance
is mainly only useful if chrominance subsampling is disabled. 2x2
chrominance subsampling (AKA "4:2:0") is the default, but you can
explicitly disable subsampling as follows:

```
cinfo->comp_info[0].v_samp_factor = 1;
cinfo->comp_info[0].h_samp_factor = 1;
```

JHUFF_TBL * dc_huff_tbl_ptrs[NUM_HUFF_TBLS]
JHUFF_TBL * ac_huff_tbl_ptrs[NUM_HUFF_TBLS]
 Pointers to Huffman coding tables, one per table slot, or NULL if
 no table is defined for a slot. Slots 0 and 1 are filled with the
 JPEG sample tables by jpeg_set_defaults(). If you need to allocate
 more table structures, jpeg_alloc_huff_table() may be used.
 Note that optimal Huffman tables can be computed for an image
 by setting optimize_coding,
 as discussed above; there's seldom
 any need to mess with providing your own Huffman tables.

[libjpeg v7+ API/ABI emulation only]
The actual dimensions of the JPEG image that will be written to the file are
given by the following fields. These are computed from the input image
dimensions and the compression parameters by jpeg_start_compress(). You can
also call jpeg_calc_jpeg_dimensions() to obtain the values that will result
from the current parameter settings. This can be useful if you are trying
to pick a scaling ratio that will get close to a desired target size.

JDIMENSION jpeg_width Actual dimensions of output image.
JDIMENSION jpeg_height

Per-component parameters are stored in the struct cinfo.comp_info[i] for
component number i. Note that components here refer to components of the
JPEG color space, *not* the source image color space. A suitably large
comp_info[] array is allocated by jpeg_set_defaults(); if you choose not
to use that routine, it's up to you
 to allocate the array.

int component_id
 The one-byte identifier code to be recorded in the JPEG file for
 this component. For the standard color spaces, we recommend you
 leave the default values alone.

int h_samp_factor
int v_samp_factor
 Horizontal and vertical sampling factors for the component; must
 be 1..4 according to the JPEG standard. Note that larger sampling
 factors indicate a higher-resolution component; many people find
 this behavior quite unintuitive. The default values are 2,2 for
 luminance components and 1,1 for chrominance components, except
 for grayscale where 1,1 is used.

int quant_tbl_no
 Quantization table number for component. The default value is
 0 for luminance components and 1 for chrominance components.

int dc_tbl_no
int ac_tbl_no
 DC and AC entropy coding table numbers. The default values are
 0 for luminance components and 1 for chrominance components.

int component_index
 Must equal the component's index in comp_info[]. (Beginning in
 release
 v6, the compressor library will fill this in automatically;
 you don't have to.)

Decompression parameter selection

Decompression parameter selection is somewhat simpler than compression parameter selection, since all of the JPEG internal parameters are recorded in the source file and need not be supplied by the application. (Unless you are working with abbreviated files, in which case see "Abbreviated datastreams", below.) Decompression parameters control the postprocessing done on the image to deliver it in a format suitable for the application's use. Many of the parameters control speed/quality tradeoffs, in which faster decompression may be obtained at the price of a poorer-quality image. The defaults select the highest quality (slowest) processing.

The following fields in the JPEG object are set by jpeg_read_header() and may be useful to the application in choosing decompression parameters:

JDIMENSION image_width   Width and height of
 image
JDIMENSION image_height
int num_components   Number of color components
J_COLOR_SPACE jpeg_color_space Colorspace of image
boolean saw_JFIF_marker   TRUE if a JFIF APP0 marker was seen
 UINT8 JFIF_major_version Version information from JFIF marker
 UINT8 JFIF_minor_version
 UINT8 density_unit   Resolution data from JFIF marker
 UINT16 X_density
 UINT16 Y_density
boolean saw_Adobe_marker TRUE if an Adobe APP14 marker was seen
 UINT8 Adobe_transform   Color transform code from Adobe marker

The JPEG color space, unfortunately, is something of a guess since the JPEG standard proper does not provide a way to record it. In practice most files adhere to the JFIF or Adobe conventions, and the decoder will recognize these correctly. See "Special color spaces", below, for more info.

The decompression parameters that determine the basic properties of the returned image are:

J_COLOR_SPACE out_color_space
 Output color space. jpeg_read_header() sets an appropriate default based
 on jpeg_color_space; typically it will be RGB or grayscale.
 The application can change this field to request output in a different
 colorspace. For example, set it to JCS_GRAYSCALE to get grayscale
 output from a color file. (This is useful for previewing: grayscale
 output is faster than full color since the color components need not
 be processed.) Note that not all possible color space transforms are
 currently implemented; you may need to extend jdcolor.c if you want an
 unusual conversion.

unsigned int scale_num, scale_denom
 Scale the image by the fraction scale_num/scale_denom. Default is
 1/1, or no scaling. Currently, the only supported scaling ratios
 are M/8 with all M from 1 to 16, or any reduced fraction thereof (such
 as 1/2, 3/4, etc.) (The library design allows for arbitrary
 scaling ratios but this is not likely to be implemented any time soon.)
 Smaller scaling ratios permit significantly faster decoding since
 fewer pixels need be processed and a simpler IDCT
 method can be used.

boolean quantize_colors
 If set TRUE, colormapped output will be delivered. Default is FALSE,
 meaning that full-color output will be delivered.

The next three parameters are relevant only if quantize_colors is TRUE.

int desired_number_of_colors
 Maximum number of colors to use in generating a library-supplied color
 map (the actual number of colors is returned in a different field).
 Default 256. Ignored when the application supplies its own color map.

boolean two_pass_quantize
 If TRUE, an extra pass over the image is made to select a custom color
 map for the image. This usually looks a lot better than the one-size-
 fits-all colormap that is used otherwise. Default is TRUE. Ignored
 when the application supplies its own color map.

J_DITHER_MODE dither_mode
 Selects color dithering method. Supported values are:
  JDITHER_NONE no dithering: fast, very low quality
  JDITHER_ORDERED ordered dither: moderate speed and quality

JDITHER_FS Floyd-Steinberg
dither: slow, high quality
Default is JDITHER_FS. (At present, ordered dither is implemented
only in the single-pass, standard-colormap case. If you ask for
ordered dither when two_pass_quantize is TRUE or when you supply
an external color map, you'll get F-S dithering.)

When quantize_colors is TRUE, the target color map is described by the next
two fields. colormap is set to NULL by jpeg_read_header(). The application
can supply a color map by setting colormap non-NULL and setting
actual_number_of_colors to the map size. Otherwise, jpeg_start_decompress()
selects a suitable color map and sets these two fields itself.
[Implementation restriction: at present, an externally supplied colormap is
only accepted for 3-component output color spaces.]

JSAMPARRAY colormap
The color map, represented as a 2-D pixel array of out_color_components
rows and actual_number_of_colors columns. Ignored if not quantizing.
CAUTION: if the JPEG library creates its own colormap, the storage
pointed
to by this field is released by jpeg_finish_decompress().
Copy the colormap somewhere else first, if you want to save it.

int actual_number_of_colors
The number of colors in the color map.

Additional decompression parameters that the application may set include:

J_DCT_METHOD dct_method
Selects the algorithm used for the DCT step. Choices are the same
as described above for compression.

boolean do_fancy_upsampling
If TRUE, do careful upsampling of chroma components. If FALSE,
a faster but sloppier method is used. Default is TRUE. The visual
impact of the sloppier method is often very small.

boolean do_block_smoothing
If TRUE, interblock smoothing is applied in early stages of decoding
progressive JPEG files; if FALSE, not. Default is TRUE. Early
progression stages look "fuzzy" with smoothing, "blocky" without.
In any case, block smoothing ceases to be applied after the first few
AC coefficients are known to full accuracy, so it is relevant only
when using
buffered-image mode for progressive images.

boolean enable_1pass_quant
boolean enable_external_quant

boolean enable_2pass_quant
 These are significant only in buffered-image mode, which is
 described in its own section below.

The output image dimensions are given by the following fields. These are
computed from the source image dimensions and the decompression parameters
by jpeg_start_decompress(). You can also call jpeg_calc_output_dimensions()
to obtain the values that will result from the current parameter settings.
This can be useful if you are trying to pick a scaling ratio that will get
close to a desired target size. It's also important if you are using the
JPEG library's memory manager to allocate output buffer space, because you
are supposed to request such buffers *before* jpeg_start_decompress().

JDIMENSION output_width Actual dimensions of output image.
JDIMENSION output_height
int out_color_components Number of color components in out_color_space.
int output_components Number
 of color components returned.
int rec_outbuf_height Recommended height of scanline buffer.

When quantizing colors, output_components is 1, indicating a single color map
index per pixel. Otherwise it equals out_color_components. The output arrays
are required to be output_width * output_components JSAMPLEs wide.

rec_outbuf_height is the recommended minimum height (in scanlines) of the
buffer passed to jpeg_read_scanlines(). If the buffer is smaller, the
library will still work, but time will be wasted due to unnecessary data
copying. In high-quality modes, rec_outbuf_height is always 1, but some
faster, lower-quality modes set it to larger values (typically 2 to 4).
If you are going to ask for a high-speed processing mode, you may as well
go to the trouble of honoring rec_outbuf_height so as to avoid data copying.
(An output buffer larger than rec_outbuf_height lines is OK, but won't
provide any material speed improvement over that height.)

Special color spaces

The
 JPEG standard itself is "color blind" and doesn't specify any particular
color space. It is customary to convert color data to a luminance/chrominance
color space before compressing, since this permits greater compression. The
existing de-facto JPEG file format standards specify YCbCr or grayscale data
(JFIF), or grayscale, RGB, YCbCr, CMYK, or YCCK (Adobe). For special
applications such as multispectral images, other color spaces can be used,
but it must be understood that such files will be unportable.

The JPEG library can handle the most common colorspace conversions (namely
RGB <=> YCbCr and CMYK <=> YCCK). It can also deal with data of an unknown
color space, passing it through without conversion. If you deal extensively
with an unusual color space, you can easily extend the library to understand
additional color spaces and perform appropriate conversions.

For compression, the source data's color space is specified by field
in_color_space. This is
transformed to the JPEG file's color space given
by jpeg_color_space. jpeg_set_defaults() chooses a reasonable JPEG color
space depending on in_color_space, but you can override this by calling
jpeg_set_colorspace(). Of course you must select a supported transformation.
jccolor.c currently supports the following transformations:
RGB => YCbCr
RGB => GRAYSCALE
YCbCr => GRAYSCALE
CMYK => YCCK
plus the null transforms: GRAYSCALE => GRAYSCALE, RGB => RGB,
YCbCr => YCbCr, CMYK => CMYK, YCCK => YCCK, and UNKNOWN => UNKNOWN.

The de-facto file format standards (JFIF and Adobe) specify APPn markers that
indicate the color space of the JPEG file. It is important to ensure that
these are written correctly, or omitted if the JPEG file's color space is not
one of the ones supported by the de-facto standards. jpeg_set_colorspace()
will set the compression parameters to include or omit the APPn markers
properly, so long as it is told the truth about the JPEG color space.
For example, if you are
writing some random 3-component color space without
conversion, don't try to fake out the library by setting in_color_space and
jpeg_color_space to JCS_YCbCr; use JCS_UNKNOWN. You may want to write an
APPn marker of your own devising to identify the colorspace --- see "Special
markers", below.

When told that the color space is UNKNOWN, the library will default to using
luminance-quality compression parameters for all color components. You may
well want to change these parameters. See the source code for
jpeg_set_colorspace(), in jcparam.c, for details.

For decompression, the JPEG file's color space is given in jpeg_color_space,
and this is transformed to the output color space out_color_space.
jpeg_read_header's setting of jpeg_color_space can be relied on if the file
conforms to JFIF or Adobe conventions, but otherwise it is no better than a
guess. If you know the JPEG file's color space for certain, you can override
jpeg_read_header's guess by setting jpeg_color_space. jpeg_read_header
also
selects a default output color space based on (its guess of) jpeg_color_space;
set out_color_space to override this. Again, you must select a supported
transformation. jdcolor.c currently supports

YCbCr => RGB
YCbCr => GRAYSCALE
RGB => GRAYSCALE
GRAYSCALE => RGB
YCCK => CMYK
as well as the null transforms. (Since GRAYSCALE=>RGB is provided, an application can force grayscale JPEGs to look like color JPEGs if it only wants to handle one case.)

The two-pass color quantizer, jquant2.c, is specialized to handle RGB data (it weights distances appropriately for RGB colors). You'll need to modify the code if you want to use it for non-RGB output color spaces. Note that jquant2.c is used to map to an application-supplied colormap as well as for the normal two-pass colormap selection process.

CAUTION: it appears that Adobe Photoshop writes inverted data in CMYK JPEG files: 0 represents 100% ink coverage, rather than 0% ink as you'd expect. This is arguably a bug in
Photoshop, but if you need to work with Photoshop
CMYK files, you will have to deal with it in your application. We cannot "fix" this in the library by inverting the data during the CMYK<=>YCCK transform, because that would break other applications, notably Ghostscript. Photoshop versions prior to 3.0 write EPS files containing JPEG-encoded CMYK data in the same inverted-YCCK representation used in bare JPEG files, but the surrounding PostScript code performs an inversion using the PS image operator. I am told that Photoshop 3.0 will write uninverted YCCK in EPS/JPEG files, and will omit the PS-level inversion. (But the data polarity used in bare JPEG files will not change in 3.0.) In either case, the JPEG library must not invert the data itself, or else Ghostscript would read these EPS files incorrectly.

Error handling

When the default error handler is used, any error detected inside the JPEG routines will cause a message to be printed on stderr, followed by exit(). You
can supply your own error handling routines to override this behavior and to control the treatment of nonfatal warnings and trace/debug messages. The file example.c illustrates the most common case, which is to have the application regain control after an error rather than exiting.

The JPEG library never writes any message directly; it always goes through the error handling routines. Three classes of messages are recognized:
* Fatal errors: the library cannot continue.
* Warnings: the library can continue, but the data is corrupt, and a damaged output image is likely to result.

* Trace/informational messages. These come with a trace level indicating
  the importance of the message; you can control the verbosity of the
  program by adjusting the maximum trace level that will be displayed.

You may, if you wish, simply replace the entire JPEG error handling module
(jerror.c) with your own code. However, you can avoid code duplication by
only replacing some of the
 routines depending on the behavior you need.
This is accomplished by calling jpeg_std_error() as usual, but then overriding
some of the method pointers in the jpeg_error_mgr struct, as illustrated by
example.c.

All of the error handling routines will receive a pointer to the JPEG object
(a j_common_ptr which points to either a jpeg_compress_struct or a
jpeg_decompress_struct; if you need to tell which, test the is_decompressor
field). This struct includes a pointer to the error manager struct in its
"err" field. Frequently, custom error handler routines will need to access
additional data which is not known to the JPEG library or the standard error
handler. The most convenient way to do this is to embed either the JPEG
object or the jpeg_error_mgr struct in a larger structure that contains
additional fields; then casting the passed pointer provides access to the
additional fields. Again, see example.c for one way to do it. (Beginning
with IJG version 6b, there is also a void pointer
 "client_data" in each
JPEG object, which the application can also use to find related data.
The library does not touch client_data at all.)

The individual methods that you might wish to override are:

error_exit (j_common_ptr cinfo)
 Receives control for a fatal error. Information sufficient to
 generate the error message has been stored in cinfo->err; call
 output_message to display it. Control must NOT return to the caller;
 generally this routine will exit() or longjmp() somewhere.
 Typically you would override this routine to get rid of the exit()
 default behavior. Note that if you continue processing, you should
 clean up the JPEG object with jpeg_abort() or jpeg_destroy().

output_message (j_common_ptr cinfo)
 Actual output of any JPEG message. Override this to send messages
 somewhere other than stderr. Note that this method does not know
 how to generate a message, only where to send it.

format_message (j_common_ptr cinfo, char * buffer)
 Constructs a readable error
 message string based on the error info
 stored in cinfo->err. This method is called by output_message. Few
 applications should need to override this method. One possible

reason for doing so is to implement dynamic switching of error message
language.

emit_message (j_common_ptr cinfo, int msg_level)
Decide whether or not to emit a warning or trace message; if so,
calls output_message. The main reason for overriding this method
would be to abort on warnings. msg_level is -1 for warnings,
0 and up for trace messages.

Only error_exit() and emit_message() are called from the rest of the JPEG
library; the other two are internal to the error handler.

The actual message texts are stored in an array of strings which is pointed to
by the field err->jpeg_message_table. The messages are numbered from 0 to
err->last_jpeg_message, and it is these code numbers that are used in the
JPEG library code. You could replace the message texts (for instance, with
messages in French or German)
by changing the message table pointer. See
jerror.h for the default texts. CAUTION: this table will almost certainly
change or grow from one library version to the next.

It may be useful for an application to add its own message texts that are
handled by the same mechanism. The error handler supports a second "add-on"
message table for this purpose. To define an addon table, set the pointer
err->addon_message_table and the message numbers err->first_addon_message and
err->last_addon_message. If you number the addon messages beginning at 1000
or so, you won't have to worry about conflicts with the library's built-in
messages. See the sample applications cjpeg/djpeg for an example of using
addon messages (the addon messages are defined in cderror.h).

Actual invocation of the error handler is done via macros defined in jerror.h:
ERREXITn(...) for fatal errors
WARNMSn(...) for corrupt-data warnings
TRACEMSn(...) for trace and informational messages.
These macros store the message
code and any additional parameters into the
error handler struct, then invoke the error_exit() or emit_message() method.
The variants of each macro are for varying numbers of additional parameters.
The additional parameters are inserted into the generated message using
standard printf() format codes.

See jerror.h and jerror.c for further details.

Compressed data handling (source and destination managers)

The JPEG compression library sends its compressed data to a "destination

manager" module. The default destination manager just writes the data to a memory buffer or to a stdio stream, but you can provide your own manager to do something else. Similarly, the decompression library calls a "source manager" to obtain the compressed data; you can provide your own source manager if you want the data to come from somewhere other than a memory buffer or a stdio stream.

In both cases, compressed data is processed a bufferload
 at a time: the
destination or source manager provides a work buffer, and the library invokes the manager only when the buffer is filled or emptied. (You could define a one-character buffer to force the manager to be invoked for each byte, but that would be rather inefficient.) The buffer's size and location are controlled by the manager, not by the library. For example, the memory source manager just makes the buffer pointer and length point to the original data in memory. In this case the buffer-reload procedure will be invoked only if the decompressor ran off the end of the datastream, which would indicate an erroneous datastream.

The work buffer is defined as an array of datatype JOCTET, which is generally "char" or "unsigned char". On a machine where char is not exactly 8 bits wide, you must define JOCTET as a wider data type and then modify the data source and destination modules to transcribe the work arrays into 8-bit units on external storage.

A data destination manager
 struct contains a pointer and count defining the
next byte to write in the work buffer and the remaining free space:

```
 JOCTET * next_output_byte;  /* => next byte to write in buffer */
 size_t free_in_buffer;      /* # of byte spaces remaining in buffer */
```

The library increments the pointer and decrements the count until the buffer is filled. The manager's empty_output_buffer method must reset the pointer and count. The manager is expected to remember the buffer's starting address and total size in private fields not visible to the library.

A data destination manager provides three methods:

init_destination (j_compress_ptr cinfo)
 Initialize destination. This is called by jpeg_start_compress()
 before any data is actually written. It must initialize
 next_output_byte and free_in_buffer. free_in_buffer must be
 initialized to a positive value.

empty_output_buffer (j_compress_ptr cinfo)
 This is called whenever the buffer has filled (free_in_buffer
 reaches zero). In typical

applications, it should write out the
entire buffer (use the saved start address and buffer length;
ignore the current state of next_output_byte and free_in_buffer).
Then reset the pointer & count to the start of the buffer, and
return TRUE indicating that the buffer has been dumped.
free_in_buffer must be set to a positive value when TRUE is
returned. A FALSE return should only be used when I/O suspension is
desired (this operating mode is discussed in the next section).

term_destination (j_compress_ptr cinfo)
Terminate destination --- called by jpeg_finish_compress() after all
data has been written. In most applications, this must flush any
data remaining in the buffer. Use either next_output_byte or
free_in_buffer to determine how much data is in the buffer.

term_destination() is NOT called by jpeg_abort() or jpeg_destroy(). If you
want the destination manager to be cleaned up during an abort, you must do it
yourself.

You will also need code to create a jpeg_destination_mgr
struct, fill in its
method pointers, and insert a pointer to the struct into the "dest" field of
the JPEG compression object. This can be done in-line in your setup code if
you like, but it's probably cleaner to provide a separate routine similar to
the jpeg_stdio_dest() or jpeg_mem_dest() routines of the supplied destination
managers.

Decompression source managers follow a parallel design, but with some
additional frammishes. The source manager struct contains a pointer and count
defining the next byte to read from the work buffer and the number of bytes
remaining:

const JOCTET * next_input_byte; /* => next byte to read from buffer */
size_t bytes_in_buffer;   /* # of bytes remaining in buffer */

The library increments the pointer and decrements the count until the buffer
is emptied. The manager's fill_input_buffer method must reset the pointer and
count. In most applications, the manager must remember the buffer's starting
address and total size in private
fields not visible to the library.

A data source manager provides five methods:

init_source (j_decompress_ptr cinfo)
Initialize source. This is called by jpeg_read_header() before any
data is actually read. Unlike init_destination(), it may leave
bytes_in_buffer set to 0 (in which case a fill_input_buffer() call
will occur immediately).

fill_input_buffer (j_decompress_ptr cinfo)
 This is called whenever bytes_in_buffer has reached zero and more
 data is wanted. In typical applications, it should read fresh data
 into the buffer (ignoring the current state of next_input_byte and
 bytes_in_buffer), reset the pointer & count to the start of the
 buffer, and return TRUE indicating that the buffer has been reloaded.
 It is not necessary to fill the buffer entirely, only to obtain at
 least one more byte. bytes_in_buffer MUST be set to a positive value
 if TRUE is returned. A FALSE return should only be used when I/O
 suspension is desired (this mode is discussed in the next section).

skip_input_data
 (j_decompress_ptr cinfo, long num_bytes)
 Skip num_bytes worth of data. The buffer pointer and count should
 be advanced over num_bytes input bytes, refilling the buffer as
 needed. This is used to skip over a potentially large amount of
 uninteresting data (such as an APPn marker). In some applications
 it may be possible to optimize away the reading of the skipped data,
 but it's not clear that being smart is worth much trouble; large
 skips are uncommon. bytes_in_buffer may be zero on return.
 A zero or negative skip count should be treated as a no-op.

resync_to_restart (j_decompress_ptr cinfo, int desired)
 This routine is called only when the decompressor has failed to find
 a restart (RSTn) marker where one is expected. Its mission is to
 find a suitable point for resuming decompression. For most
 applications, we recommend that you just use the default resync
 procedure, jpeg_resync_to_restart(). However, if you are able to back
 up in the input
 data stream, or if you have a-priori knowledge about
 the likely location of restart markers, you may be able to do better.
 Read the read_restart_marker() and jpeg_resync_to_restart() routines
 in jdmarker.c if you think you'd like to implement your own resync
 procedure.

term_source (j_decompress_ptr cinfo)
 Terminate source --- called by jpeg_finish_decompress() after all
 data has been read. Often a no-op.

For both fill_input_buffer() and skip_input_data(), there is no such thing
as an EOF return. If the end of the file has been reached, the routine has
a choice of exiting via ERREXIT() or inserting fake data into the buffer.
In most cases, generating a warning message and inserting a fake EOI marker
is the best course of action --- this will allow the decompressor to output
however much of the image is there. In pathological cases, the decompressor
may swallow the EOI and again demand data ... just keep feeding it fake EOIs.
jdatasrc.c illustrates the recommended error recovery

behavior.

term_source() is NOT called by jpeg_abort() or jpeg_destroy(). If you want the source manager to be cleaned up during an abort, you must do it yourself.

You will also need code to create a jpeg_source_mgr struct, fill in its method pointers, and insert a pointer to the struct into the "src" field of the JPEG decompression object. This can be done in-line in your setup code if you like, but it's probably cleaner to provide a separate routine similar to the jpeg_stdio_src() or jpeg_mem_src() routines of the supplied source managers.

For more information, consult the memory and stdio source and destination managers in jdatasrc.c and jdatadst.c.

I/O suspension

Some applications need to use the JPEG library as an incremental memory-to-memory filter: when the compressed data buffer is filled or emptied, they want control to return to the outer loop, rather than expecting that the buffer can be emptied or reloaded within the data source/destination manager subroutine.
The library supports this need by providing an "I/O suspension" mode, which we describe in this section.

The I/O suspension mode is not a panacea: nothing is guaranteed about the maximum amount of time spent in any one call to the library, so it will not eliminate response-time problems in single-threaded applications. If you need guaranteed response time, we suggest you "bite the bullet" and implement a real multi-tasking capability.

To use I/O suspension, cooperation is needed between the calling application and the data source or destination manager; you will always need a custom source/destination manager. (Please read the previous section if you haven't already.) The basic idea is that the empty_output_buffer() or fill_input_buffer() routine is a no-op, merely returning FALSE to indicate that it has done nothing. Upon seeing this, the JPEG library suspends operation and returns to its caller. The surrounding application is responsible for emptying or refilling
the work buffer before calling the
JPEG library again.

Compression suspension:

For compression suspension, use an empty_output_buffer() routine that returns FALSE; typically it will not do anything else. This will cause the compressor to return to the caller of jpeg_write_scanlines(), with the return

value indicating that not all the supplied scanlines have been accepted.
The application must make more room in the output buffer, adjust the output
buffer pointer/count appropriately, and then call jpeg_write_scanlines()
again, pointing to the first unconsumed scanline.

When forced to suspend, the compressor will backtrack to a convenient stopping
point (usually the start of the current MCU); it will regenerate some output
data when restarted. Therefore, although empty_output_buffer() is only
called when the buffer is filled, you should NOT write out the entire buffer
after a suspension. Write only the data up to the current position of
next_output_byte/free_in_buffer. The data beyond
that point will be
regenerated after resumption.

Because of the backtracking behavior, a good-size output buffer is essential
for efficiency; you don't want the compressor to suspend often. (In fact, an
overly small buffer could lead to infinite looping, if a single MCU required
more data than would fit in the buffer.) We recommend a buffer of at least
several Kbytes. You may want to insert explicit code to ensure that you don't
call jpeg_write_scanlines() unless there is a reasonable amount of space in
the output buffer; in other words, flush the buffer before trying to compress
more data.

The compressor does not allow suspension while it is trying to write JPEG
markers at the beginning and end of the file. This means that:
* At the beginning of a compression operation, there must be enough free
space in the output buffer to hold the header markers (typically 600 or
so bytes). The recommended buffer size is bigger than this anyway, so
this is not a problem as
long as you start with an empty buffer. However,
this restriction might catch you if you insert large special markers, such
as a JFIF thumbnail image, without flushing the buffer afterwards.
* When you call jpeg_finish_compress(), there must be enough space in the
output buffer to emit any buffered data and the final EOI marker. In the
current implementation, half a dozen bytes should suffice for this, but
for safety's sake we recommend ensuring that at least 100 bytes are free
before calling jpeg_finish_compress().

A more significant restriction is that jpeg_finish_compress() cannot suspend.
This means you cannot use suspension with multi-pass operating modes, namely
Huffman code optimization and multiple-scan output. Those modes write the
whole file during jpeg_finish_compress(), which will certainly result in
buffer overrun. (Note that this restriction applies only to compression,
not decompression. The decompressor supports input suspension in all of
its
operating modes.)

Decompression suspension:

For decompression suspension, use a fill_input_buffer() routine that simply returns FALSE (except perhaps during error recovery, as discussed below). This will cause the decompressor to return to its caller with an indication that suspension has occurred. This can happen at four places:
 * jpeg_read_header(): will return JPEG_SUSPENDED.
 * jpeg_start_decompress(): will return FALSE, rather than its usual TRUE.
 * jpeg_read_scanlines(): will return the number of scanlines already completed (possibly 0).
 * jpeg_finish_decompress(): will return FALSE, rather than its usual TRUE.
The surrounding application must recognize these cases, load more data into the input buffer, and repeat the call. In the case of jpeg_read_scanlines(), increment the passed pointers past any scanlines successfully read.

Just as with compression, the decompressor will typically backtrack to a convenient restart point before suspending. When fill_input_buffer() is
called, next_input_byte/bytes_in_buffer point to the current restart point, which is where the decompressor will backtrack to if FALSE is returned. The data beyond that position must NOT be discarded if you suspend; it needs to be re-read upon resumption. In most implementations, you'll need to shift this data down to the start of your work buffer and then load more data after it. Again, this behavior means that a several-Kbyte work buffer is essential for decent performance; furthermore, you should load a reasonable amount of new data before resuming decompression. (If you loaded, say, only one new byte each time around, you could waste a LOT of cycles.)

The skip_input_data() source manager routine requires special care in a suspension scenario. This routine is NOT granted the ability to suspend the decompressor; it can decrement bytes_in_buffer to zero, but no more. If the requested skip distance exceeds the amount of data currently in the input buffer, then skip_input_data() must set bytes_in_buffer to zero and record the
additional skip distance somewhere else. The decompressor will immediately call fill_input_buffer(), which should return FALSE, which will cause a suspension return. The surrounding application must then arrange to discard the recorded number of bytes before it resumes loading the input buffer. (Yes, this design is rather baroque, but it avoids complexity in the far more common case where a non-suspending source manager is used.)

If the input data has been exhausted, we recommend that you emit a warning and insert dummy EOI markers just as a non-suspending data source manager would do. This can be handled either in the surrounding application logic or within fill_input_buffer(); the latter is probably more efficient. If fill_input_buffer() knows that no more data is available, it can set the pointer/count to point to a dummy EOI marker and then return TRUE just as though it had read more data in a non-suspending situation.

The
decompressor does not attempt to suspend within standard JPEG markers;
instead it will backtrack to the start of the marker and reprocess the whole
marker next time. Hence the input buffer must be large enough to hold the
longest standard marker in the file. Standard JPEG markers should normally
not exceed a few hundred bytes each (DHT tables are typically the longest).
We recommend at least a 2K buffer for performance reasons, which is much
larger than any correct marker is likely to be. For robustness against
damaged marker length counts, you may wish to insert a test in your
application for the case that the input buffer is completely full and yet
the decoder has suspended without consuming any data --- otherwise, if this
situation did occur, it would lead to an endless loop. (The library can't
provide this test since it has no idea whether "the buffer is full", or
even whether there is a fixed-size input buffer.)

The input buffer would need to be 64K to allow for arbitrary
COM or APPn
markers, but these are handled specially: they are either saved into allocated
memory, or skipped over by calling skip_input_data(). In the former case,
suspension is handled correctly, and in the latter case, the problem of
buffer overrun is placed on skip_input_data's shoulders, as explained above.
Note that if you provide your own marker handling routine for large markers,
you should consider how to deal with buffer overflow.

Multiple-buffer management:

In some applications it is desirable to store the compressed data in a linked
list of buffer areas, so as to avoid data copying. This can be handled by
having empty_output_buffer() or fill_input_buffer() set the pointer and count
to reference the next available buffer; FALSE is returned only if no more
buffers are available. Although seemingly straightforward, there is a
pitfall in this approach: the backtrack that occurs when FALSE is returned
could back up into an earlier buffer. For example, when fill_input_buffer()
is
called, the current pointer & count indicate the backtrack restart point.
Since fill_input_buffer() will set the pointer and count to refer to a new
buffer, the restart position must be saved somewhere else. Suppose a second
call to fill_input_buffer() occurs in the same library call, and no
additional input data is available, so fill_input_buffer must return FALSE.
If the JPEG library has not moved the pointer/count forward in the current
buffer, then *the correct restart point is the saved position in the prior
buffer*. Prior buffers may be discarded only after the library establishes
a restart point within a later buffer. Similar remarks apply for output into
a chain of buffers.

The library will never attempt to backtrack over a skip_input_data() call,
so any skipped data can be permanently discarded. You still have to deal
with the case of skipping not-yet-received data, however.

It's much simpler to use only a single buffer; when fill_input_buffer() is
called, move any
unconsumed data (beyond the current pointer/count) down to
the beginning of this buffer and then load new data into the remaining buffer
space. This approach requires a little more data copying but is far easier
to get right.

Progressive JPEG support

Progressive JPEG rearranges the stored data into a series of scans of
increasing quality. In situations where a JPEG file is transmitted across a
slow communications link, a decoder can generate a low-quality image very
quickly from the first scan, then gradually improve the displayed quality as
more scans are received. The final image after all scans are complete is
identical to that of a regular (sequential) JPEG file of the same quality
setting. Progressive JPEG files are often slightly smaller than equivalent
sequential JPEG files, but the possibility of incremental display is the main
reason for using progressive JPEG.

The IJG encoder library generates progressive JPEG files when given a
suitable "scan
script" defining how to divide the data into scans.
Creation of progressive JPEG files is otherwise transparent to the encoder.
Progressive JPEG files can also be read transparently by the decoder library.
If the decoding application simply uses the library as defined above, it
will receive a final decoded image without any indication that the file was
progressive. Of course, this approach does not allow incremental display.
To perform incremental display, an application needs to use the decoder
library's "buffered-image" mode, in which it receives a decoded image
multiple times.

Each displayed scan requires about as much work to decode as a full JPEG
image of the same size, so the decoder must be fairly fast in relation to the
data transmission rate in order to make incremental display useful. However,
it is possible to skip displaying the image and simply add the incoming bits
to the decoder's coefficient buffer. This is fast because only Huffman
decoding need be done, not IDCT,
upsampling, colorspace conversion, etc.
The IJG decoder library allows the application to switch dynamically between
displaying the image and simply absorbing the incoming bits. A properly
coded application can automatically adapt the number of display passes to
suit the time available as the image is received. Also, a final
higher-quality display cycle can be performed from the buffered data after
the end of the file is reached.

Progressive compression:

To create a progressive JPEG file (or a multiple-scan sequential JPEG file),
set the scan_info cinfo field to point to an array of scan descriptors, and
perform compression as usual. Instead of constructing your own scan list,
you can call the jpeg_simple_progression() helper routine to create a
recommended progression sequence; this method should be used by all
applications that don't want to get involved in the nitty-gritty of
progressive scan sequence design. (If you want to provide user control of
scan sequences, you may
 wish to borrow the scan script reading code found
in rdswitch.c, so that you can read scan script files just like cjpeg's.)
When scan_info is not NULL, the compression library will store DCT'd data
into a buffer array as jpeg_write_scanlines() is called, and will emit all
the requested scans during jpeg_finish_compress(). This implies that
multiple-scan output cannot be created with a suspending data destination
manager, since jpeg_finish_compress() does not support suspension. We
should also note that the compressor currently forces Huffman optimization
mode when creating a progressive JPEG file, because the default Huffman
tables are unsuitable for progressive files.

Progressive decompression:

When buffered-image mode is not used, the decoder library will read all of
a multi-scan file during jpeg_start_decompress(), so that it can provide a
final decoded image. (Here "multi-scan" means either progressive or
multi-scan sequential.) This makes multi-scan files transparent to the
decoding
 application. However, existing applications that used suspending
input with version 5 of the IJG library will need to be modified to check
for a suspension return from jpeg_start_decompress().

To perform incremental display, an application must use the library's
buffered-image mode. This is described in the next section.

Buffered-image mode

In buffered-image mode, the library stores the partially decoded image in a
coefficient buffer, from which it can be read out as many times as desired.
This mode is typically used for incremental display of progressive JPEG files,
but it can be used with any JPEG file. Each scan of a progressive JPEG file
adds more data (more detail) to the buffered image. The application can
display in lockstep with the source file (one display pass per input scan),
or it can allow input processing to outrun display processing. By making
input and display processing run independently, it is possible for the
application to adapt

progressive display to a wide range of data transmission
rates.

The basic control flow for buffered-image decoding is

```
jpeg_create_decompress()
set data source
jpeg_read_header()
set overall decompression parameters
cinfo.buffered_image = TRUE; /* select buffered-image mode */
jpeg_start_decompress()
for (each output pass) {
    adjust output decompression parameters if required
    jpeg_start_output()  /* start a new output pass */
    for (all scanlines in image) {
        jpeg_read_scanlines()
        display scanlines
    }
    jpeg_finish_output() /* terminate output pass */
}
jpeg_finish_decompress()
jpeg_destroy_decompress()
```

This differs from ordinary unbuffered decoding in that there is an additional level of looping. The application can choose how many output passes to make and how to display each pass.

The simplest approach to displaying progressive images is to do one display pass for each scan appearing in the input file. In this case the outer loop condition
is typically
```
while (! jpeg_input_complete(&cinfo))
```
and the start-output call should read
```
jpeg_start_output(&cinfo, cinfo.input_scan_number);
```
The second parameter to jpeg_start_output() indicates which scan of the input file is to be displayed; the scans are numbered starting at 1 for this purpose. (You can use a loop counter starting at 1 if you like, but using the library's input scan counter is easier.) The library automatically reads data as necessary to complete each requested scan, and jpeg_finish_output() advances to the next scan or end-of-image marker (hence input_scan_number will be incremented by the time control arrives back at jpeg_start_output()). With this technique, data is read from the input file only as needed, and input and output processing run in lockstep.

After reading the final scan and reaching the end of the input file, the buffered image remains available; it can be read additional times by repeating the jpeg_start_output()/jpeg_read_scanlines()/jpeg_finish_output() sequence.

For example, a useful technique is to use fast one-pass color quantization for display passes made while the image is arriving, followed by a final display pass using two-pass quantization for highest quality. This is done by changing the library parameters before the final output pass. Changing parameters between passes is discussed in detail below.

In general the last scan of a progressive file cannot be recognized as such until after it is read, so a post-input display pass is the best approach if you want special processing in the final pass.

When done with the image, be sure to call jpeg_finish_decompress() to release the buffered image (or just use jpeg_destroy_decompress()).

If input data arrives faster than it can be displayed, the application can cause the library to decode input data in advance of what's needed to produce output. This is done by calling the routine jpeg_consume_input(). The return value is one of the following:

JPEG_REACHED_SOS:
reached an SOS marker (the start of a new scan)
JPEG_REACHED_EOI: reached the EOI marker (end of image)
JPEG_ROW_COMPLETED: completed reading one MCU row of compressed data
JPEG_SCAN_COMPLETED: completed reading last MCU row of current scan
JPEG_SUSPENDED: suspended before completing any of the above

(JPEG_SUSPENDED can occur only if a suspending data source is used.) This routine can be called at any time after initializing the JPEG object. It reads some additional data and returns when one of the indicated significant events occurs. (If called after the EOI marker is reached, it will immediately return JPEG_REACHED_EOI without attempting to read more data.)

The library's output processing will automatically call jpeg_consume_input() whenever the output processing overtakes the input; thus, simple lockstep display requires no direct calls to jpeg_consume_input(). But by adding calls to jpeg_consume_input(), you can absorb data in advance of what is being displayed.

This has two benefits:

* You can limit buildup of unprocessed data in your input buffer.
* You can eliminate extra display passes by paying attention to the state of the library's input processing.

The first of these benefits only requires interspersing calls to jpeg_consume_input() with your display operations and any other processing you may be doing. To avoid wasting cycles due to backtracking, it's best to call jpeg_consume_input() only after a hundred or so new bytes have arrived. This is discussed further under "I/O suspension", above. (Note: the JPEG library currently is not thread-safe. You must not call jpeg_consume_input() from one thread of control if a different library routine is working on the same JPEG object in another thread.)

When input arrives fast enough that more than one new scan is available
before you start a new output pass, you may as well skip the output pass
corresponding to the completed scan. This occurs for free if you pass
cinfo.input_scan_number
 as the target scan number to jpeg_start_output().
The input_scan_number field is simply the index of the scan currently being
consumed by the input processor. You can ensure that this is up-to-date by
emptying the input buffer just before calling jpeg_start_output(): call
jpeg_consume_input() repeatedly until it returns JPEG_SUSPENDED or
JPEG_REACHED_EOI.

The target scan number passed to jpeg_start_output() is saved in the
cinfo.output_scan_number field. The library's output processing calls
jpeg_consume_input() whenever the current input scan number and row within
that scan is less than or equal to the current output scan number and row.
Thus, input processing can "get ahead" of the output processing but is not
allowed to "fall behind". You can achieve several different effects by
manipulating this interlock rule. For example, if you pass a target scan
number greater than the current input scan number, the output processor will
wait until that scan starts to arrive
 before producing any output. (To avoid
an infinite loop, the target scan number is automatically reset to the last
scan number when the end of image is reached. Thus, if you specify a large
target scan number, the library will just absorb the entire input file and
then perform an output pass. This is effectively the same as what
jpeg_start_decompress() does when you don't select buffered-image mode.)
When you pass a target scan number equal to the current input scan number,
the image is displayed no faster than the current input scan arrives. The
final possibility is to pass a target scan number less than the current input
scan number; this disables the input/output interlock and causes the output
processor to simply display whatever it finds in the image buffer, without
waiting for input. (However, the library will not accept a target scan
number less than one, so you can't avoid waiting for the first scan.)

When data is arriving faster than the output display processing can
 advance
through the image, jpeg_consume_input() will store data into the buffered
image beyond the point at which the output processing is reading data out
again. If the input arrives fast enough, it may "wrap around" the buffer to
the point where the input is more than one whole scan ahead of the output.
If the output processing simply proceeds through its display pass without
paying attention to the input, the effect seen on-screen is that the lower
part of the image is one or more scans better in quality than the upper part.
Then, when the next output scan is started, you have a choice of what target
scan number to use. The recommended choice is to use the current input scan
number at that time, which implies that you've skipped the output scans
corresponding to the input scans that were completed while you processed the
previous output scan. In this way, the decoder automatically adapts its

speed to the arriving data, by skipping output scans as necessary to keep up with the arriving
data.

When using this strategy, you'll want to be sure that you perform a final output pass after receiving all the data; otherwise your last display may not be full quality across the whole screen. So the right outer loop logic is something like this:

```
do {
    absorb any waiting input by calling jpeg_consume_input()
    final_pass = jpeg_input_complete(&cinfo);
    adjust output decompression parameters if required
    jpeg_start_output(&cinfo, cinfo.input_scan_number);
    ...
    jpeg_finish_output()
} while (! final_pass);
```

rather than quitting as soon as jpeg_input_complete() returns TRUE. This arrangement makes it simple to use higher-quality decoding parameters for the final pass. But if you don't want to use special parameters for the final pass, the right loop logic is like this:

```
for (;;) {
    absorb any waiting input by calling jpeg_consume_input()
    jpeg_start_output(&cinfo, cinfo.input_scan_number);
    ...
    jpeg_finish_output()
    if (jpeg_input_complete(&cinfo)
&&
        cinfo.input_scan_number == cinfo.output_scan_number)
      break;
}
```

In this case you don't need to know in advance whether an output pass is to be the last one, so it's not necessary to have reached EOF before starting the final output pass; rather, what you want to test is whether the output pass was performed in sync with the final input scan. This form of the loop will avoid an extra output pass whenever the decoder is able (or nearly able) to keep up with the incoming data.

When the data transmission speed is high, you might begin a display pass, then find that much or all of the file has arrived before you can complete the pass. (You can detect this by noting the JPEG_REACHED_EOI return code from jpeg_consume_input(), or equivalently by testing jpeg_input_complete().) In this situation you may wish to abort the current display pass and start a new one using the newly arrived information. To do so, just call jpeg_finish_output() and then start
a new pass with jpeg_start_output().

A variant strategy is to abort and restart display if more than one complete scan arrives during an output pass; this can be detected by noting

JPEG_REACHED_SOS returns and/or examining cinfo.input_scan_number. This
idea should be employed with caution, however, since the display process
might never get to the bottom of the image before being aborted, resulting
in the lower part of the screen being several passes worse than the upper.
In most cases it's probably best to abort an output pass only if the whole
file has arrived and you want to begin the final output pass immediately.

When receiving data across a communication link, we recommend always using
the current input scan number for the output target scan number; if a
higher-quality final pass is to be done, it should be started (aborting any
incomplete output pass) as soon as the end of file is received. However,
many other strategies are possible. For example, the application can examine
the
parameters of the current input scan and decide whether to display it or
not. If the scan contains only chroma data, one might choose not to use it
as the target scan, expecting that the scan will be small and will arrive
quickly. To skip to the next scan, call jpeg_consume_input() until it
returns JPEG_REACHED_SOS or JPEG_REACHED_EOI. Or just use the next higher
number as the target scan for jpeg_start_output(); but that method doesn't
let you inspect the next scan's parameters before deciding to display it.

In buffered-image mode, jpeg_start_decompress() never performs input and
thus never suspends. An application that uses input suspension with
buffered-image mode must be prepared for suspension returns from these
routines:
* jpeg_start_output() performs input only if you request 2-pass quantization
and the target scan isn't fully read yet. (This is discussed below.)
* jpeg_read_scanlines(), as always, returns the number of scanlines that it
was able to produce before
suspending.
* jpeg_finish_output() will read any markers following the target scan,
up to the end of the file or the SOS marker that begins another scan.
(But it reads no input if jpeg_consume_input() has already reached the
end of the file or a SOS marker beyond the target output scan.)
* jpeg_finish_decompress() will read until the end of file, and thus can
suspend if the end hasn't already been reached (as can be tested by
calling jpeg_input_complete()).
jpeg_start_output(), jpeg_finish_output(), and jpeg_finish_decompress()
all return TRUE if they completed their tasks, FALSE if they had to suspend.
In the event of a FALSE return, the application must load more input data
and repeat the call. Applications that use non-suspending data sources need
not check the return values of these three routines.

It is possible to change decoding parameters between output passes in the
buffered-image mode. The decoder library currently supports only very
limited changes of parameters.

ONLY THE FOLLOWING parameter changes are
allowed after jpeg_start_decompress() is called:
* dct_method can be changed before each call to jpeg_start_output().
For example, one could use a fast DCT method for early scans, changing
to a higher quality method for the final scan.
* dither_mode can be changed before each call to jpeg_start_output();
of course this has no impact if not using color quantization. Typically
one would use ordered dither for initial passes, then switch to
Floyd-Steinberg dither for the final pass. Caution: changing dither mode
can cause more memory to be allocated by the library. Although the amount
of memory involved is not large (a scanline or so), it may cause the
initial max_memory_to_use specification to be exceeded, which in the worst
case would result in an out-of-memory failure.
* do_block_smoothing can be changed before each call to jpeg_start_output().
This setting is relevant only when decoding a progressive JPEG image.

During the first DC-only scan, block smoothing provides a very "fuzzy" look
instead of the very "blocky" look seen without it; which is better seems a
matter of personal taste. But block smoothing is nearly always a win
during later stages, especially when decoding a successive-approximation
image: smoothing helps to hide the slight blockiness that otherwise shows
up on smooth gradients until the lowest coefficient bits are sent.
* Color quantization mode can be changed under the rules described below.
You *cannot* change between full-color and quantized output (because that
would alter the required I/O buffer sizes), but you can change which
quantization method is used.

When generating color-quantized output, changing quantization method is a
very useful way of switching between high-speed and high-quality display.
The library allows you to change among its three quantization methods:
1. Single-pass quantization to a fixed color cube.
Selected by cinfo.two_pass_quantize
= FALSE and cinfo.colormap = NULL.
2. Single-pass quantization to an application-supplied colormap.
Selected by setting cinfo.colormap to point to the colormap (the value of
two_pass_quantize is ignored); also set cinfo.actual_number_of_colors.
3. Two-pass quantization to a colormap chosen specifically for the image.
Selected by cinfo.two_pass_quantize = TRUE and cinfo.colormap = NULL.
(This is the default setting selected by jpeg_read_header, but it is
probably NOT what you want for the first pass of progressive display!)
These methods offer successively better quality and lesser speed. However,
only the first method is available for quantizing in non-RGB color spaces.

IMPORTANT: because the different quantizer methods have very different
working-storage requirements, the library requires you to indicate which
one(s) you intend to use before you call jpeg_start_decompress(). (If we did
not require this, the max_memory_to_use setting would be a complete fiction.)
You

do this by setting one or more of these three cinfo fields to TRUE:
 enable_1pass_quant Fixed color cube colormap
 enable_external_quant Externally-supplied colormap
 enable_2pass_quant Two-pass custom colormap
All three are initialized FALSE by jpeg_read_header(). But
jpeg_start_decompress() automatically sets TRUE the one selected by the
current two_pass_quantize and colormap settings, so you only need to set the
enable flags for any other quantization methods you plan to change to later.

After setting the enable flags correctly at jpeg_start_decompress() time, you
can change to any enabled quantization method by setting two_pass_quantize
and colormap properly just before calling jpeg_start_output(). The following
special rules apply:
1. You must explicitly set cinfo.colormap to NULL when switching to 1-pass
  or 2-pass mode from a different mode, or when you want the 2-pass
  quantizer to be re-run to generate a new colormap.
2. To switch to an external colormap, or to
 change to a different external
  colormap than was used on the prior pass, you must call
  jpeg_new_colormap() after setting cinfo.colormap.
NOTE: if you want to use the same colormap as was used in the prior pass,
you should not do either of these things. This will save some nontrivial
switchover costs.
(These requirements exist because cinfo.colormap will always be non-NULL
after completing a prior output pass, since both the 1-pass and 2-pass
quantizers set it to point to their output colormaps. Thus you have to
do one of these two things to notify the library that something has changed.
Yup, it's a bit klugy, but it's necessary to do it this way for backwards
compatibility.)

Note that in buffered-image mode, the library generates any requested colormap
during jpeg_start_output(), not during jpeg_start_decompress().

When using two-pass quantization, jpeg_start_output() makes a pass over the
buffered image to determine the optimum color map; it therefore may take a
significant
 amount of time, whereas ordinarily it does little work. The
progress monitor hook is called during this pass, if defined. It is also
important to realize that if the specified target scan number is greater than
or equal to the current input scan number, jpeg_start_output() will attempt
to consume input as it makes this pass. If you use a suspending data source,
you need to check for a FALSE return from jpeg_start_output() under these
conditions. The combination of 2-pass quantization and a not-yet-fully-read
target scan is the only case in which jpeg_start_output() will consume input.

Application authors who support buffered-image mode may be tempted to use it
for all JPEG images, even single-scan ones. This will work, but it is

inefficient: there is no need to create an image-sized coefficient buffer for single-scan images. Requesting buffered-image mode for such an image wastes memory. Worse, it can cost time on large images, since the buffered data has to be swapped out or written to a temporary file. If you are concerned about maximum performance on baseline JPEG files, you should use buffered-image mode only when the incoming file actually has multiple scans. This can be tested by calling jpeg_has_multiple_scans(), which will return a correct result at any time after jpeg_read_header() completes.

It is also worth noting that when you use jpeg_consume_input() to let input processing get ahead of output processing, the resulting pattern of access to the coefficient buffer is quite nonsequential. It's best to use the memory manager jmemnobs.c if you can (ie, if you have enough real or virtual main memory). If not, at least make sure that max_memory_to_use is set as high as possible. If the JPEG memory manager has to use a temporary file, you will probably see a lot of disk traffic and poor performance. (This could be improved with additional work on the memory manager, but we haven't gotten around to it yet.)

In some applications it may be convenient to use jpeg_consume_input() for all input processing, including reading the initial markers; that is, you may wish to call jpeg_consume_input() instead of jpeg_read_header() during startup. This works, but note that you must check for JPEG_REACHED_SOS and JPEG_REACHED_EOI return codes as the equivalent of jpeg_read_header's codes. Once the first SOS marker has been reached, you must call jpeg_start_decompress() before jpeg_consume_input() will consume more input; it'll just keep returning JPEG_REACHED_SOS until you do. If you read a tables-only file this way, jpeg_consume_input() will return JPEG_REACHED_EOI without ever returning JPEG_REACHED_SOS; be sure to check for this case. If this happens, the decompressor will not read any more input until you call jpeg_abort() to reset it. It is OK to call jpeg_consume_input() even when not using buffered-image mode, but in that case it's basically a no-op after the initial markers have been read: it will just return JPEG_SUSPENDED.

Abbreviated datastreams and multiple images

A JPEG compression or decompression object can be reused to process multiple images. This saves a small amount of time per image by eliminating the "create" and "destroy" operations, but that isn't the real purpose of the feature. Rather, reuse of an object provides support for abbreviated JPEG datastreams. Object reuse can also simplify processing a series of images in a single input or output file. This section explains these features.

A JPEG file normally contains several hundred bytes worth of quantization
and Huffman tables. In a situation where many images will be stored or
transmitted with identical tables, this may represent an annoying overhead.
The JPEG standard therefore permits tables to be omitted. The standard
defines three classes of JPEG datastreams:

 * "Interchange" datastreams contain an image and all tables needed to decode
    the image. These are the usual kind of JPEG
 file.
 * "Abbreviated image" datastreams contain an image, but are missing some or
   all of the tables needed to decode that image.
 * "Abbreviated table specification" (henceforth "tables-only") datastreams
   contain only table specifications.

To decode an abbreviated image, it is necessary to load the missing table(s)
into the decoder beforehand. This can be accomplished by reading a separate
tables-only file. A variant scheme uses a series of images in which the first
image is an interchange (complete) datastream, while subsequent ones are
abbreviated and rely on the tables loaded by the first image. It is assumed
that once the decoder has read a table, it will remember that table until a
new definition for the same table number is encountered.

It is the application designer's responsibility to figure out how to associate
the correct tables with an abbreviated image. While abbreviated datastreams
can be useful in a closed environment, their use is strongly discouraged
 in
any situation where data exchange with other applications might be needed.
Caveat designer.

The JPEG library provides support for reading and writing any combination of
tables-only datastreams and abbreviated images. In both compression and
decompression objects, a quantization or Huffman table will be retained for
the lifetime of the object, unless it is overwritten by a new table definition.

To create abbreviated image datastreams, it is only necessary to tell the
compressor not to emit some or all of the tables it is using. Each
quantization and Huffman table struct contains a boolean field "sent_table",
which normally is initialized to FALSE. For each table used by the image, the
header-writing process emits the table and sets sent_table = TRUE unless it is
already TRUE. (In normal usage, this prevents outputting the same table
definition multiple times, as would otherwise occur because the chroma
components typically share tables.) Thus, setting this field to TRUE before
calling
 jpeg_start_compress() will prevent the table from being written at
all.

If you want to create a "pure" abbreviated image file containing no tables,
just call "jpeg_suppress_tables(&cinfo, TRUE)" after constructing all the
tables. If you want to emit some but not all tables, you'll need to set the

individual sent_table fields directly.

To create an abbreviated image, you must also call jpeg_start_compress()
with a second parameter of FALSE, not TRUE. Otherwise jpeg_start_compress()
will force all the sent_table fields to FALSE. (This is a safety feature to
prevent abbreviated images from being created accidentally.)

To create a tables-only file, perform the same parameter setup that you
normally would, but instead of calling jpeg_start_compress() and so on, call
jpeg_write_tables(&cinfo). This will write an abbreviated datastream
containing only SOI, DQT and/or DHT markers, and EOI. All the quantization
and Huffman tables that are currently defined in the compression object
 will
be emitted unless their sent_tables flag is already TRUE, and then all the
sent_tables flags will be set TRUE.

A sure-fire way to create matching tables-only and abbreviated image files
is to proceed as follows:

```
 create JPEG compression object
 set JPEG parameters
 set destination to tables-only file
 jpeg_write_tables(&cinfo);
 set destination to image file
 jpeg_start_compress(&cinfo, FALSE);
 write data...
 jpeg_finish_compress(&cinfo);
```

Since the JPEG parameters are not altered between writing the table file and
the abbreviated image file, the same tables are sure to be used. Of course,
you can repeat the jpeg_start_compress() ... jpeg_finish_compress() sequence
many times to produce many abbreviated image files matching the table file.

You cannot suppress output of the computed Huffman tables when Huffman
optimization is selected. (If you could, there'd be no way to decode the
image...) Generally, you don't want to set optimize_coding = TRUE when
you are trying to
 produce abbreviated files.

In some cases you might want to compress an image using tables which are
not stored in the application, but are defined in an interchange or
tables-only file readable by the application. This can be done by setting up
a JPEG decompression object to read the specification file, then copying the
tables into your compression object. See jpeg_copy_critical_parameters()
for an example of copying quantization tables.

To read abbreviated image files, you simply need to load the proper tables

into the decompression object before trying to read the abbreviated image.
If the proper tables are stored in the application program, you can just
allocate the table structs and fill in their contents directly. For example,
to load a fixed quantization table into table slot "n":

```
  if (cinfo.quant_tbl_ptrs[n] == NULL)
    cinfo.quant_tbl_ptrs[n] = jpeg_alloc_quant_table((j_common_ptr) &cinfo);
  quant_ptr = cinfo.quant_tbl_ptrs[n]; /* quant_ptr is JQUANT_TBL* */

  for (i = 0; i < 64; i++) {
    /* Qtable[] is desired quantization table, in natural array order */
    quant_ptr->quantval[i] = Qtable[i];
  }
```

Code to load a fixed Huffman table is typically (for AC table "n"):

```
  if (cinfo.ac_huff_tbl_ptrs[n] == NULL)
    cinfo.ac_huff_tbl_ptrs[n] = jpeg_alloc_huff_table((j_common_ptr) &cinfo);
  huff_ptr = cinfo.ac_huff_tbl_ptrs[n]; /* huff_ptr is JHUFF_TBL* */
  for (i = 1; i <= 16; i++) {
    /* counts[i] is number of Huffman codes of length i bits, i=1..16 */
    huff_ptr->bits[i] = counts[i];
  }
  for (i = 0; i < 256; i++) {
    /* symbols[] is the list of Huffman symbols, in code-length order */
    huff_ptr->huffval[i] = symbols[i];
  }
```

(Note that trying to set cinfo.quant_tbl_ptrs[n] to point directly at a
constant JQUANT_TBL object is not safe. If the incoming file happened to
contain a quantization table definition, your master table would get
overwritten! Instead allocate a working table copy and copy the
 master table
into it, as illustrated above. Ditto for Huffman tables, of course.)

You might want to read the tables from a tables-only file, rather than
hard-wiring them into your application. The jpeg_read_header() call is
sufficient to read a tables-only file. You must pass a second parameter of
FALSE to indicate that you do not require an image to be present. Thus, the
typical scenario is

```
 create JPEG decompression object
 set source to tables-only file
 jpeg_read_header(&cinfo, FALSE);
 set source to abbreviated image file
 jpeg_read_header(&cinfo, TRUE);
 set decompression parameters
 jpeg_start_decompress(&cinfo);
```

read data...
jpeg_finish_decompress(&cinfo);

In some cases, you may want to read a file without knowing whether it contains
an image or just tables. In that case, pass FALSE and check the return value
from jpeg_read_header(): it will be JPEG_HEADER_OK if an image was found,
JPEG_HEADER_TABLES_ONLY if only tables were found. (A third return value,
JPEG_SUSPENDED,
is possible when using a suspending data source manager.)
Note that jpeg_read_header() will not complain if you read an abbreviated
image for which you haven't loaded the missing tables; the missing-table check
occurs later, in jpeg_start_decompress().

It is possible to read a series of images from a single source file by
repeating the jpeg_read_header() ... jpeg_finish_decompress() sequence,
without releasing/recreating the JPEG object or the data source module.
(If you did reinitialize, any partial bufferload left in the data source
buffer at the end of one image would be discarded, causing you to lose the
start of the next image.) When you use this method, stored tables are
automatically carried forward, so some of the images can be abbreviated images
that depend on tables from earlier images.

If you intend to write a series of images into a single destination file,
you might want to make a specialized data destination module that doesn't
flush the output buffer at term_destination()
time. This would speed things
up by some trifling amount. Of course, you'd need to remember to flush the
buffer after the last image. You can make the later images be abbreviated
ones by passing FALSE to jpeg_start_compress().

Special markers

Some applications may need to insert or extract special data in the JPEG
datastream. The JPEG standard provides marker types "COM" (comment) and
"APP0" through "APP15" (application) to hold application-specific data.
Unfortunately, the use of these markers is not specified by the standard.
COM markers are fairly widely used to hold user-supplied text. The JFIF file
format spec uses APP0 markers with specified initial strings to hold certain
data. Adobe applications use APP14 markers beginning with the string "Adobe"
for miscellaneous data. Other APPn markers are rarely seen, but might
contain almost anything.

If you wish to store user-supplied text, we recommend you use COM markers
and place readable 7-bit ASCII

text in them. Newline conventions are not
standardized --- expect to find LF (Unix style), CR/LF (DOS style), or CR
(Mac style). A robust COM reader should be able to cope with random binary
garbage, including nulls, since some applications generate COM markers
containing non-ASCII junk. (But yours should not be one of them.)

For program-supplied data, use an APPn marker, and be sure to begin it with an
identifying string so that you can tell whether the marker is actually yours.
It's probably best to avoid using APP0 or APP14 for any private markers.
(NOTE: the upcoming SPIFF standard will use APP8 markers; we recommend you
not use APP8 markers for any private purposes, either.)

Keep in mind that at most 65533 bytes can be put into one marker, but you
can have as many markers as you like.

By default, the IJG compression library will write a JFIF APP0 marker if the
selected JPEG colorspace is grayscale or YCbCr, or an Adobe APP14 marker if
the selected colorspace is RGB, CMYK,
or YCCK. You can disable this, but
we don't recommend it. The decompression library will recognize JFIF and
Adobe markers and will set the JPEG colorspace properly when one is found.

You can write special markers immediately following the datastream header by
calling jpeg_write_marker() after jpeg_start_compress() and before the first
call to jpeg_write_scanlines(). When you do this, the markers appear after
the SOI and the JFIF APP0 and Adobe APP14 markers (if written), but before
all else. Specify the marker type parameter as "JPEG_COM" for COM or
"JPEG_APP0 + n" for APPn. (Actually, jpeg_write_marker will let you write
any marker type, but we don't recommend writing any other kinds of marker.)
For example, to write a user comment string pointed to by comment_text:
jpeg_write_marker(cinfo, JPEG_COM, comment_text, strlen(comment_text));

If it's not convenient to store all the marker data in memory at once,
you can instead call jpeg_write_m_header() followed by multiple calls
to
jpeg_write_m_byte(). If you do it this way, it's your responsibility to
call jpeg_write_m_byte() exactly the number of times given in the length
parameter to jpeg_write_m_header(). (This method lets you empty the
output buffer partway through a marker, which might be important when
using a suspending data destination module. In any case, if you are using
a suspending destination, you should flush its buffer after inserting
any special markers. See "I/O suspension".)

Or, if you prefer to synthesize the marker byte sequence yourself,
you can just cram it straight into the data destination module.

If you are writing JFIF 1.02 extension markers (thumbnail images), don't

forget to set cinfo.JFIF_minor_version = 2 so that the encoder will write the correct JFIF version number in the JFIF header marker. The library's default is to write version 1.01, but that's wrong if you insert any 1.02 extension markers. (We could probably get away with just defaulting to 1.02, but there used
to be broken decoders that would complain about unknown minor version numbers. To reduce compatibility risks it's safest not to write 1.02 unless you are actually using 1.02 extensions.)

When reading, two methods of handling special markers are available:
1. You can ask the library to save the contents of COM and/or APPn markers into memory, and then examine them at your leisure afterwards.
2. You can supply your own routine to process COM and/or APPn markers on-the-fly as they are read.
The first method is simpler to use, especially if you are using a suspending data source; writing a marker processor that copes with input suspension is not easy (consider what happens if the marker is longer than your available input buffer). However, the second method conserves memory since the marker data need not be kept around after it's been processed.

For either method, you'd normally set up marker handling after creating a decompression object and before calling jpeg_read_header(), because
the
markers of interest will typically be near the head of the file and so will be scanned by jpeg_read_header. Once you've established a marker handling method, it will be used for the life of that decompression object (potentially many datastreams), unless you change it. Marker handling is determined separately for COM markers and for each APPn marker code.

To save the contents of special markers in memory, call
jpeg_save_markers(cinfo, marker_code, length_limit)
where marker_code is the marker type to save, JPEG_COM or JPEG_APP0+n. (To arrange to save all the special marker types, you need to call this routine 17 times, for COM and APP0-APP15.) If the incoming marker is longer than length_limit data bytes, only length_limit bytes will be saved; this parameter allows you to avoid chewing up memory when you only need to see the first few bytes of a potentially large marker. If you want to save all the data, set length_limit to 0xFFFF; that is enough since marker lengths are only
16
bits. As a special case, setting length_limit to 0 prevents that marker type from being saved at all. (That is the default behavior, in fact.)

After jpeg_read_header() completes, you can examine the special markers by following the cinfo->marker_list pointer chain. All the special markers in the file appear in this list, in order of their occurrence in the file (but omitting any markers of types you didn't ask for). Both the original data

length and the saved data length are recorded for each list entry; the latter
will not exceed length_limit for the particular marker type. Note that these
lengths exclude the marker length word, whereas the stored representation
within the JPEG file includes it. (Hence the maximum data length is really
only 65533.)

It is possible that additional special markers appear in the file beyond the
SOS marker at which jpeg_read_header stops; if so, the marker list will be
extended during reading of the rest of the file. This is not expected to
 be
common, however. If you are short on memory you may want to reset the length
limit to zero for all marker types after finishing jpeg_read_header, to
ensure that the max_memory_to_use setting cannot be exceeded due to addition
of later markers.

The marker list remains stored until you call jpeg_finish_decompress or
jpeg_abort, at which point the memory is freed and the list is set to empty.
(jpeg_destroy also releases the storage, of course.)

Note that the library is internally interested in APP0 and APP14 markers;
if you try to set a small nonzero length limit on these types, the library
will silently force the length up to the minimum it wants. (But you can set
a zero length limit to prevent them from being saved at all.) Also, in a
16-bit environment, the maximum length limit may be constrained to less than
65533 by malloc() limitations. It is therefore best not to assume that the
effective length limit is exactly what you set it to be.

If you want to supply your own marker-reading
 routine, you do it by calling
jpeg_set_marker_processor(). A marker processor routine must have the
signature
 boolean jpeg_marker_parser_method (j_decompress_ptr cinfo)
Although the marker code is not explicitly passed, the routine can find it
in cinfo->unread_marker. At the time of call, the marker proper has been
read from the data source module. The processor routine is responsible for
reading the marker length word and the remaining parameter bytes, if any.
Return TRUE to indicate success. (FALSE should be returned only if you are
using a suspending data source and it tells you to suspend. See the standard
marker processors in jdmarker.c for appropriate coding methods if you need to
use a suspending data source.)

If you override the default APP0 or APP14 processors, it is up to you to
recognize JFIF and Adobe markers if you want colorspace recognition to occur
properly. We recommend copying and extending the default processors if you
want to do that. (A better idea
 is to save these marker types for later
examination by calling jpeg_save_markers(); that method doesn't interfere

with the library's own processing of these markers.)

jpeg_set_marker_processor() and jpeg_save_markers() are mutually exclusive
--- if you call one it overrides any previous call to the other, for the
particular marker type specified.

A simple example of an external COM processor can be found in djpeg.c.
Also, see jpegtran.c for an example of using jpeg_save_markers.

Raw (downsampled) image data

Some applications need to supply already-downsampled image data to the JPEG
compressor, or to receive raw downsampled data from the decompressor. The
library supports this requirement by allowing the application to write or
read raw data, bypassing the normal preprocessing or postprocessing steps.
The interface is different from the standard one and is somewhat harder to
use. If your interest is merely in bypassing color conversion, we recommend
that
you use the standard interface and simply set jpeg_color_space =
in_color_space (or jpeg_color_space = out_color_space for decompression).
The mechanism described in this section is necessary only to supply or
receive downsampled image data, in which not all components have the same
dimensions.

To compress raw data, you must supply the data in the colorspace to be used
in the JPEG file (please read the earlier section on Special color spaces)
and downsampled to the sampling factors specified in the JPEG parameters.
You must supply the data in the format used internally by the JPEG library,
namely a JSAMPIMAGE array. This is an array of pointers to two-dimensional
arrays, each of type JSAMPARRAY. Each 2-D array holds the values for one
color component. This structure is necessary since the components are of
different sizes. If the image dimensions are not a multiple of the MCU size,
you must also pad the data correctly (usually, this is done by replicating
the last column and/or
row). The data must be padded to a multiple of a DCT
block in each component: that is, each downsampled row must contain a
multiple of 8 valid samples, and there must be a multiple of 8 sample rows
for each component. (For applications such as conversion of digital TV
images, the standard image size is usually a multiple of the DCT block size,
so that no padding need actually be done.)

The procedure for compression of raw data is basically the same as normal
compression, except that you call jpeg_write_raw_data() in place of
jpeg_write_scanlines(). Before calling jpeg_start_compress(), you must do
the following:

* Set cinfo->raw_data_in to TRUE. (It is set FALSE by jpeg_set_defaults().)
  This notifies the library that you will be supplying raw data.
* Ensure jpeg_color_space is correct --- an explicit jpeg_set_colorspace()
  call is a good idea. Note that since color conversion is bypassed,
  in_color_space is ignored, except that jpeg_set_defaults() uses it to
  choose the default jpeg_color_space setting.
* Ensure the sampling factors, cinfo->comp_info[i].h_samp_factor and
  cinfo->comp_info[i].v_samp_factor, are correct. Since these indicate the
  dimensions of the data you are supplying, it's wise to set them
  explicitly, rather than assuming the library's defaults are what you want.

To pass raw data to the library, call jpeg_write_raw_data() in place of
jpeg_write_scanlines(). The two routines work similarly except that
jpeg_write_raw_data takes a JSAMPIMAGE data array rather than JSAMPARRAY.
The scanlines count passed to and returned from jpeg_write_raw_data is
measured in terms of the component with the largest v_samp_factor.

jpeg_write_raw_data() processes one MCU row per call, which is to say
v_samp_factor*DCTSIZE sample rows of each component. The passed num_lines
value must be at least max_v_samp_factor*DCTSIZE, and the return value will
be exactly that amount (or possibly some multiple of that amount, in future
library
 versions). This is true even on the last call at the bottom of the
image; don't forget to pad your data as necessary.

The required dimensions of the supplied data can be computed for each
component as
 cinfo->comp_info[i].width_in_blocks*DCTSIZE samples per row
 cinfo->comp_info[i].height_in_blocks*DCTSIZE rows in image
after jpeg_start_compress() has initialized those fields. If the valid data
is smaller than this, it must be padded appropriately. For some sampling
factors and image sizes, additional dummy DCT blocks are inserted to make
the image a multiple of the MCU dimensions. The library creates such dummy
blocks itself; it does not read them from your supplied data. Therefore you
need never pad by more than DCTSIZE samples. An example may help here.
Assume 2h2v downsampling of YCbCr data, that is
 cinfo->comp_info[0].h_samp_factor = 2 for Y
 cinfo->comp_info[0].v_samp_factor = 2
 cinfo->comp_info[1].h_samp_factor = 1 for Cb
 cinfo->comp_info[1].v_samp_factor = 1
 cinfo->comp_info[2].h_samp_factor
 = 1 for Cr
 cinfo->comp_info[2].v_samp_factor = 1
and suppose that the nominal image dimensions (cinfo->image_width and
cinfo->image_height) are 101x101 pixels. Then jpeg_start_compress() will
compute downsampled_width = 101 and width_in_blocks = 13 for Y,
downsampled_width = 51 and width_in_blocks = 7 for Cb and Cr (and the same
for the height fields). You must pad the Y data to at least 13*8 = 104

columns and rows, the Cb/Cr data to at least 7*8 = 56 columns and rows. The MCU height is max_v_samp_factor = 2 DCT rows so you must pass at least 16 scanlines on each call to jpeg_write_raw_data(), which is to say 16 actual sample rows of Y and 8 each of Cb and Cr. A total of 7 MCU rows are needed, so you must pass a total of 7*16 = 112 "scanlines". The last DCT block row of Y data is dummy, so it doesn't matter what you pass for it in the data arrays, but the scanlines count must total up to 112 so that all of the Cb and Cr data gets passed.

Output
suspension is supported with raw-data compression: if the data destination module suspends, jpeg_write_raw_data() will return 0. In this case the same data rows must be passed again on the next call.

Decompression with raw data output implies bypassing all postprocessing: you cannot ask for rescaling or color quantization, for instance. More seriously, you must deal with the color space and sampling factors present in the incoming file. If your application only handles, say, 2h1v YCbCr data, you must check for and fail on other color spaces or other sampling factors. The library will not convert to a different color space for you.

To obtain raw data output, set cinfo->raw_data_out = TRUE before jpeg_start_decompress() (it is set FALSE by jpeg_read_header()). Be sure to verify that the color space and sampling factors are ones you can handle. Then call jpeg_read_raw_data() in place of jpeg_read_scanlines(). The decompression process is otherwise the same as usual.

jpeg_read_raw_data()
returns one MCU row per call, and thus you must pass a buffer of at least max_v_samp_factor*DCTSIZE scanlines (scanline counting is the same as for raw-data compression). The buffer you pass must be large enough to hold the actual data plus padding to DCT-block boundaries. As with compression, any entirely dummy DCT blocks are not processed so you need not allocate space for them, but the total scanline count includes them. The above example of computing buffer dimensions for raw-data compression is equally valid for decompression.

Input suspension is supported with raw-data decompression: if the data source module suspends, jpeg_read_raw_data() will return 0. You can also use buffered-image mode to read raw data in multiple passes.

Really raw data: DCT coefficients

It is possible to read or write the contents of a JPEG file as raw DCT coefficients. This facility is mainly intended for use in lossless

transcoding between different JPEG
file formats. Other possible applications
include lossless cropping of a JPEG image, lossless reassembly of a
multi-strip or multi-tile TIFF/JPEG file into a single JPEG datastream, etc.

To read the contents of a JPEG file as DCT coefficients, open the file and do
jpeg_read_header() as usual. But instead of calling jpeg_start_decompress()
and jpeg_read_scanlines(), call jpeg_read_coefficients(). This will read the
entire image into a set of virtual coefficient-block arrays, one array per
component. The return value is a pointer to an array of virtual-array
descriptors. Each virtual array can be accessed directly using the JPEG
memory manager's access_virt_barray method (see Memory management, below,
and also read structure.txt's discussion of virtual array handling). Or,
for simple transcoding to a different JPEG file format, the array list can
just be handed directly to jpeg_write_coefficients().

Each block in the block arrays contains quantized coefficient values in
normal array
order (not JPEG zigzag order). The block arrays contain only
DCT blocks containing real data; any entirely-dummy blocks added to fill out
interleaved MCUs at the right or bottom edges of the image are discarded
during reading and are not stored in the block arrays. (The size of each
block array can be determined from the width_in_blocks and height_in_blocks
fields of the component's comp_info entry.) This is also the data format
expected by jpeg_write_coefficients().

When you are done using the virtual arrays, call jpeg_finish_decompress()
to release the array storage and return the decompression object to an idle
state; or just call jpeg_destroy() if you don't need to reuse the object.

If you use a suspending data source, jpeg_read_coefficients() will return
NULL if it is forced to suspend; a non-NULL return value indicates successful
completion. You need not test for a NULL return value when using a
non-suspending data source.

It is also possible to call jpeg_read_coefficients()
to obtain access to the
decoder's coefficient arrays during a normal decode cycle in buffered-image
mode. This frammish might be useful for progressively displaying an incoming
image and then re-encoding it without loss. To do this, decode in buffered-
image mode as discussed previously, then call jpeg_read_coefficients() after
the last jpeg_finish_output() call. The arrays will be available for your use
until you call jpeg_finish_decompress().

To write the contents of a JPEG file as DCT coefficients, you must provide
the DCT coefficients stored in virtual block arrays. You can either pass
block arrays read from an input JPEG file by jpeg_read_coefficients(), or

allocate virtual arrays from the JPEG compression object and fill them
yourself. In either case, jpeg_write_coefficients() is substituted for
jpeg_start_compress() and jpeg_write_scanlines(). Thus the sequence is
 * Create compression object
 * Set all compression parameters as necessary
 * Request virtual arrays
 if needed
 * jpeg_write_coefficients()
 * jpeg_finish_compress()
 * Destroy or re-use compression object
jpeg_write_coefficients() is passed a pointer to an array of virtual block
array descriptors; the number of arrays is equal to cinfo.num_components.

The virtual arrays need only have been requested, not realized, before
jpeg_write_coefficients() is called. A side-effect of
jpeg_write_coefficients() is to realize any virtual arrays that have been
requested from the compression object's memory manager. Thus, when obtaining
the virtual arrays from the compression object, you should fill the arrays
after calling jpeg_write_coefficients(). The data is actually written out
when you call jpeg_finish_compress(); jpeg_write_coefficients() only writes
the file header.

When writing raw DCT coefficients, it is crucial that the JPEG quantization
tables and sampling factors match the way the data was encoded, or the
resulting file will be invalid. For transcoding from an existing JPEG
 file,
we recommend using jpeg_copy_critical_parameters(). This routine initializes
all the compression parameters to default values (like jpeg_set_defaults()),
then copies the critical information from a source decompression object.
The decompression object should have just been used to read the entire
JPEG input file --- that is, it should be awaiting jpeg_finish_decompress().

jpeg_write_coefficients() marks all tables stored in the compression object
as needing to be written to the output file (thus, it acts like
jpeg_start_compress(cinfo, TRUE)). This is for safety's sake, to avoid
emitting abbreviated JPEG files by accident. If you really want to emit an
abbreviated JPEG file, call jpeg_suppress_tables(), or set the tables'
individual sent_table flags, between calling jpeg_write_coefficients() and
jpeg_finish_compress().

Progress monitoring

Some applications may need to regain control from the JPEG library every so
often. The typical use of this feature
 is to produce a percent-done bar or
other progress display. (For a simple example, see cjpeg.c or djpeg.c.)

Although you do get control back frequently during the data-transferring pass
(the jpeg_read_scanlines or jpeg_write_scanlines loop), any additional passes
will occur inside jpeg_finish_compress or jpeg_start_decompress; those
routines may take a long time to execute, and you don't get control back
until they are done.

You can define a progress-monitor routine which will be called periodically
by the library. No guarantees are made about how often this call will occur,
so we don't recommend you use it for mouse tracking or anything like that.
At present, a call will occur once per MCU row, scanline, or sample row
group, whichever unit is convenient for the current processing mode; so the
wider the image, the longer the time between calls. During the data
transferring pass, only one call occurs per call of jpeg_read_scanlines or
jpeg_write_scanlines, so don't pass a large number
 of scanlines at once if
you want fine resolution in the progress count. (If you really need to use
the callback mechanism for time-critical tasks like mouse tracking, you could
insert additional calls inside some of the library's inner loops.)

To establish a progress-monitor callback, create a struct jpeg_progress_mgr,
fill in its progress_monitor field with a pointer to your callback routine,
and set cinfo->progress to point to the struct. The callback will be called
whenever cinfo->progress is non-NULL. (This pointer is set to NULL by
jpeg_create_compress or jpeg_create_decompress; the library will not change
it thereafter. So if you allocate dynamic storage for the progress struct,
make sure it will live as long as the JPEG object does. Allocating from the
JPEG memory manager with lifetime JPOOL_PERMANENT will work nicely.) You
can use the same callback routine for both compression and decompression.

The jpeg_progress_mgr struct contains four fields which are set by the
 library:
 long pass_counter; /* work units completed in this pass */
 long pass_limit; /* total number of work units in this pass */
 int completed_passes; /* passes completed so far */
 int total_passes; /* total number of passes expected */
During any one pass, pass_counter increases from 0 up to (not including)
pass_limit; the step size is usually but not necessarily 1. The pass_limit
value may change from one pass to another. The expected total number of
passes is in total_passes, and the number of passes already completed is in
completed_passes. Thus the fraction of work completed may be estimated as
  completed_passes + (pass_counter/pass_limit)
  ----
    total_passes
ignoring the fact that the passes may not be equal amounts of work.

When decompressing, pass_limit can even change within a pass, because it
depends on the number of scans in the JPEG file, which isn't always known in
advance. The computed fraction-of-work-done may jump

suddenly (if the library
discovers it has overestimated the number of scans) or even decrease (in the opposite case). It is not wise to put great faith in the work estimate.

When using the decompressor's buffered-image mode, the progress monitor work estimate is likely to be completely unhelpful, because the library has no way to know how many output passes will be demanded of it. Currently, the library sets total_passes based on the assumption that there will be one more output pass if the input file end hasn't yet been read (jpeg_input_complete() isn't TRUE), but no more output passes if the file end has been reached when the output pass is started. This means that total_passes will rise as additional output passes are requested. If you have a way of determining the input file size, estimating progress based on the fraction of the file that's been read will probably be more useful than using the library's value.

Memory management

This section covers some key
facts about the JPEG library's built-in memory
manager. For more info, please read structure.txt's section about the memory manager, and consult the source code if necessary.

All memory and temporary file allocation within the library is done via the memory manager. If necessary, you can replace the "back end" of the memory manager to control allocation yourself (for example, if you don't want the library to use malloc() and free() for some reason).

Some data is allocated "permanently" and will not be freed until the JPEG object is destroyed. Most data is allocated "per image" and is freed by jpeg_finish_compress, jpeg_finish_decompress, or jpeg_abort. You can call the memory manager yourself to allocate structures that will automatically be freed at these times. Typical code for this is
ptr = (*cinfo->mem->alloc_small) ((j_common_ptr) cinfo, JPOOL_IMAGE, size);
Use JPOOL_PERMANENT to get storage that lasts as long as the JPEG object.
Use alloc_large instead of alloc_small for
anything bigger than a few Kbytes.
There are also alloc_sarray and alloc_barray routines that automatically build 2-D sample or block arrays.

The library's minimum space requirements to process an image depend on the image's width, but not on its height, because the library ordinarily works with "strip" buffers that are as wide as the image but just a few rows high. Some operating modes (eg, two-pass color quantization) require full-image buffers. Such buffers are treated as "virtual arrays": only the current strip need be in memory, and the rest can be swapped out to a temporary file.

If you use the simplest memory manager back end (jmemnobs.c), then no temporary files are used; virtual arrays are simply malloc()'d. Images bigger than memory can be processed only if your system supports virtual memory. The other memory manager back ends support temporary files of various flavors and thus work in machines without virtual memory. They may also be useful on Unix machines if you need
to process images that exceed available swap space.

When using temporary files, the library will make the in-memory buffers for its virtual arrays just big enough to stay within a "maximum memory" setting. Your application can set this limit by setting cinfo->mem->max_memory_to_use after creating the JPEG object. (Of course, there is still a minimum size for the buffers, so the max-memory setting is effective only if it is bigger than the minimum space needed.) If you allocate any large structures yourself, you must allocate them before jpeg_start_compress() or jpeg_start_decompress() in order to have them counted against the max memory limit. Also keep in mind that space allocated with alloc_small() is ignored, on the assumption that it's too small to be worth worrying about; so a reasonable safety margin should be left when setting max_memory_to_use.

If you use the jmemname.c or jmemdos.c memory manager back end, it is important to clean up the JPEG object properly to ensure
that the temporary
files get deleted. (This is especially crucial with jmemdos.c, where the "temporary files" may be extended-memory segments; if they are not freed, DOS will require a reboot to recover the memory.) Thus, with these memory managers, it's a good idea to provide a signal handler that will trap any early exit from your program. The handler should call either jpeg_abort() or jpeg_destroy() for any active JPEG objects. A handler is not needed with jmemnobs.c, and shouldn't be necessary with jmemansi.c or jmemmac.c either, since the C library is supposed to take care of deleting files made with tmpfile().

Memory usage

Working memory requirements while performing compression or decompression depend on image dimensions, image characteristics (such as colorspace and JPEG process), and operating mode (application-selected options).

As of v6b, the decompressor requires:
1. About 24K in more-or-less-fixed-size data. This varies a bit depending
on operating
mode and image characteristics (particularly color vs.
grayscale), but it doesn't depend on image dimensions.
2. Strip buffers (of size proportional to the image width) for IDCT and
upsampling results. The worst case for commonly used sampling factors

is about 34 bytes * width in pixels for a color image. A grayscale image only needs about 8 bytes per pixel column.
3. A full-image DCT coefficient buffer is needed to decode a multi-scan JPEG file (including progressive JPEGs), or whenever you select buffered-image mode. This takes 2 bytes/coefficient. At typical 2x2 sampling, that's 3 bytes per pixel for a color image. Worst case (1x1 sampling) requires 6 bytes/pixel. For grayscale, figure 2 bytes/pixel.
4. To perform 2-pass color quantization, the decompressor also needs a 128K color lookup table and a full-image pixel buffer (3 bytes/pixel).

This does not count any memory allocated by the application, such as a buffer to hold the final output image.

The above figures are valid for 8-bit JPEG data precision and a machine with 32-bit ints. For 12-bit JPEG data, double the size of the strip buffers and quantization pixel buffer. The "fixed-size" data will be somewhat smaller with 16-bit ints, larger with 64-bit ints. Also, CMYK or other unusual color spaces will require different amounts of space.

The full-image coefficient and pixel buffers, if needed at all, do not have to be fully RAM resident; you can have the library use temporary files instead when the total memory usage would exceed a limit you set. (But if your OS supports virtual memory, it's probably better to just use jmemnobs and let the OS do the swapping.)

The compressor's memory requirements are similar, except that it has no need for color quantization. Also, it needs a full-image DCT coefficient buffer if Huffman-table optimization is asked for, even if progressive mode is not requested.

If you need more detailed information about memory usage in a particular situation, you can enable the MEM_STATS code in jmemmgr.c.

Library compile-time options

A number of compile-time options are available by modifying jmorecfg.h.

The JPEG standard provides for both the baseline 8-bit DCT process and a 12-bit DCT process. The IJG code supports 12-bit lossy JPEG if you define BITS_IN_JSAMPLE as 12 rather than 8. Note that this causes JSAMPLE to be larger than a char, so it affects the surrounding application's image data. The sample applications cjpeg and djpeg can support 12-bit mode only for PPM and GIF file formats; you must disable the other file formats to compile a 12-bit cjpeg or djpeg. (install.txt has more information about that.) At present, a 12-bit library can handle *only* 12-bit images, not both

precisions. (If you need to include both 8- and 12-bit libraries in a single
application, you could probably do it by defining NEED_SHORT_EXTERNAL_NAMES
for just one of the copies. You'd have to access
 the 8-bit and 12-bit copies
from separate application source files. This is untested ... if you try it,
we'd like to hear whether it works!)

Note that a 12-bit library always compresses in Huffman optimization mode,
in order to generate valid Huffman tables. This is necessary because our
default Huffman tables only cover 8-bit data. If you need to output 12-bit
files in one pass, you'll have to supply suitable default Huffman tables.
You may also want to supply your own DCT quantization tables; the existing
quality-scaling code has been developed for 8-bit use, and probably doesn't
generate especially good tables for 12-bit.

The maximum number of components (color channels) in the image is determined
by MAX_COMPONENTS. The JPEG standard allows up to 255 components, but we
expect that few applications will need more than four or so.

On machines with unusual data type sizes, you may be able to improve
performance or reduce memory space by tweaking the various typedefs in
jmorecfg.h.
  In particular, on some RISC CPUs, access to arrays of "short"s
is quite slow; consider trading memory for speed by making JCOEF, INT16, and
UINT16 be "int" or "unsigned int". UINT8 is also a candidate to become int.
You probably don't want to make JSAMPLE be int unless you have lots of memory
to burn.

You can reduce the size of the library by compiling out various optional
functions. To do this, undefine xxx_SUPPORTED symbols as necessary.

You can also save a few K by not having text error messages in the library;
the standard error message table occupies about 5Kb. This is particularly
reasonable for embedded applications where there's no good way to display
a message anyway. To do this, remove the creation of the message table
(jpeg_std_message_table[]) from jerror.c, and alter format_message to do
something reasonable without it. You could output the numeric value of the
message code number, for example. If you do this, you can also save a couple
more K by modifying
 the TRACEMSn() macros in jerror.h to expand to nothing;
you don't need trace capability anyway, right?

Portability considerations

The JPEG library has been written to be extremely portable; the sample
applications cjpeg and djpeg are slightly less so. This section summarizes

the design goals in this area. (If you encounter any bugs that cause the
library to be less portable than is claimed here, we'd appreciate hearing
about them.)

The code works fine on ANSI C, C++, and pre-ANSI C compilers, using any of
the popular system include file setups, and some not-so-popular ones too.
See install.txt for configuration procedures.

The code is not dependent on the exact sizes of the C data types. As
distributed, we make the assumptions that
 char is at least 8 bits wide
 short is at least 16 bits wide
 int is at least 16 bits wide
 long is at least 32 bits wide
(These are the minimum requirements of the ANSI C standard.) Wider types will
work fine, although
 memory may be used inefficiently if char is much larger
than 8 bits or short is much bigger than 16 bits. The code should work
equally well with 16- or 32-bit ints.

In a system where these assumptions are not met, you may be able to make the
code work by modifying the typedefs in jmorecfg.h. However, you will probably
have difficulty if int is less than 16 bits wide, since references to plain
int abound in the code.

char can be either signed or unsigned, although the code runs faster if an
unsigned char type is available. If char is wider than 8 bits, you will need
to redefine JOCTET and/or provide custom data source/destination managers so
that JOCTET represents exactly 8 bits of data on external storage.

The JPEG library proper does not assume ASCII representation of characters.
But some of the image file I/O modules in cjpeg/djpeg do have ASCII
dependencies in file-header manipulation; so does cjpeg's select_file_type()
routine.

The JPEG library does not rely heavily on the C
 library. In particular, C
stdio is used only by the data source/destination modules and the error
handler, all of which are application-replaceable. (cjpeg/djpeg are more
heavily dependent on stdio.) malloc and free are called only from the memory
manager "back end" module, so you can use a different memory allocator by
replacing that one file.

The code generally assumes that C names must be unique in the first 15
characters. However, global function names can be made unique in the
first 6 characters by defining NEED_SHORT_EXTERNAL_NAMES.

More info about porting the code may be gleaned by reading jconfig.txt,

jmorecfg.h, and jinclude.h.

Notes for MS-DOS implementors

The IJG code is designed to work efficiently in 80x86 "small" or "medium"
memory models (i.e., data pointers are 16 bits unless explicitly declared
"far"; code pointers can be either size). You may be able to use small
model to compile cjpeg or djpeg by itself, but you will probably
have to use
medium model for any larger application. This won't make much difference in
performance. You *will* take a noticeable performance hit if you use a
large-data memory model (perhaps 10%-25%), and you should avoid "huge" model
if at all possible.

The JPEG library typically needs 2Kb-3Kb of stack space. It will also
malloc about 20K-30K of near heap space while executing (and lots of far
heap, but that doesn't count in this calculation). This figure will vary
depending on selected operating mode, and to a lesser extent on image size.
There is also about 5Kb-6Kb of constant data which will be allocated in the
near data segment (about 4Kb of this is the error message table).
Thus you have perhaps 20K available for other modules' static data and near
heap space before you need to go to a larger memory model. The C library's
static data will account for several K of this, but that still leaves a good
deal for your needs. (If you are tight on space, you could reduce the sizes
of
the I/O buffers allocated by jdatasrc.c and jdatadst.c, say from 4K to
1K. Another possibility is to move the error message table to far memory;
this should be doable with only localized hacking on jerror.c.)

About 2K of the near heap space is "permanent" memory that will not be
released until you destroy the JPEG object. This is only an issue if you
save a JPEG object between compression or decompression operations.

Far data space may also be a tight resource when you are dealing with large
images. The most memory-intensive case is decompression with two-pass color
quantization, or single-pass quantization to an externally supplied color
map. This requires a 128Kb color lookup table plus strip buffers amounting
to about 40 bytes per column for typical sampling ratios (eg, about 25600
bytes for a 640-pixel-wide image). You may not be able to process wide
images if you have large data structures of your own.

Of course, all of these concerns vanish if you use a 32-bit flat-memory-model
compiler,
such as DJGPP or Watcom C. We highly recommend flat model if you
can use it; the JPEG library is significantly faster in flat model.

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/libjpeg.txt
No license file was found, but licenses were detected in source scan.

```
/*
* transupp.h
*
* Copyright (C) 1997-2011, Thomas G. Lane, Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains declarations for image transformation routines and
* other utility code used by the jpegtran sample application.  These are
* NOT part of the core JPEG library.  But we keep these routines separate
* from jpegtran.c to ease the task of maintaining jpegtran-like programs
* that have other user interfaces.
*
* NOTE: all the routines declared here have very specific requirements
* about when they are to be executed during the reading and writing of the
* source and destination files.  See the comments in transupp.c, or see
* jpegtran.c for an example of correct usage.
*/
```

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No license file was found, but licenses were detected in source scan.

```
; For conditions of distribution and use, see copyright notice in jsimdext.inc
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* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jsimdcpu.asm
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jcclrss2-64.asm
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jcqnts2i-64.asm
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jcclrmmx.asm
*
/opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jdclrmmx.asm
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/ji3dnflt.asm
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jdcolss2-64.asm
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jcgrass2-64.asm
*
/opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jdcolmmx.asm
No license file was found, but licenses were detected in source scan.

/*
* jmemsys.h
*
* Copyright (C) 1992-1997, Thomas G. Lane.

```
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This include file defines the interface between the system-independent
* and system-dependent portions of the JPEG memory manager.  No other
* modules need include it.  (The system-independent portion is jmemmgr.c;
* there are several different versions of the system-dependent portion.)
*
* This file works as-is for the system-dependent memory managers supplied
* in the IJG distribution.  You may need to modify it if you write a
* custom memory manager.  If system-dependent changes are needed in
* this file, the best method is to #ifdef them based on a configuration
* symbol supplied in jconfig.h, as we have done with USE_MSDOS_MEMMGR
* and USE_MAC_MEMMGR.
*/
```

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jmemsys.h
No license file was found, but licenses were detected in source scan.

```
/*
* jdarith.c
*
* Developed 1997-2009 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains portable arithmetic entropy decoding routines for JPEG
* (implementing the ISO/IEC IS 10918-1 and CCITT Recommendation ITU-T T.81).
*
* Both sequential and progressive modes are supported in this single module.
*
* Suspension is not currently supported in this module.
*/
```

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdarith.c
No license file was found, but licenses were detected in source scan.

```
;
; jdct.inc - private declarations for forward & reverse DCT subsystems
;
; Copyright 2009 Pierre Ossman <ossman@cendio.se> for Cendio AB
;
; Based on
; x86 SIMD extension for IJG JPEG library
```

```
; Copyright (C) 1999-2006, MIYASAKA Masaru.
; For conditions of distribution and use, see copyright notice in jsimdext.inc
;
; [TAB8]

; Each IDCT routine is responsible for range-limiting its results and
; converting them to unsigned form (0..MAXJSAMPLE).  The raw outputs could
; be quite far out of range if the input data is corrupt, so a bulletproof
; range-limiting step is required.  We use a mask-and-table-lookup method
; to do the combined operations quickly.
;
%define RANGE_MASK  (MAXJSAMPLE * 4 + 3)  ; 2 bits wider than legal samples

%define ROW(n,b,s)  ((b)+(n)*(s))
%define COL(n,b,s)  ((b)+(n)*(s)*DCTSIZE)

%define DWBLOCK(m,n,b,s) ((b)+(m)*DCTSIZE*(s)+(n)*SIZEOF_DWORD)
%define MMBLOCK(m,n,b,s) ((b)+(m)*DCTSIZE*(s)+(n)*SIZEOF_MMWORD)
%define
 XMMBLOCK(m,n,b,s) ((b)+(m)*DCTSIZE*(s)+(n)*SIZEOF_XMMWORD)

; --------------------------------------------------------------------------
```

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jdct.inc
No license file was found, but licenses were detected in source scan.

```
/*
* Copyright (C)2011 D. R. Commander.  All Rights Reserved.
*
* Redistribution and use in source and binary forms, with or without
* modification, are permitted provided that the following conditions are met:
*
* - Redistributions of source code must retain the above copyright notice,
*   this list of conditions and the following disclaimer.
* - Redistributions in binary form must reproduce the above copyright notice,
*   this list of conditions and the following disclaimer in the documentation
*   and/or other materials provided with the distribution.
* - Neither the name of the libjpeg-turbo Project nor the names of its
*   contributors may be used to endorse or promote products derived from this
*   software without specific prior written permission.
*
* THIS SOFTWARE IS PROVIDED BY THE COPYRIGHT HOLDERS AND CONTRIBUTORS "AS IS",
* AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED
 TO, THE
* IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE
* ARE DISCLAIMED.  IN NO EVENT SHALL THE COPYRIGHT HOLDERS OR CONTRIBUTORS BE
```

```
* LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR
* CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF
* SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS
* INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN
* CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE)
* ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE
* POSSIBILITY OF SUCH DAMAGE.
*/

package org.libjpegturbo.turbojpeg;

final class TJLoader {
 static void load() {
   System.loadLibrary("@TURBOJPEG_DLL_NAME@");
 }
};
```

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/java/org/libjpegturbo/turbojpeg/TJLoader.java.in
No license file was found, but licenses were detected in source scan.

```
/*
* cdjpeg.c
*
* Copyright (C) 1991-1997, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains common support routines used by the IJG application
* programs (cjpeg, djpeg, jpegtran).
*/
```

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/cdjpeg.c
No license file was found, but licenses were detected in source scan.

```
/*
* jdmrgext.c
*
* This file was part of the Independent JPEG Group's software:
* Copyright (C) 1994-1996, Thomas G. Lane.
* Modifications:
* Copyright (C) 2011, D. R. Commander.
* For conditions of distribution and use, see the accompanying README file.
*
```

```
* This file contains code for merged upsampling/color conversion.
*/
```

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdmrgext.c
No license file was found, but licenses were detected in source scan.

```
/*
* transupp.c
*
* This file was part of the Independent JPEG Group's software:
* Copyright (C) 1997-2011, Thomas G. Lane, Guido Vollbeding.
* Modifications:
* Copyright (C) 2010, D. R. Commander.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains image transformation routines and other utility code
* used by the jpegtran sample application.  These are NOT part of the core
* JPEG library.  But we keep these routines separate from jpegtran.c to
* ease the task of maintaining jpegtran-like programs that have other user
* interfaces.
*/
```

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/transupp.c
No license file was found, but licenses were detected in source scan.

```
/*
* jerror.h
*
* Copyright (C) 1994-1997, Thomas G. Lane.
* Modified 1997-2009 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file defines the error and message codes for the JPEG library.
* Edit this file to add new codes, or to translate the message strings to
* some other language.
* A set of error-reporting macros are defined too.  Some applications using
* the JPEG library may wish to include this file to get the error codes
* and/or the macros.
*/
```

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jerror.h

No license file was found, but licenses were detected in source scan.

```
/*
* jfdctfst.c
*
* Copyright (C) 1994-1996, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains a fast, not so accurate integer implementation of the
* forward DCT (Discrete Cosine Transform).
*
* A 2-D DCT can be done by 1-D DCT on each row followed by 1-D DCT
* on each column.  Direct algorithms are also available, but they are
* much more complex and seem not to be any faster when reduced to code.
*
* This implementation is based on Arai, Agui, and Nakajima's algorithm for
* scaled DCT.  Their original paper (Trans. IEICE E-71(11):1095) is in
* Japanese, but the algorithm is described in the Pennebaker & Mitchell
* JPEG textbook (see REFERENCES section in file README).  The following code
* is based directly on figure 4-8 in P&M.
* While an 8-point DCT cannot be done in less
 than 11 multiplies, it is
* possible to arrange the computation so that many of the multiplies are
* simple scalings of the final outputs.  These multiplies can then be
* folded into the multiplications or divisions by the JPEG quantization
* table entries.  The AA&N method leaves only 5 multiplies and 29 adds
* to be done in the DCT itself.
* The primary disadvantage of this method is that with fixed-point math,
* accuracy is lost due to imprecise representation of the scaled
* quantization values.  The smaller the quantization table entry, the less
* precise the scaled value, so this implementation does worse with high-
* quality-setting files than with low-quality ones.
*/
```

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jfdctfst.c

No license file was found, but licenses were detected in source scan.

```
/*
* jcapistd.c
*
* Copyright (C) 1994-1996, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains application interface code for the compression half
```

```
* of the JPEG library.  These are the "standard" API routines that are
* used in the normal full-compression case.  They are not used by a
* transcoding-only application.  Note that if an application links in
* jpeg_start_compress, it will end up linking in the entire compressor.
* We thus must separate this file from jcapimin.c to avoid linking the
* whole compression library into a transcoder.
*/
```

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jcapistd.c
No license file was found, but licenses were detected in source scan.

```
/*
* rdswitch.c
*
* This file was part of the Independent JPEG Group's software:
* Copyright (C) 1991-1996, Thomas G. Lane.
* Modifications:
* Copyright (C) 2010, D. R. Commander.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains routines to process some of cjpeg's more complicated
* command-line switches.  Switches processed here are:
* -qtables file  Read quantization tables from text file
* -scans file  Read scan script from text file
* -quality N[,N,...] Set quality ratings
* -qslots N[,N,...] Set component quantization table selectors
* -sample HxV[,HxV,...] Set component sampling factors
*/
```

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/rdswitch.c
No license file was found, but licenses were detected in source scan.

```
/*
* djpeg.c
*
* This file was part of the Independent JPEG Group's software:
* Copyright (C) 1991-1997, Thomas G. Lane.
* Modifications:
* Copyright (C) 2010-2011, 2013, D. R. Commander.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains a command-line user interface for the JPEG decompressor.
* It should work on any system with Unix- or MS-DOS-style command lines.
*
```

* Two different command line styles are permitted, depending on the
* compile-time switch TWO_FILE_COMMANDLINE:
* djpeg [options] inputfile outputfile
* djpeg [options] [inputfile]
* In the second style, output is always to standard output, which you'd
* normally redirect to a file or pipe to some other program. Input is
* either from a named file or from standard input (typically redirected).
* The second style is convenient on Unix but is unhelpful on systems that
* don't support pipes.
  Also, you MUST use the first style if your system
* doesn't do binary I/O to stdin/stdout.
* To simplify script writing, the "-outfile" switch is provided. The syntax
* djpeg [options] -outfile outputfile inputfile
* works regardless of which command line style is used.
*/

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/djpeg.c
No license file was found, but licenses were detected in source scan.

/*
* jdmainct.c
*
* This file was part of the Independent JPEG Group's software:
* Copyright (C) 1994-1996, Thomas G. Lane.
* Modifications:
* Copyright (C) 2010, D. R. Commander.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains the main buffer controller for decompression.
* The main buffer lies between the JPEG decompressor proper and the
* post-processor; it holds downsampled data in the JPEG colorspace.
*
* Note that this code is bypassed in raw-data mode, since the application
* supplies the equivalent of the main buffer in that case.
*/

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdmainct.c
No license file was found, but licenses were detected in source scan.

/*
* jchuff.h
*
* Copyright (C) 1991-1997, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.

```
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains declarations for Huffman entropy encoding routines
* that are shared between the sequential encoder (jchuff.c) and the
* progressive encoder (jcphuff.c).  No other modules need to see these.
*/
```

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jchuff.h
No license file was found, but licenses were detected in source scan.

```
/*
* jctrans.c
*
* Copyright (C) 1995-1998, Thomas G. Lane.
* Modified 2000-2009 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains library routines for transcoding compression,
* that is, writing raw DCT coefficient arrays to an output JPEG file.
* The routines in jcapimin.c will also be needed by a transcoder.
*/
```

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jctrans.c
No license file was found, but licenses were detected in source scan.

```
;
; jcolsamp.inc - private declarations for color conversion & up/downsampling
;
; Copyright 2009 Pierre Ossman <ossman@cendio.se> for Cendio AB
;
; Based on
; x86 SIMD extension for IJG JPEG library
; Copyright (C) 1999-2006, MIYASAKA Masaru.
; For conditions of distribution and use, see copyright notice in jsimdext.inc
;
; [TAB8]

; --------------------------------------------------------------------------

; pseudo-resisters to make ordering of RGB configurable
;
%if RGB_RED == 0
%define  mmA  mm0
```

```
%define  mmB  mm1
%define xmmA xmm0
%define xmmB xmm1
%elif RGB_GREEN == 0
%define  mmA  mm2
%define  mmB  mm3
%define xmmA xmm2
%define xmmB xmm3
%elif RGB_BLUE == 0
%define  mmA  mm4
%define  mmB  mm5
%define xmmA xmm4
%define xmmB xmm5
%else
%define  mmA  mm6
%define  mmB  mm7
%define xmmA xmm6
%define xmmB xmm7
%endif

%if RGB_RED == 1
%define  mmC  mm0
%define  mmD  mm1
%define xmmC xmm0
%define xmmD xmm1
%elif RGB_GREEN
 == 1
%define  mmC  mm2
%define  mmD  mm3
%define xmmC xmm2
%define xmmD xmm3
%elif RGB_BLUE == 1
%define  mmC  mm4
%define  mmD  mm5
%define xmmC xmm4
%define xmmD xmm5
%else
%define  mmC  mm6
%define  mmD  mm7
%define xmmC xmm6
%define xmmD xmm7
%endif

%if RGB_RED == 2
%define  mmE  mm0
%define  mmF  mm1
%define xmmE xmm0
%define xmmF xmm1
```

```
%elif RGB_GREEN == 2
%define  mmE  mm2
%define  mmF  mm3
%define xmmE xmm2
%define xmmF xmm3
%elif RGB_BLUE == 2
%define  mmE  mm4
%define  mmF  mm5
%define xmmE xmm4
%define xmmF xmm5
%else
%define  mmE  mm6
%define  mmF  mm7
%define xmmE xmm6
%define xmmF xmm7
%endif

%if RGB_RED == 3
%define  mmG  mm0
%define  mmH  mm1
%define xmmG xmm0
%define xmmH xmm1
%elif RGB_GREEN == 3
%define  mmG  mm2
%define  mmH  mm3
%define xmmG xmm2
%define xmmH xmm3
%elif RGB_BLUE == 3
%define  mmG  mm4
%define  mmH  mm5
%define xmmG xmm4
%define xmmH xmm5
%else
%define  mmG  mm6
%define  mmH  mm7
%define xmmG xmm6
%define xmmH xmm7
%endif

; ------------------------------------------------------------------------
```

Found
in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jcolsamp.inc
No license file was found, but licenses were detected in source scan.

```
/*
```

```
* jcparam.c
*
* This file was part of the Independent JPEG Group's software:
* Copyright (C) 1991-1998, Thomas G. Lane.
* Modified 2003-2008 by Guido Vollbeding.
* Modifications:
* Copyright (C) 2009-2011, D. R. Commander.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains optional default-setting code for the JPEG compressor.
* Applications do not have to use this file, but those that don't use it
* must know a lot more about the innards of the JPEG code.
*/
```

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jcparam.c
No license file was found, but licenses were detected in source scan.

```
/*
* jdmaster.c
*
* This file was part of the Independent JPEG Group's software:
* Copyright (C) 1991-1997, Thomas G. Lane.
* Modified 2002-2009 by Guido Vollbeding.
* Modifications:
* Copyright (C) 2009-2011, D. R. Commander.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains master control logic for the JPEG decompressor.
* These routines are concerned with selecting the modules to be executed
* and with determining the number of passes and the work to be done in each
* pass.
*/
```

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdmaster.c
No license file was found, but licenses were detected in source scan.

```
/*
* jdatasrc.c
*
* This file was part of the Independent JPEG Group's software:
* Copyright (C) 1994-1996, Thomas G. Lane.
* Modified 2009-2011 by Guido Vollbeding.
* Modifications:
* Copyright (C) 2013, D. R. Commander.
```

* For conditions of distribution and use, see the accompanying README file.
*
* This file contains decompression data source routines for the case of
* reading JPEG data from memory or from a file (or any stdio stream).
* While these routines are sufficient for most applications,
* some will want to use a different source manager.
* IMPORTANT: we assume that fread() will correctly transcribe an array of
* JOCTETs from 8-bit-wide elements on external storage. If char is wider
* than 8 bits on your machine, you may need to do some tweaking.
*/

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdatasrc.c
No license file was found, but licenses were detected in source scan.

/*
* jQuery JavaScript Library v1.3.2
* http://jquery.com/
*
* Copyright (c) 2009 John Resig
* Dual licensed under the MIT and GPL licenses.
* http://docs.jquery.com/License
*
* Date: 2009-02-19 17:34:21 -0500 (Thu, 19 Feb 2009)
* Revision: 6246
*/
/*
* Sizzle CSS Selector Engine - v0.9.3
* Copyright 2009, The Dojo Foundation
* Released under the MIT, BSD, and GPL Licenses.
* More information: http://sizzlejs.com/
*/
/*
* jQuery UI 1.7.2
*
* Copyright (c) 2009 AUTHORS.txt (http://jqueryui.com/about)
* Dual licensed under the MIT (MIT-LICENSE.txt)
* and GPL (GPL-LICENSE.txt) licenses.
*
* http://docs.jquery.com/UI
*/
/**
* jQuery.ScrollTo - Easy element scrolling using jQuery.
* Copyright (c) 2008 Ariel Flesler - aflesler(at)gmail(dot)com
* Licensed under GPL license (http://www.opensource.org/licenses/gpl-license.php).
* Date: 2/8/2008
* @author Ariel Flesler

* @version 1.3.2
*/

Found
in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/doc/html/jquery.js
No license file was found, but licenses were detected in source scan.

/*
* jdatadst-tj.c
*
* This file was part of the Independent JPEG Group's software:
* Copyright (C) 1994-1996, Thomas G. Lane.
* Modified 2009-2012 by Guido Vollbeding.
* Modifications:
* Copyright (C) 2011, D. R. Commander.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains compression data destination routines for the case of
* emitting JPEG data to memory or to a file (or any stdio stream).
* While these routines are sufficient for most applications,
* some will want to use a different destination manager.
* IMPORTANT: we assume that fwrite() will correctly transcribe an array of
* JOCTETs into 8-bit-wide elements on external storage. If char is wider
* than 8 bits on your machine, you may need to do some tweaking.
*/

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdatadst-tj.c
No license file was found, but licenses were detected in source scan.

/*
* cdjpeg.h
*
* Copyright (C) 1994-1997, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains common declarations for the sample applications
* cjpeg and djpeg. It is NOT used by the core JPEG library.
*/

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/cdjpeg.h

No license file was found, but licenses were detected in source scan.

```
/*
* jdhuff.h
*
* This file was part of the Independent JPEG Group's software:
* Copyright (C) 1991-1997, Thomas G. Lane.
* Modifications:
* Copyright (C) 2010-2011, D. R. Commander.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains declarations for Huffman entropy decoding routines
* that are shared between the sequential decoder (jdhuff.c) and the
* progressive decoder (jdphuff.c).  No other modules need to see these.
*/
```

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdhuff.h
No license file was found, but licenses were detected in source scan.

```
/*
* jdsample.c
*
* This file was part of the Independent JPEG Group's software:
* Copyright (C) 1991-1996, Thomas G. Lane.
* Modifications:
* Copyright 2009 Pierre Ossman <ossman@cendio.se> for Cendio AB
* Copyright (C) 2010, D. R. Commander.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains upsampling routines.
*
* Upsampling input data is counted in "row groups".  A row group
* is defined to be (v_samp_factor * DCT_scaled_size / min_DCT_scaled_size)
* sample rows of each component.  Upsampling will normally produce
* max_v_samp_factor pixel rows from each row group (but this could vary
* if the upsampler is applying a scale factor of its own).
*
* An excellent reference for image resampling is
*   Digital Image Warping, George Wolberg, 1990.
*   Pub. by IEEE Computer Society Press, Los Alamitos, CA. ISBN 0-8186-8944-7.
*/
```

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdsample.c

No license file was found, but licenses were detected in source scan.

```
/*
* rdcolmap.c
*
* Copyright (C) 1994-1996, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file implements djpeg's "-map file" switch.  It reads a source image
* and constructs a colormap to be supplied to the JPEG decompressor.
*
* Currently, these file formats are supported for the map file:
*   GIF: the contents of the GIF's global colormap are used.
*   PPM (either text or raw flavor): the entire file is read and
*      each unique pixel value is entered in the map.
* Note that reading a large PPM file will be horrendously slow.
* Typically, a PPM-format map file should contain just one pixel
* of each desired color.  Such a file can be extracted from an
* ordinary image PPM file with ppmtomap(1).
*
* Rescaling a PPM that has a maxval unequal to MAXJSAMPLE is not
* currently implemented.
 */
/* Portions of this code are based on the PBMPLUS library, which is:
**
** Copyright (C) 1988 by Jef Poskanzer.
**
** Permission to use, copy, modify, and distribute this software and its
** documentation for any purpose and without fee is hereby granted, provided
** that the above copyright notice appear in all copies and that both that
** copyright notice and this permission notice appear in supporting
** documentation.  This software is provided "as is" without express or
** implied warranty.
*/
```

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/rdcolmap.c
No license file was found, but licenses were detected in source scan.

```
/*
* jsimd_arm.c
*
* Copyright 2009 Pierre Ossman <ossman@cendio.se> for Cendio AB
* Copyright 2009-2011 D. R. Commander
*
* Based on the x86 SIMD extension for IJG JPEG library,
```

* Copyright (C) 1999-2006, MIYASAKA Masaru.
* For conditions of distribution and use, see copyright notice in jsimdext.inc
*
* This file contains the interface between the "normal" portions
* of the library and the SIMD implementations when running on
* ARM architecture.
*
* Based on the stubs from 'jsimd_none.c'
*/

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jsimd_arm.c
No license file was found, but licenses were detected in source scan.

/*
* Copyright (C)2011 D. R. Commander. All Rights Reserved.
*
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* modification, are permitted provided that the following conditions are met:
*
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*   this list of conditions and the following disclaimer.
* - Redistributions in binary form must reproduce the above copyright notice,
*   this list of conditions and the following disclaimer in the documentation
*   and/or other materials provided with the distribution.
* - Neither the name of the libjpeg-turbo Project nor the names of its
*   contributors may be used to endorse or promote products derived from this
*   software without specific prior written permission.
*
* THIS SOFTWARE IS PROVIDED BY THE COPYRIGHT HOLDERS AND CONTRIBUTORS "AS IS",
* AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED
 TO, THE
* IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE
* ARE DISCLAIMED. IN NO EVENT SHALL THE COPYRIGHT HOLDERS OR CONTRIBUTORS BE
* LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR
* CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF
* SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS
* INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN
* CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE)
* ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE
* POSSIBILITY OF SUCH DAMAGE.
*/

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/bmp.h
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-

UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/java/org/libjpegturbo/turbojpeg/TJScalingFactor.java
*
/opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jcstest.c
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/tjutil.h
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/bmp.c
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/java/org/libjpegturbo/turbojpeg/TJCustomFilter.java
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/java/org/libjpegturbo/turbojpeg/TJTransform.java
*
/opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/java/org/libjpegturbo/turbojpeg/TJTransformer.java
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/tjutil.c
No license file was found, but licenses were detected in source scan.

/*
* jpegint.h
*
* Copyright (C) 1991-1997, Thomas G. Lane.
* Modified 1997-2009 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file provides common declarations for the various JPEG modules.
* These declarations are considered internal to the JPEG library; most
* applications using the library shouldn't need to include this file.
*/

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jpegint.h
No license file was found, but licenses were detected in source scan.

/*
* jquant1.c
*
* This file was part of the Independent JPEG Group's software:
* Copyright (C) 1991-1996, Thomas G. Lane.
* Modifications:
* Copyright (C) 2009, D. R. Commander

* For conditions of distribution and use, see the accompanying README file.
*
* This file contains 1-pass color quantization (color mapping) routines.
* These routines provide mapping to a fixed color map using equally spaced
* color values. Optional Floyd-Steinberg or ordered dithering is available.
*/

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jquant1.c
No license file was found, but licenses were detected in source scan.

1.2.90 (1.3 beta1)
==========

[1] Added support for additional scaling factors (3/8, 5/8, 3/4, 7/8, 9/8, 5/4, 11/8, 3/2, 13/8, 7/4, 15/8, and 2) when decompressing. Note that the IDCT will not be SIMD-accelerated when using any of these new scaling factors.

[2] The TurboJPEG dynamic library is now versioned. It was not strictly necessary to do so, because TurboJPEG uses versioned symbols, and if a function changes in an ABI-incompatible way, that function is renamed and a legacy function is provided to maintain backward compatibility. However, certain Linux distro maintainers will blindly reject any library that is not versioned, so this was an attempt to make them happy.

[3] Extended the TurboJPEG Java API so that it can be used to compress a JPEG image from and decompress a JPEG image to an arbitrary position in a large image buffer.

[4] The tjDecompressToYUV() function now supports the TJFLAG_FASTDCT flag.

[5] The 32-bit supplementary package for amd64 Debian systems now provides symlinks in /usr/lib/i386-linux-gnu for the TurboJPEG libraries in /usr/lib32. This allows those libraries to be used on MultiArch-compatible systems (such as Ubuntu 11 and later) without setting the linker path.

[6] The TurboJPEG Java wrapper should now find the JNI library on Mac systems without having to pass -Djava.library.path=/usr/lib to java.

[7] TJBench has been ported to Java to provide a convenient way of validating the performance of the TurboJPEG Java API. It can be run with 'java -cp turbojpeg.jar TJBench'.

[8] cjpeg can now be used to generate JPEG files with the RGB colorspace (feature ported from jpeg-8d.)

[9] The width and height in the -crop argument passed to jpegtran can now be suffixed with "f" to indicate that, when the upper left corner of the cropping region is automatically moved to the nearest iMCU boundary, the bottom right corner should be moved by the same amount. In other words, this feature causes jpegtran to strictly honor the specified width/height rather than the specified bottom right corner (feature ported from jpeg-8d.)

[10] JPEG files using the RGB colorspace can now be decompressed into grayscale images (feature ported from jpeg-8d.)

[11] Fixed a regression caused by 1.2.1[7] whereby the build would fail with multiple "Mismatch in operand sizes" errors when attempting to build the x86 SIMD code with NASM 0.98.

[12] The in-memory source/destination managers (jpeg_mem_src() and jpeg_mem_dest()) are now included by default when building libjpeg-turbo with libjpeg v6b or v7 emulation, so that programs can take advantage of these functions without requiring the use of the backward-incompatible libjpeg v8 ABI. The "age number" of the libjpeg-turbo library on Un*x systems has been incremented by 1 to reflect this. You can disable this feature with a configure/CMake switch in order to retain strict API/ABI compatibility with the libjpeg v6b or v7 API/ABI (or with previous versions of libjpeg-turbo.) See README-turbo.txt for more details.

[13] Added ARM v7s architecture to libjpeg.a and libturbojpeg.a in the official libjpeg-turbo binary package for OS X, so that those libraries can be used to build applications that leverage the faster CPUs in the iPhone 5 and iPad 4.

1.2.1
=====

[1] Creating or decoding a JPEG file that uses the RGB colorspace should now properly work when the input or output colorspace is one of the libjpeg-turbo colorspace extensions.

[2] When libjpeg-turbo was built without SIMD support and merged (non-fancy) upsampling was used along with an alpha-enabled colorspace during decompression, the unused byte of the decompressed pixels was not being set to 0xFF. This has been fixed. TJUnitTest has also been extended to test for the correct behavior of the colorspace extensions when merged upsampling is used.

[3] Fixed a bug whereby the libjpeg-turbo SSE2 SIMD code would not preserve the upper 64 bits of xmm6 and xmm7 on Win64 platforms, which violated the Win64 calling conventions.

[4] Fixed a regression caused by 1.2.0[6] whereby decompressing corrupt JPEG images (specifically, images in which the component count was erroneously set to a large value) would cause libjpeg-turbo to segfault.

[5] Worked around a severe performance issue with "Bobcat" (AMD Embedded APU) processors. The MASKMOVDQU instruction, which was used by the libjpeg-turbo SSE2 SIMD code, is apparently implemented in microcode on AMD processors, and it is painfully slow on Bobcat processors in particular. Eliminating the use of this instruction improved performance by an order of magnitude on Bobcat processors and by a small amount (typically 5%) on AMD desktop processors.

[6] Added SIMD acceleration for performing 4:2:2 upsampling on NEON-capable ARM platforms. This speeds up the decompression of 4:2:2 JPEGs by 20-25% on such platforms.

[7] Fixed a regression caused by 1.2.0[2] whereby, on Linux/x86 platforms running
the 32-bit SSE2 SIMD code in libjpeg-turbo, decompressing a 4:2:0 or 4:2:2 JPEG image into a 32-bit (RGBX, BGRX, etc.) buffer without using fancy upsampling would produce several incorrect columns of pixels at the right-hand side of the output image if each row in the output image was not evenly divisible by 16 bytes.

[8] Fixed an issue whereby attempting to build the SIMD extensions with Xcode 4.3 on OS X platforms would cause NASM to return numerous errors of the form "'%define' expects a macro identifier".

[9] Added flags to the TurboJPEG API that allow the caller to force the use of either the fast or the accurate DCT/IDCT algorithms in the underlying codec.

1.2.0
=====

[1] Fixed build issue with YASM on Unix systems (the libjpeg-turbo build system was not adding the current directory to the assembler include path, so YASM was not able to find jsimdcfg.inc.)

[2] Fixed out-of-bounds read in SSE2 SIMD code that occurred when decompressing a JPEG image to a bitmap
buffer whose size was not a multiple of 16 bytes.
This was more of an annoyance than an actual bug, since it did not cause any actual run-time problems, but the issue showed up when running libjpeg-turbo in valgrind. See http://crbug.com/72399 for more information.

[3] Added a compile-time macro (LIBJPEG_TURBO_VERSION) that can be used to check the version of libjpeg-turbo against which an application was compiled.

[4] Added new RGBA/BGRA/ABGR/ARGB colorspace extension constants (libjpeg API)
and pixel formats (TurboJPEG API), which allow applications to specify that,
when decompressing to a 4-component RGB buffer, the unused byte should be set
to 0xFF so that it can be interpreted as an opaque alpha channel.

[5] Fixed regression issue whereby DevIL failed to build against libjpeg-turbo
because libjpeg-turbo's distributed version of jconfig.h contained an INLINE
macro, which conflicted with a similar macro in DevIL. This macro is used only
internally when building libjpeg-turbo,
so it was moved into config.h.

[6] libjpeg-turbo will now correctly decompress erroneous CMYK/YCCK JPEGs whose
K component is assigned a component ID of 1 instead of 4. Although these files
are in violation of the spec, other JPEG implementations handle them
correctly.

[7] Added ARM v6 and ARM v7 architectures to libjpeg.a and libturbojpeg.a in
the official libjpeg-turbo binary package for OS X, so that those libraries can
be used to build both OS X and iOS applications.

1.1.90 (1.2 beta1)
==========

[1] Added a Java wrapper for the TurboJPEG API. See java/README for more
details.

[2] The TurboJPEG API can now be used to scale down images during
decompression.

[3] Added SIMD routines for RGB-to-grayscale color conversion, which
significantly improves the performance of grayscale JPEG compression from an
RGB source image.

[4] Improved the performance of the C color conversion routines, which are used
on platforms for which SIMD acceleration is not available.

[5] Added
a function to the TurboJPEG API that performs lossless transforms.
This function is implemented using the same back end as jpegtran, but it
performs transcoding entirely in memory and allows multiple transforms and/or
crop operations to be batched together, so the source coefficients only need to
be read once. This is useful when generating image tiles from a single source
JPEG.

[6] Added tests for the new TurboJPEG scaled decompression and lossless
transform features to tjbench (the TurboJPEG benchmark, formerly called

"jpgtest".)

[7] Added support for 4:4:0 (transposed 4:2:2) subsampling in TurboJPEG, which was necessary in order for it to read 4:2:2 JPEG files that had been losslessly transposed or rotated 90 degrees.

[8] All legacy VirtualGL code has been re-factored, and this has allowed libjpeg-turbo, in its entirety, to be re-licensed under a BSD-style license.

[9] libjpeg-turbo can now be built with YASM.

[10] Added SIMD acceleration for ARM Linux and iOS platforms that support NEON instructions.

[11] Refactored the TurboJPEG C API and documented it using Doxygen. The TurboJPEG 1.2 API uses pixel formats to define the size and component order of the uncompressed source/destination images, and it includes a more efficient version of TJBUFSIZE() that computes a worst-case JPEG size based on the level of chrominance subsampling. The refactored implementation of the TurboJPEG API now uses the libjpeg memory source and destination managers, which allows the TurboJPEG compressor to grow the JPEG buffer as necessary.

[12] Eliminated errors in the output of jpegtran on Windows that occurred when the application was invoked using I/O redirection (jpegtran <input.jpg >output.jpg).

[13] The inclusion of libjpeg v7 and v8 emulation as well as arithmetic coding support in libjpeg-turbo v1.1.0 introduced several new error constants in jerror.h, and these were mistakenly enabled for all emulation modes, causing the error enum in libjpeg-turbo to sometimes have different values than the same enum in libjpeg. This represents an ABI incompatibility, and it caused problems with rare applications that took specific action based on a particular error value. The fix was to include the new error constants conditionally based on whether libjpeg v7 or v8 emulation was enabled.

[14] Fixed an issue whereby Windows applications that used libjpeg-turbo would fail to compile if the Windows system headers were included before jpeglib.h. This issue was caused by a conflict in the definition of the INT32 type.

[15] Fixed 32-bit supplementary package for amd64 Debian systems, which was broken by enhancements to the packaging system in 1.1.

[16] When decompressing a JPEG image using an output colorspace of JCS_EXT_RGBX, JCS_EXT_BGRX, JCS_EXT_XBGR, or JCS_EXT_XRGB, libjpeg-turbo will now set the unused byte to 0xFF, which allows applications to interpret that byte as an alpha channel (0xFF = opaque).

1.1.1
=====

[1] Fixed a 1-pixel error in row 0, column
21 of the luminance plane generated
by tjEncodeYUV().

[2] libjpeg-turbo's accelerated Huffman decoder previously ignored unexpected markers found in the middle of the JPEG data stream during decompression. It will now hand off decoding of a particular block to the unaccelerated Huffman decoder if an unexpected marker is found, so that the unaccelerated Huffman decoder can generate an appropriate warning.

[3] Older versions of MinGW64 prefixed symbol names with underscores by default, which differed from the behavior of 64-bit Visual C++. MinGW64 1.0 has adopted the behavior of 64-bit Visual C++ as the default, so to accommodate this, the libjpeg-turbo SIMD function names are no longer prefixed with an underscore when building with MinGW64. This means that, when building libjpeg-turbo with older versions of MinGW64, you will now have to add -fno-leading-underscore to the CFLAGS.

[4] Fixed a regression bug in the NSIS script that caused the Windows installer build to fail when using
the Visual Studio IDE.

[5] Fixed a bug in jpeg_read_coefficients() whereby it would not initialize cinfo->image_width and cinfo->image_height if libjpeg v7 or v8 emulation was enabled. This specifically caused the jpegoptim program to fail if it was linked against a version of libjpeg-turbo that was built with libjpeg v7 or v8 emulation.

[6] Eliminated excessive I/O overhead that occurred when reading BMP files in cjpeg.

[7] Eliminated errors in the output of cjpeg on Windows that occurred when the application was invoked using I/O redirection (cjpeg <inputfile >output.jpg).

1.1.0
=====

[1] The algorithm used by the SIMD quantization function cannot produce correct results when the JPEG quality is >= 98 and the fast integer forward DCT is used. Thus, the non-SIMD quantization function is now used for those cases, and libjpeg-turbo should now produce identical output to libjpeg v6b in all cases.

[2] Despite the above, the fast integer forward DCT still degrades somewhat for
JPEG
qualities greater than 95, so the TurboJPEG wrapper will now automatically
use the slow integer forward DCT when generating JPEG images of quality 96 or
greater. This reduces compression performance by as much as 15% for these
high-quality images but is necessary to ensure that the images are perceptually
lossless. It also ensures that the library can avoid the performance pitfall
created by [1].

[3] Ported jpgtest.cxx to pure C to avoid the need for a C++ compiler.

[4] Fixed visual artifacts in grayscale JPEG compression caused by a typo in
the RGB-to-luminance lookup tables.

[5] The Windows distribution packages now include the libjpeg run-time programs
(cjpeg, etc.)

[6] All packages now include jpgtest.

[7] The TurboJPEG dynamic library now uses versioned symbols.

[8] Added two new TurboJPEG API functions, tjEncodeYUV() and
tjDecompressToYUV(), to replace the somewhat hackish TJ_YUV flag.

1.0.90 (1.1 beta1)
==========

[1] Added emulation of the libjpeg v7 and
v8 APIs and ABIs. See
README-turbo.txt for more details. This feature was sponsored by CamTrace SAS.

[2] Created a new CMake-based build system for the Visual C++ and MinGW builds.

[3] Grayscale bitmaps can now be compressed from/decompressed to using the
TurboJPEG API.

[4] jpgtest can now be used to test decompression performance with existing
JPEG images.

[5] If the default install prefix (/opt/libjpeg-turbo) is used, then
'make install' now creates /opt/libjpeg-turbo/lib32 and
/opt/libjpeg-turbo/lib64 sym links to duplicate the behavior of the binary
packages.

[6] All symbols in the libjpeg-turbo dynamic library are now versioned, even
when the library is built with libjpeg v6b emulation.

[7] Added arithmetic encoding and decoding support (can be disabled with
configure or CMake options)

[8] Added a TJ_YUV flag to the TurboJPEG API, which causes both the compressor
and decompressor to output planar YUV images.

[9] Added an extended version of tjDecompressHeader() to the TurboJPEG
API,
which allows the caller to determine the type of subsampling used in a JPEG
image.

[10] Added further protections against invalid Huffman codes.

1.0.1
=====

[1] The Huffman decoder will now handle erroneous Huffman codes (for instance,
from a corrupt JPEG image.) Previously, these would cause libjpeg-turbo to
crash under certain circumstances.

[2] Fixed typo in SIMD dispatch routines that was causing 4:2:2 upsampling to
be used instead of 4:2:0 when decompressing JPEG images using SSE2 code.

[3] configure script will now automatically determine whether the
INCOMPLETE_TYPES_BROKEN macro should be defined.

1.0.0
=====

[1] 2983700: Further FreeBSD build tweaks (no longer necessary to specify
--host when configuring on a 64-bit system)

[2] Created symlinks in the Unix/Linux packages so that the TurboJPEG
include file can always be found in /opt/libjpeg-turbo/include, the 32-bit
static libraries can always be found in /opt/libjpeg-turbo/lib32, and the
64-bit static
libraries can always be found in /opt/libjpeg-turbo/lib64.

[3] The Unix/Linux distribution packages now include the libjpeg run-time
programs (cjpeg, etc.) and man pages.

[4] Created a 32-bit supplementary package for amd64 Debian systems, which
contains just the 32-bit libjpeg-turbo libraries.

[5] Moved the libraries from */lib32 to */lib in the i386 Debian package.

[6] Include distribution package for Cygwin

[7] No longer necessary to specify --without-simd on non-x86 architectures, and
unit tests now work on those architectures.

0.0.93
======

[1] 2982659, Fixed x86-64 build on FreeBSD systems

[2] 2988188: Added support for Windows 64-bit systems

0.0.91
======

[1] Added documentation to .deb packages

[2] 2968313: Fixed data corruption issues when decompressing large JPEG images
and/or using buffered I/O with the libjpeg-turbo decompressor

0.0.90
======

Initial release

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/ChangeLog.txt
No license file was found, but licenses were detected in source scan.

```
/*
* jconfig.txt
*
* Copyright (C) 1991-1994, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file documents the configuration options that are required to
* customize the JPEG software for a particular system.
*
* The actual configuration options for a particular installation are stored
* in jconfig.h.  On many machines, jconfig.h can be generated automatically
* or copied from one of the "canned" jconfig files that we supply.  But if
* you need to generate a jconfig.h file by hand, this file tells you how.
```

```
*
* DO NOT EDIT THIS FILE --- IT WON'T ACCOMPLISH ANYTHING.
* EDIT A COPY NAMED JCONFIG.H.
*/


/*
* These symbols indicate the properties of your machine or compiler.
* #define the symbol if yes, #undef it if no.
*/

/* Does your compiler support function prototypes?
* (If not,
 you also need to use ansi2knr, see install.txt)
*/
#define HAVE_PROTOTYPES

/* Does your compiler support the declaration "unsigned char" ?
* How about "unsigned short" ?
*/
#define HAVE_UNSIGNED_CHAR
#define HAVE_UNSIGNED_SHORT

/* Define "void" as "char" if your compiler doesn't know about type void.
* NOTE: be sure to define void such that "void *" represents the most general
* pointer type, e.g., that returned by malloc().
*/
/* #define void char */

/* Define "const" as empty if your compiler doesn't know the "const" keyword.
*/
/* #define const */

/* Define this if an ordinary "char" type is unsigned.
* If you're not sure, leaving it undefined will work at some cost in speed.
* If you defined HAVE_UNSIGNED_CHAR then the speed difference is minimal.
*/
#undef CHAR_IS_UNSIGNED

/* Define this if your system has an ANSI-conforming <stddef.h> file.
*/
#define HAVE_STDDEF_H

/* Define this if your system has an ANSI-conforming <stdlib.h> file.
*/
#define HAVE_STDLIB_H

/*
```

```
 Define this if your system does not have an ANSI/SysV <string.h>,
* but does have a BSD-style <strings.h>.
*/
#undef NEED_BSD_STRINGS

/* Define this if your system does not provide typedef size_t in any of the
* ANSI-standard places (stddef.h, stdlib.h, or stdio.h), but places it in
* <sys/types.h> instead.
*/
#undef NEED_SYS_TYPES_H

/* For 80x86 machines, you need to define NEED_FAR_POINTERS,
* unless you are using a large-data memory model or 80386 flat-memory mode.
* On less brain-damaged CPUs this symbol must not be defined.
* (Defining this symbol causes large data structures to be referenced through
* "far" pointers and to be allocated with a special version of malloc.)
*/
#undef NEED_FAR_POINTERS

/* Define this if your linker needs global names to be unique in less
* than the first 15 characters.
*/
#undef NEED_SHORT_EXTERNAL_NAMES

/* Although a real ANSI C compiler can deal perfectly well with pointers to
* unspecified structures (see "incomplete types" in the
 spec), a few pre-ANSI
* and pseudo-ANSI compilers get confused.  To keep one of these bozos happy,
* define INCOMPLETE_TYPES_BROKEN.  This is not recommended unless you
* actually get "missing structure definition" warnings or errors while
* compiling the JPEG code.
*/
#undef INCOMPLETE_TYPES_BROKEN

/* Define "boolean" as unsigned char, not int, on Windows systems.
*/
#ifdef _WIN32
#ifndef __RPCNDR_H__  /* don't conflict if rpcndr.h already read */
typedef unsigned char boolean;
#endif
#define HAVE_BOOLEAN  /* prevent jmorecfg.h from redefining it */
#endif



/*
* The following options affect code selection within the JPEG library,
* but they don't need to be visible to applications using the library.
* To minimize application namespace pollution, the symbols won't be
```

```
* defined unless JPEG_INTERNALS has been defined.
*/

#ifdef JPEG_INTERNALS

/* Define this if your compiler implements ">>" on signed values as a logical
* (unsigned) shift; leave it undefined if ">>" is a
 signed (arithmetic) shift,
* which is the normal and rational definition.
*/
#undef RIGHT_SHIFT_IS_UNSIGNED


#endif /* JPEG_INTERNALS */


/*
* The remaining options do not affect the JPEG library proper,
* but only the sample applications cjpeg/djpeg (see cjpeg.c, djpeg.c).
* Other applications can ignore these.
*/

#ifdef JPEG_CJPEG_DJPEG

/* These defines indicate which image (non-JPEG) file formats are allowed. */

#define BMP_SUPPORTED  /* BMP image file format */
#define GIF_SUPPORTED  /* GIF image file format */
#define PPM_SUPPORTED  /* PBMPLUS PPM/PGM image file format */
#undef RLE_SUPPORTED  /* Utah RLE image file format */
#define TARGA_SUPPORTED  /* Targa image file format */

/* Define this if you want to name both input and output files on the command
* line, rather than using stdout and optionally stdin.  You MUST do this if
* your system can't cope with binary I/O to stdin/stdout.  See comments at
* head of cjpeg.c or djpeg.c.
*/
#undef TWO_FILE_COMMANDLINE

/*
 Define this if your system needs explicit cleanup of temporary files.
* This is crucial under MS-DOS, where the temporary "files" may be areas
* of extended memory; on most other systems it's not as important.
*/
#undef NEED_SIGNAL_CATCHER

/* By default, we open image files with fopen(...,"rb") or fopen(...,"wb").
* This is necessary on systems that distinguish text files from binary files,
```

```
* and is harmless on most systems that don't.  If you have one of the rare
* systems that complains about the "b" spec, define this symbol.
*/
#undef DONT_USE_B_MODE

/* Define this if you want percent-done progress reports from cjpeg/djpeg.
*/
#undef PROGRESS_REPORT


#endif /* JPEG_CJPEG_DJPEG */
```

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jconfig.txt
No license file was found, but licenses were detected in source scan.

```
/*
* jerror.c
*
* Copyright (C) 1991-1998, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains simple error-reporting and trace-message routines.
* These are suitable for Unix-like systems and others where writing to
* stderr is the right thing to do.  Many applications will want to replace
* some or all of these routines.
*
* If you define USE_WINDOWS_MESSAGEBOX in jconfig.h or in the makefile,
* you get a Windows-specific hack to display error messages in a dialog box.
* It ain't much, but it beats dropping error messages into the bit bucket,
* which is what happens to output to stderr under most Windows C compilers.
*
* These routines are used by both the compression and decompression code.
*/
```

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jerror.c
No license file was found, but licenses were detected in source scan.

License: IJG

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo.spec

No license file was found, but licenses were detected in source scan.

```
/*
* jcsample.c
*
* Copyright (C) 1991-1996, Thomas G. Lane.
* Copyright 2009 Pierre Ossman <ossman@cendio.se> for Cendio AB
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains downsampling routines.
*
* Downsampling input data is counted in "row groups".  A row group
* is defined to be max_v_samp_factor pixel rows of each component,
* from which the downsampler produces v_samp_factor sample rows.
* A single row group is processed in each call to the downsampler module.
*
* The downsampler is responsible for edge-expansion of its output data
* to fill an integral number of DCT blocks horizontally.  The source buffer
* may be modified if it is helpful for this purpose (the source buffer is
* allocated wide enough to correspond to the desired output width).
* The caller (the prep controller) is
 responsible for vertical padding.
*
* The downsampler may request "context rows" by setting need_context_rows
* during startup.  In this case, the input arrays will contain at least
* one row group's worth of pixels above and below the passed-in data;
* the caller will create dummy rows at image top and bottom by replicating
* the first or last real pixel row.
*
* An excellent reference for image resampling is
*   Digital Image Warping, George Wolberg, 1990.
*   Pub. by IEEE Computer Society Press, Los Alamitos, CA. ISBN 0-8186-8944-7.
*
* The downsampling algorithm used here is a simple average of the source
* pixels covered by the output pixel.  The hi-falutin sampling literature
* refers to this as a "box filter".  In general the characteristics of a box
* filter are not very good, but for the specific cases we normally use (1:1
* and 2:1 ratios) the box is equivalent to a "triangle filter" which is not
* nearly so bad.  If you intend to use other sampling ratios,
 you'd be well
* advised to improve this code.
*
* A simple input-smoothing capability is provided.  This is mainly intended
* for cleaning up color-dithered GIF input files (if you find it inadequate,
* we suggest using an external filtering program such as pnmconvol).  When
* enabled, each input pixel P is replaced by a weighted sum of itself and its
* eight neighbors.  P's weight is 1-8*SF and each neighbor's weight is SF,
```

* where SF = (smoothing_factor / 1024).
* Currently, smoothing is only supported for 2h2v sampling factors.
*/

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jcsample.c
No license file was found, but licenses were detected in source scan.

// Natural Docs is licensed under the GPL.

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/doc/html/search/search.js
No license file was found, but licenses were detected in source scan.

/*
* jdinput.c
*
* This file was part of the Independent JPEG Group's software:
* Copyright (C) 1991-1997, Thomas G. Lane.
* Modifications:
* Copyright (C) 2010, D. R. Commander.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains input control logic for the JPEG decompressor.
* These routines are concerned with controlling the decompressor's input
* processing (marker reading and coefficient decoding). The actual input
* reading is done in jdmarker.c, jdhuff.c, and jdphuff.c.
*/

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdinput.c
No license file was found, but licenses were detected in source scan.

/*
* wrgif.c
*
* Copyright (C) 1991-1997, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains routines to write output images in GIF format.
*
****
* NOTE: to avoid entanglements with Unisys' patent on LZW compression,   *

```
* this code has been modified to output "uncompressed GIF" files.        *
* There is no trace of the LZW algorithm in this file.                   *
*************************************************************************
*
* These routines may need modification for non-Unix environments or
* specialized applications.  As they stand, they assume output to
* an ordinary stdio stream.
*/
/*
* This code is loosely based on ppmtogif from the PBMPLUS distribution
* of Feb. 1991.  That file
 contains the following copyright notice:
*    Based on GIFENCODE by David Rowley <mgardi@watdscu.waterloo.edu>.
*    Lempel-Ziv compression based on "compress" by Spencer W. Thomas et al.
*    Copyright (C) 1989 by Jef Poskanzer.
*    Permission to use, copy, modify, and distribute this software and its
*    documentation for any purpose and without fee is hereby granted, provided
*    that the above copyright notice appear in all copies and that both that
*    copyright notice and this permission notice appear in supporting
*    documentation.  This software is provided "as is" without express or
*    implied warranty.
*
* We are also required to state that
*    "The Graphics Interchange Format(c) is the Copyright property of
*    CompuServe Incorporated. GIF(sm) is a Service Mark property of
*    CompuServe Incorporated."
*/
```

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/wrgif.c
No license file was found, but licenses were detected in source scan.

```
/*
* jmemmgr.c
*
* Copyright (C) 1991-1997, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains the JPEG system-independent memory management
* routines.  This code is usable across a wide variety of machines; most
* of the system dependencies have been isolated in a separate file.
* The major functions provided here are:
*   * pool-based allocation and freeing of memory;
*   * policy decisions about how to divide available memory among the
*     virtual arrays;
*   * control logic for swapping virtual arrays between main memory and
```

```
*     backing storage.
* The separate system-dependent file provides the actual backing-storage
* access code, and it contains the policy decision about how much total
* main memory to use.
* This file is system-dependent in the sense that some of
 its functions
* are unnecessary in some systems.  For example, if there is enough virtual
* memory so that backing storage will never be used, much of the virtual
* array control logic could be removed.  (Of course, if you have that much
* memory then you shouldn't care about a little bit of unused code...)
*/
```

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jmemmgr.c
No license file was found, but licenses were detected in source scan.

```
/*
* jchuff.c
*
* This file was part of the Independent JPEG Group's software:
* Copyright (C) 1991-1997, Thomas G. Lane.
* Modifications:
* Copyright (C) 2009-2011, D. R. Commander.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains Huffman entropy encoding routines.
*
* Much of the complexity here has to do with supporting output suspension.
* If the data destination module demands suspension, we want to be able to
* back up to the start of the current MCU.  To do this, we copy state
* variables into local working storage, and update them back to the
* permanent JPEG objects only upon successful completion of an MCU.
*/
```

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jchuff.c
No license file was found, but licenses were detected in source scan.

```
/*
* jquant2.c
*
* This file was part of the Independent JPEG Group's software:
* Copyright (C) 1991-1996, Thomas G. Lane.
* Modifications:
* Copyright (C) 2009, D. R. Commander.
* For conditions of distribution and use, see the accompanying README file.
```

*
* This file contains 2-pass color quantization (color mapping) routines.
* These routines provide selection of a custom color map for an image,
* followed by mapping of the image to that color map, with optional
* Floyd-Steinberg dithering.
* It is also possible to use just the second pass to map to an arbitrary
* externally-given color map.
*
* Note: ordered dithering is not supported, since there isn't any fast
* way to compute intercolor distances; it's unclear that ordered dither's
* fundamental assumptions even hold with an irregularly spaced color map.
*/

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jquant2.c
No license file was found, but licenses were detected in source scan.

/*
* jdct.h
*
* Copyright (C) 1994-1996, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This include file contains common declarations for the forward and
* inverse DCT modules. These declarations are private to the DCT managers
* (jcdctmgr.c, jddctmgr.c) and the individual DCT algorithms.
* The individual DCT algorithms are kept in separate files to ease
* machine-dependent tuning (e.g., assembly coding).
*/

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdct.h
No license file was found, but licenses were detected in source scan.

/*
* jpegcomp.h
*
* Copyright (C) 2010, D. R. Commander
* For conditions of distribution and use, see the accompanying README file.
*
* JPEG compatibility macros
* These declarations are considered internal to the JPEG library; most
* applications using the library shouldn't need to include this file.
*/

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jpegcomp.h
No license file was found, but licenses were detected in source scan.

```
/*
* wrjpgcom.c
*
* Copyright (C) 1994-1997, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains a very simple stand-alone application that inserts
* user-supplied text as a COM (comment) marker in a JFIF file.
* This may be useful as an example of the minimum logic needed to parse
* JPEG markers.
*/
```

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/wrjpgcom.c
No license file was found, but licenses were detected in source scan.

TurboJPEG Java Wrapper
==========

The TurboJPEG shared library can optionally be built with a Java Native Interface wrapper, which allows the library to be loaded and used directly from Java applications. The Java front end for this is defined in several classes located under org/libjpegturbo/turbojpeg. The source code for these Java classes is licensed under a BSD-style license, so the files can be incorporated directly into both open source and proprietary projects without restriction. A Java archive (JAR) file containing these classes is also shipped with the "official" distribution packages of libjpeg-turbo.

TJExample.java, which should also be located in the same directory as this README file, demonstrates how to use the TurboJPEG Java API to compress and decompress JPEG images in memory.

Performance Pitfalls

The TurboJPEG Java API defines several convenience methods that
can allocate
image buffers or instantiate classes to hold the result of compress, decompress, or transform operations. However, if you use these methods, then be mindful of the amount of new data you are creating on the heap. It may be

necessary to manually invoke the garbage collector to prevent heap exhaustion
or to prevent performance degradation. Background garbage collection can kill
performance, particularly in a multi-threaded environment (Java pauses all
threads when the GC runs.)

The TurboJPEG Java API always gives you the option of pre-allocating your own
source and destination buffers, which allows you to re-use those buffers for
compressing/decompressing multiple images. If the image sequence you are
compressing or decompressing consists of images of the same size, then
pre-allocating the buffers is recommended.

Installation Directory

If the TurboJPEG JNI library (libturbojpeg.so, libturbojpeg.jnilib, or
turbojpeg.dll) is not installed under
 a system library directory or under a
directory specified in LD_LIBRARY_PATH (Unix) or PATH (Windows), then you will
need to pass an argument of -Djava.library.path={path_to_JNI_library} to java.

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/java/README
No license file was found, but licenses were detected in source scan.

```
/*
* jidctred.c
*
* Copyright (C) 1994-1998, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains inverse-DCT routines that produce reduced-size output:
* either 4x4, 2x2, or 1x1 pixels from an 8x8 DCT block.
*
* The implementation is based on the Loeffler, Ligtenberg and Moschytz (LL&M)
* algorithm used in jidctint.c.  We simply replace each 8-to-8 1-D IDCT step
* with an 8-to-4 step that produces the four averages of two adjacent outputs
* (or an 8-to-2 step producing two averages of four outputs, for 2x2 output).
* These steps were derived by computing the corresponding values at the end
* of the normal LL&M code, then simplifying as much as possible.
*
* 1x1 is trivial: just take the DC coefficient divided by 8.
*
* See jidctint.c for additional comments.
*/
```

Found in path(s):
*
/opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jidctred.c
No license file was found, but licenses were detected in source scan.

/*
* jcdctmgr.c
*
* This file was part of the Independent JPEG Group's software:
* Copyright (C) 1994-1996, Thomas G. Lane.
* Modifications:
* Copyright (C) 1999-2006, MIYASAKA Masaru.
* Copyright 2009 Pierre Ossman <ossman@cendio.se> for Cendio AB
* Copyright (C) 2011 D. R. Commander
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains the forward-DCT management logic.
* This code selects a particular DCT implementation to be used,
* and it performs related housekeeping chores including coefficient
* quantization.
*/

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jcdctmgr.c
No license file was found, but licenses were detected in source scan.

/*
* jccolor.c
*
* This file was part of the Independent JPEG Group's software:
* Copyright (C) 1991-1996, Thomas G. Lane.
* Modifications:
* Copyright 2009 Pierre Ossman <ossman@cendio.se> for Cendio AB
* Copyright (C) 2009-2012, D. R. Commander.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains input colorspace conversion routines.
*/

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jccolor.c
No license file was found, but licenses were detected in source scan.

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\f0\fs24 \cf0 libjpeg-turbo is a JPEG image codec that uses SIMD instructions (MMX, SSE2, NEON) to accelerate baseline JPEG compression and decompression on x86, x86-64, and ARM systems. On such systems, libjpeg-turbo is generally 2-4x as fast as libjpeg, all else being equal. On other types of systems, libjpeg-turbo can still outperform libjpeg by a significant amount, by virtue of its highly-optimized Huffman coding routines. In many cases, the performance of libjpeg-turbo rivals that of proprietary high-speed JPEG codecs.\
\
libjpeg-turbo implements both the traditional libjpeg API as well as the less powerful but more straightforward TurboJPEG API. libjpeg-turbo also features colorspace
 extensions that allow it to compress from/decompress to 32-bit and\
big-endian pixel buffers (RGBX, XBGR, etc.), as well as a full-featured Java interface.\
\
libjpeg-turbo was originally based on libjpeg/SIMD, an MMX-accelerated derivative of libjpeg v6b developed by Miyasaka Masaru. The TigerVNC and VirtualGL projects made numerous enhancements to the codec in 2009, and in early 2010, libjpeg-turbo spun off into an independent project, with the goal of making high-speed JPEG compression/decompression technology available to a broader range of users and developers.\
}

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/release/ReadMe.rtf
No license file was found, but licenses were detected in source scan.

```
/*
* jdphuff.c
*
* Copyright (C) 1995-1997, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains Huffman entropy decoding routines for progressive JPEG.
*
* Much of the complexity here has to do with supporting input suspension.
* If the data source module demands suspension, we want to be able to back
* up to the start of the current MCU.  To do this, we copy state variables
* into local working storage, and update them back to the permanent
* storage only upon successful completion of an MCU.
*/
```

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdphuff.c
No license file was found, but licenses were detected in source scan.

```
/*
* jcarith.c
*
* Developed 1997-2009 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains portable arithmetic entropy encoding routines for JPEG
* (implementing the ISO/IEC IS 10918-1 and CCITT Recommendation ITU-T T.81).
*
* Both sequential and progressive modes are supported in this single module.
*
* Suspension is not currently supported in this module.
*/
```

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jcarith.c
No license file was found, but licenses were detected in source scan.

```
/*
* jdatadst.c
*
* This file was part of the Independent JPEG Group's software:
* Copyright (C) 1994-1996, Thomas G. Lane.
* Modified 2009-2012 by Guido Vollbeding.
* Modifications:
* Copyright (C) 2013, D. R. Commander.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains compression data destination routines for the case of
* emitting JPEG data to memory or to a file (or any stdio stream).
* While these routines are sufficient for most applications,
* some will want to use a different destination manager.
* IMPORTANT: we assume that fwrite() will correctly transcribe an array of
* JOCTETs into 8-bit-wide elements on external storage.  If char is wider
* than 8 bits on your machine, you may need to do some tweaking.
*/
```

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdatadst.c
No license file was found, but licenses were detected in source scan.

```
/*
* cjpeg.c
*
* This file was part of the Independent JPEG Group's software:
```

```
* Copyright (C) 1991-1998, Thomas G. Lane.
* Modified 2003-2011 by Guido Vollbeding.
* Modifications:
* Copyright (C) 2010, 2013, D. R. Commander.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains a command-line user interface for the JPEG compressor.
* It should work on any system with Unix- or MS-DOS-style command lines.
*
* Two different command line styles are permitted, depending on the
* compile-time switch TWO_FILE_COMMANDLINE:
* cjpeg [options]  inputfile outputfile
* cjpeg [options]  [inputfile]
* In the second style, output is always to standard output, which you'd
* normally redirect to a file or pipe to some other program.  Input is
* either from a named file or from standard input (typically redirected).
* The second style is convenient on Unix but is unhelpful
 on systems that
* don't support pipes.  Also, you MUST use the first style if your system
* doesn't do binary I/O to stdin/stdout.
* To simplify script writing, the "-outfile" switch is provided.  The syntax
* cjpeg [options]  -outfile outputfile  inputfile
* works regardless of which command line style is used.
*/
```

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/cjpeg.c
No license file was found, but licenses were detected in source scan.

```
/*
* wrtarga.c
*
* Copyright (C) 1991-1996, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains routines to write output images in Targa format.
*
* These routines may need modification for non-Unix environments or
* specialized applications.  As they stand, they assume output to
* an ordinary stdio stream.
*
* Based on code contributed by Lee Daniel Crocker.
*/
```

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-

UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/wrtarga.c
No license file was found, but licenses were detected in source scan.

```
/*
* jdmerge.c
*
* This file was part of the Independent JPEG Group's software:
* Copyright (C) 1994-1996, Thomas G. Lane.
* Copyright 2009 Pierre Ossman <ossman@cendio.se> for Cendio AB
* Modifications:
* Copyright (C) 2009, 2011, D. R. Commander.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains code for merged upsampling/color conversion.
*
* This file combines functions from jdsample.c and jdcolor.c;
* read those files first to understand what's going on.
*
* When the chroma components are to be upsampled by simple replication
* (ie, box filtering), we can save some work in color conversion by
* calculating all the output pixels corresponding to a pair of chroma
* samples at one time.  In the conversion equations
* R = Y           + K1 * Cr
* G = Y + K2 * Cb + K3 * Cr
* B = Y + K4 * Cb
* only the Y term varies among the group of pixels corresponding
 to a pair
* of chroma samples, so the rest of the terms can be calculated just once.
* At typical sampling ratios, this eliminates half or three-quarters of the
* multiplications needed for color conversion.
*
* This file currently provides implementations for the following cases:
* YCbCr => RGB color conversion only.
* Sampling ratios of 2h1v or 2h2v.
* No scaling needed at upsample time.
* Corner-aligned (non-CCIR601) sampling alignment.
* Other special cases could be added, but in most applications these are
* the only common cases.  (For uncommon cases we fall back on the more
* general code in jdsample.c and jdcolor.c.)
*/
```

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdmerge.c
No license file was found, but licenses were detected in source scan.

```
;
; jsimdext.inc - common declarations
```

```
;
; Copyright 2009 Pierre Ossman <ossman@cendio.se> for Cendio AB
; Copyright 2010 D. R. Commander
;
; Based on
; x86 SIMD extension for IJG JPEG library - version 1.02
;
; Copyright (C) 1999-2006, MIYASAKA Masaru.
;
; This software is provided 'as-is', without any express or implied
; warranty.  In no event will the authors be held liable for any damages
; arising from the use of this software.
;
; Permission is granted to anyone to use this software for any purpose,
; including commercial applications, and to alter it and redistribute it
; freely, subject to the following restrictions:
;
; 1. The origin of this software must not be misrepresented; you must not
;    claim that you wrote the original software. If you use this software
;    in a product, an acknowledgment in the product documentation would be
;    appreciated but is not required.
; 2. Altered source versions must
 be plainly marked as such, and must not be
;    misrepresented as being the original software.
; 3. This notice may not be removed or altered from any source distribution.
;
; [TAB8]

; ==========================================================================
;  System-dependent configurations

%ifdef WIN32 ; ----(nasm -fwin32 -DWIN32 ...)--------
; * Microsoft Visual C++
; * MinGW (Minimalist GNU for Windows)
; * CygWin
; * LCC-Win32

; -- segment definition --
;
%ifdef __YASM_VER__
%define SEG_TEXT    .text  align=16
%define SEG_CONST   .rdata align=16
%else
%define SEG_TEXT    .text  align=16 public use32 class=CODE
%define SEG_CONST   .rdata align=16 public use32 class=CONST
%endif

%elifdef WIN64 ; ----(nasm -fwin64 -DWIN64 ...)--------
```

```
; * Microsoft Visual C++

; -- segment definition --
;
%ifdef __YASM_VER__
%define SEG_TEXT    .text  align=16
%define SEG_CONST   .rdata align=16
%else
%define SEG_TEXT    .text  align=16 public use64 class=CODE
%define SEG_CONST   .rdata align=16
 public use64 class=CONST
%endif
%define EXTN(name)  name   ; foo() -> foo

%elifdef OBJ32 ; ----(nasm -fobj -DOBJ32 ...)----------
; * Borland C++ (Win32)

; -- segment definition --
;
%define SEG_TEXT    .text  align=16 public use32 class=CODE
%define SEG_CONST   .data  align=16 public use32 class=DATA

%elifdef ELF ; ----(nasm -felf[64] -DELF ...)------------
; * Linux
; * *BSD family Unix using elf format
; * Unix System V, including Solaris x86, UnixWare and SCO Unix

; mark stack as non-executable
section .note.GNU-stack noalloc noexec nowrite progbits

; -- segment definition --
;
%ifdef __x86_64__
%define SEG_TEXT    .text   progbits align=16
%define SEG_CONST   .rodata progbits align=16
%else
%define SEG_TEXT    .text   progbits alloc exec   nowrite align=16
%define SEG_CONST   .rodata progbits alloc noexec nowrite align=16
%endif

; To make the code position-independent, append -DPIC to the commandline
;
%define GOT_SYMBOL  _GLOBAL_OFFSET_TABLE_ ; ELF supports PIC
%define EXTN(name)
  name   ; foo() -> foo

%elifdef AOUT ; ----(nasm -faoutb/aout -DAOUT ...)----
; * Older Linux using a.out format  (nasm -f aout -DAOUT ...)
```

```
; * *BSD family Unix using a.out format  (nasm -f aoutb -DAOUT ...)

; -- segment definition --
;
%define SEG_TEXT    .text
%define SEG_CONST   .data

; To make the code position-independent, append -DPIC to the commandline
;
%define GOT_SYMBOL  __GLOBAL_OFFSET_TABLE_ ; BSD-style a.out supports PIC

%elifdef MACHO ; ----(nasm -fmacho -DMACHO ...)--------
; * NeXTstep/OpenStep/Rhapsody/Darwin/MacOS X (Mach-O format)

; -- segment definition --
;
%define SEG_TEXT    .text  ;align=16 ; nasm doesn't accept align=16. why?
%define SEG_CONST   .rodata align=16

; The generation of position-independent code (PIC) is the default on Darwin.
;
%define PIC
%define GOT_SYMBOL  _MACHO_PIC_  ; Mach-O style code-relative addressing

%else  ; ----(Other case)----------------------

; -- segment definition --
;
%define SEG_TEXT    .text
%define SEG_CONST
  .data

%endif ; ------------------------------------------------

; ===========================================================================

; ---------------------------------------------------------------------
;  Common types
;
%ifdef __x86_64__
%define POINTER             qword          ; general pointer type
%define SIZEOF_POINTER          SIZEOF_QWORD    ; sizeof(POINTER)
%define POINTER_BIT             QWORD_BIT       ; sizeof(POINTER)*BYTE_BIT
%else
%define POINTER             dword          ; general pointer type
%define SIZEOF_POINTER          SIZEOF_DWORD    ; sizeof(POINTER)
%define POINTER_BIT             DWORD_BIT       ; sizeof(POINTER)*BYTE_BIT
%endif
```

```
%define INT             dword       ; signed integer type
%define SIZEOF_INT          SIZEOF_DWORD    ; sizeof(INT)
%define INT_BIT             DWORD_BIT       ; sizeof(INT)*BYTE_BIT

%define FP32            dword       ; IEEE754 single
%define SIZEOF_FP32         SIZEOF_DWORD
   ; sizeof(FP32)
%define FP32_BIT            DWORD_BIT       ; sizeof(FP32)*BYTE_BIT

%define MMWORD              qword       ; int64  (MMX register)
%define SIZEOF_MMWORD       SIZEOF_QWORD    ; sizeof(MMWORD)
%define MMWORD_BIT          QWORD_BIT       ; sizeof(MMWORD)*BYTE_BIT

; NASM is buggy and doesn't properly handle operand sizes for SSE
; instructions, so for now we have to define XMMWORD as blank.
%define XMMWORD                         ; int128 (SSE register)
%define SIZEOF_XMMWORD      SIZEOF_OWORD    ; sizeof(XMMWORD)
%define XMMWORD_BIT         OWORD_BIT       ; sizeof(XMMWORD)*BYTE_BIT

; Similar hacks for when we load a dword or MMWORD into an xmm# register
%define XMM_DWORD
%define XMM_MMWORD

%define SIZEOF_BYTE         1           ; sizeof(BYTE)
%define SIZEOF_WORD         2           ; sizeof(WORD)
%define SIZEOF_DWORD        4           ; sizeof(DWORD)
%define SIZEOF_QWORD        8
   ; sizeof(QWORD)
%define SIZEOF_OWORD        16          ; sizeof(OWORD)

%define BYTE_BIT            8           ; CHAR_BIT in C
%define WORD_BIT            16          ; sizeof(WORD)*BYTE_BIT
%define DWORD_BIT           32          ; sizeof(DWORD)*BYTE_BIT
%define QWORD_BIT           64          ; sizeof(QWORD)*BYTE_BIT
%define OWORD_BIT           128         ; sizeof(OWORD)*BYTE_BIT

; ---------------------------------------------------------------------------
;  External Symbol Name
;
%ifndef EXTN
%define EXTN(name)   _ %+ name  ; foo() -> _foo
%endif

; ---------------------------------------------------------------------------
;  Macros for position-independent code (PIC) support
;
%ifndef GOT_SYMBOL
```

```
%undef PIC
%endif

%ifdef PIC ; ------------------------------------------

%ifidn GOT_SYMBOL,_MACHO_PIC_ ; --------------------

; At present, nasm doesn't seem to support PIC generation for Mach-O.
; The PIC support code below is a
 little tricky.

 SECTION SEG_CONST
const_base:

%define GOTOFF(got,sym) (got) + (sym) - const_base

%imacro get_GOT 1
 ; NOTE: this macro destroys ecx resister.
 call %%geteip
 add ecx, byte (%%ref - $)
 jmp short %%adjust
%%geteip:
 mov ecx, POINTER [esp]
 ret
%%adjust:
 push ebp
 xor ebp,ebp  ; ebp = 0
%ifidni %1,ebx ; (%1 == ebx)
 ; db 0x8D,0x9C + jmp near const_base =
 ;   lea ebx, [ecx+ebp*8+(const_base-%%ref)] ; 8D,9C,E9,(offset32)
 db 0x8D,0x9C  ; 8D,9C
 jmp near const_base  ; E9,(const_base-%%ref)
%%ref:
%else  ; (%1 != ebx)
 ; db 0x8D,0x8C + jmp near const_base =
 ;   lea ecx, [ecx+ebp*8+(const_base-%%ref)] ; 8D,8C,E9,(offset32)
 db 0x8D,0x8C  ; 8D,8C
 jmp near const_base  ; E9,(const_base-%%ref)
%%ref: mov %1, ecx
%endif ; (%1 == ebx)
 pop ebp
%endmacro

%else ; GOT_SYMBOL != _MACHO_PIC_ ----------------

%define GOTOFF(got,sym) (got) + (sym) wrt ..gotoff

%imacro get_GOT 1
```

```
 extern GOT_SYMBOL
 call %%geteip
 add %1, GOT_SYMBOL + $$ - $ wrt ..gotpc
 jmp short %%done
%%geteip:
 mov %1,
 POINTER [esp]
 ret
%%done:
%endmacro

%endif ; GOT_SYMBOL == _MACHO_PIC_ ----------------

%imacro pushpic 1.nolist
 push %1
%endmacro
%imacro poppic 1.nolist
 pop %1
%endmacro
%imacro movpic 2.nolist
 mov %1,%2
%endmacro

%else ; !PIC -----------------------------------------

%define GOTOFF(got,sym) (sym)

%imacro get_GOT 1.nolist
%endmacro
%imacro pushpic 1.nolist
%endmacro
%imacro poppic 1.nolist
%endmacro
%imacro movpic 2.nolist
%endmacro

%endif ;  PIC -----------------------------------------

; ---------------------------------------------------------------------------
;  Align the next instruction on {2,4,8,16,..}-byte boundary.
;  ".balign n,,m" in GNU as
;
%define MSKLE(x,y)  (~(((y) & 0xFFFF) - ((x) & 0xFFFF)) >> 16)
%define FILLB(b,n)  (($$-(b)) & ((n)-1))

%imacro alignx 1-2.nolist 0xFFFF
%%bs: times MSKLE(FILLB(%%bs,%1),%2) & MSKLE(16,FILLB($,%1)) & FILLB($,%1) \
       db 0x90                          ; nop
```

```
 times MSKLE(FILLB(%%bs,%1),%2) & FILLB($,%1)/9 \

      db 0x8D,0x9C,0x23,0x00,0x00,0x00,0x00 ; lea ebx,[ebx+0x00000000]
 times MSKLE(FILLB(%%bs,%1),%2) & FILLB($,%1)/7 \
       db 0x8D,0xAC,0x25,0x00,0x00,0x00,0x00 ; lea ebp,[ebp+0x00000000]
 times MSKLE(FILLB(%%bs,%1),%2) & FILLB($,%1)/6 \
       db 0x8D,0xAD,0x00,0x00,0x00,0x00      ; lea ebp,[ebp+0x00000000]
 times MSKLE(FILLB(%%bs,%1),%2) & FILLB($,%1)/4 \
       db 0x8D,0x6C,0x25,0x00                ; lea ebp,[ebp+0x00]
 times MSKLE(FILLB(%%bs,%1),%2) & FILLB($,%1)/3 \
       db 0x8D,0x6D,0x00                     ; lea ebp,[ebp+0x00]
 times MSKLE(FILLB(%%bs,%1),%2) & FILLB($,%1)/2 \
       db 0x8B,0xED                          ; mov ebp,ebp
 times MSKLE(FILLB(%%bs,%1),%2) & FILLB($,%1)/1 \
       db 0x90                               ; nop
%endmacro

; Align the next data on {2,4,8,16,..}-byte boundary.
;
%imacro alignz 1.nolist
 align %1, db 0  ; filling zeros
%endmacro

%ifdef __x86_64__

%ifdef WIN64

%imacro collect_args 0
 push r12
 push r13
 push r14
 push r15
 mov
 r10, rcx
 mov r11, rdx
 mov r12, r8
 mov r13, r9
 mov r14, [rax+48]
 mov r15, [rax+56]
 push rsi
 push rdi
 sub     rsp, SIZEOF_XMMWORD
 movaps  XMMWORD [rsp], xmm6
 sub     rsp, SIZEOF_XMMWORD
 movaps  XMMWORD [rsp], xmm7
%endmacro

%imacro uncollect_args 0
```

```
 movaps  xmm7, XMMWORD [rsp]
 add     rsp, SIZEOF_XMMWORD
 movaps  xmm6, XMMWORD [rsp]
 add     rsp, SIZEOF_XMMWORD
 pop rdi
 pop rsi
 pop r15
 pop r14
 pop r13
 pop r12
%endmacro

%else

%imacro collect_args 0
 push r10
 push r11
 push r12
 push r13
 push r14
 push r15
 mov r10, rdi
 mov r11, rsi
 mov r12, rdx
 mov r13, rcx
 mov r14, r8
 mov r15, r9
%endmacro

%imacro uncollect_args 0
 pop r15
 pop r14
 pop r13
 pop r12
 pop r11
 pop r10
%endmacro

%endif

%endif

; ------------------------------------------------------------------------
;  Defines picked up from the C headers
;
%include "jsimdcfg.inc"

; ------------------------------------------------------------------------
```

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jsimdext.inc
No license file was found, but licenses were detected in source scan.

```
/*
* jcphuff.c
*
* Copyright (C) 1995-1997, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains Huffman entropy encoding routines for progressive JPEG.
*
* We do not support output suspension in this module, since the library
* currently does not allow multiple-scan files to be written with output
* suspension.
*/
```

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jcphuff.c
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```
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* POSSIBILITY OF SUCH DAMAGE.
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* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/turbojpeg.c
*
/opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/java/TJBench.java
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/tjunittest.c
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/tjbench.c
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/*
* jcomapi.c
*
* Copyright (C) 1994-1997, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains application interface routines that are used for both
* compression and decompression.
*/

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jcomapi.c
No license file was found, but licenses were detected in source scan.

%ifarch x86_64
%define __lib lib64
%else
%define __lib lib
%endif

Summary: A SIMD-accelerated JPEG codec that provides both the libjpeg and TurboJPEG APIs
Name: @PACKAGE_NAME@
Version: @VERSION@
Vendor: The libjpeg-turbo Project
URL: http://www.libjpeg-turbo.org
Group: System Environment/Libraries

```
#-->Source0: http://prdownloads.sourceforge.net/libjpeg-turbo/libjpeg-turbo-%{version}.tar.gz
Release: @BUILD@
License: BSD-style
BuildRoot: %{_blddir}/%{name}-buildroot-%{version}-%{release}
Prereq: /sbin/ldconfig
%ifarch x86_64
Provides: %{name} = %{version}-%{release}, turbojpeg = 2.00, libturbojpeg.so()(64bit)
%else
Provides: %{name} = %{version}-%{release}, turbojpeg = 2.00, libturbojpeg.so
%endif
Obsoletes: turbojpeg

%description
libjpeg-turbo is a JPEG image codec that uses SIMD instructions (MMX, SSE2,
NEON) to accelerate baseline JPEG compression and decompression on x86, x86-64,
and ARM systems.  On such systems,
 libjpeg-turbo is generally 2-4x as fast as
libjpeg, all else being equal.  On other types of systems, libjpeg-turbo can
still outperform libjpeg by a significant amount, by virtue of its
highly-optimized Huffman coding routines.  In many cases, the performance of
libjpeg-turbo rivals that of proprietary high-speed JPEG codecs.

libjpeg-turbo implements both the traditional libjpeg API as well as the less
powerful but more straightforward TurboJPEG API.  libjpeg-turbo also features
colorspace extensions that allow it to compress from/decompress to 32-bit and
big-endian pixel buffers (RGBX, XBGR, etc.), as well as a full-featured Java
interface.

libjpeg-turbo was originally based on libjpeg/SIMD, an MMX-accelerated
derivative of libjpeg v6b developed by Miyasaka Masaru.  The TigerVNC and
VirtualGL projects made numerous enhancements to the codec in 2009, and in
early 2010, libjpeg-turbo spun off into an independent project, with the goal
of making high-speed JPEG compression/decompression
 technology available to a
broader range of users and developers.

#-->%prep
#-->%setup -q

#-->%build
#-->./configure libdir=/opt/%{name}/%{__lib} mandir=/opt/%{name}/man
JPEG_LIB_VERSION=@JPEG_LIB_VERSION@ SO_MAJOR_VERSION=@SO_MAJOR_VERSION@
SO_MINOR_VERSION=@SO_MINOR_VERSION@ --with-pic @RPM_CONFIG_ARGS@
#-->make DESTDIR=$RPM_BUILD_ROOT libdir=/opt/%{name}/%{__lib} mandir=/opt/%{name}/man

%install

rm -rf $RPM_BUILD_ROOT
```

```
make install DESTDIR=$RPM_BUILD_ROOT libdir=/opt/%{name}/%{__lib} mandir=/opt/%{name}/man
docdir=/opt/%{name}/doc exampledir=/opt/%{name}/doc
rm -f $RPM_BUILD_ROOT/opt/%{name}/%{__lib}/*.la
mkdir -p $RPM_BUILD_ROOT/usr/%{__lib}
mv $RPM_BUILD_ROOT/opt/%{name}/%{__lib}/libturbojpeg.* $RPM_BUILD_ROOT/usr/%{__lib}
/sbin/ldconfig -n $RPM_BUILD_ROOT/opt/%{name}/%{__lib}
/sbin/ldconfig -n $RPM_BUILD_ROOT/usr/%{__lib}
mkdir -p $RPM_BUILD_ROOT/usr/include
mv $RPM_BUILD_ROOT/opt/%{name}/include/turbojpeg.h $RPM_BUILD_ROOT/usr/include
ln -fs /usr/include/turbojpeg.h $RPM_BUILD_ROOT/opt/%{name}/include/
ln
 -fs /usr/%{__lib}/libturbojpeg.a $RPM_BUILD_ROOT/opt/%{name}/%{__lib}/
mkdir -p $RPM_BUILD_ROOT%{_defaultdocdir}
mv $RPM_BUILD_ROOT/opt/%{name}/doc $RPM_BUILD_ROOT%{_defaultdocdir}/%{name}-%{version}

%post -p /sbin/ldconfig

%postun -p /sbin/ldconfig

%clean
rm -rf $RPM_BUILD_ROOT

%files
%defattr(-,root,root)
%dir %{_defaultdocdir}/%{name}-%{version}
%doc %{_defaultdocdir}/%{name}-%{version}/*
%dir /opt/%{name}
%dir /opt/%{name}/bin
/opt/%{name}/bin/cjpeg
/opt/%{name}/bin/djpeg
/opt/%{name}/bin/jpegtran
/opt/%{name}/bin/tjbench
/opt/%{name}/bin/rdjpgcom
/opt/%{name}/bin/wrjpgcom
%dir /opt/%{name}/%{__lib}
%ifarch x86_64
%else
/opt/%{name}/lib32
%endif
/opt/%{name}/%{__lib}/libjpeg.so.@SO_MAJOR_VERSION@.@SO_AGE@.@SO_MINOR_VERSION@
/opt/%{name}/%{__lib}/libjpeg.so.@SO_MAJOR_VERSION@
/opt/%{name}/%{__lib}/libjpeg.so
/opt/%{name}/%{__lib}/libjpeg.a
/opt/%{name}/%{__lib}/libturbojpeg.a
/usr/%{__lib}/libturbojpeg.so.0.0.0
/usr/%{__lib}/libturbojpeg.so.0
/usr/%{__lib}/libturbojpeg.so
/usr/%{__lib}/libturbojpeg.a
```

/usr/include/turbojpeg.h
%dir
 /opt/%{name}/include
/opt/%{name}/include/jconfig.h
/opt/%{name}/include/jerror.h
/opt/%{name}/include/jmorecfg.h
/opt/%{name}/include/jpeglib.h
/opt/%{name}/include/turbojpeg.h
%dir /opt/%{name}/man
%dir /opt/%{name}/man/man1
/opt/%{name}/man/man1/cjpeg.1*
/opt/%{name}/man/man1/djpeg.1*
/opt/%{name}/man/man1/jpegtran.1*
/opt/%{name}/man/man1/rdjpgcom.1*
/opt/%{name}/man/man1/wrjpgcom.1*
@JAVA_RPM_CONTENTS_1@
@JAVA_RPM_CONTENTS_2@

%changelog

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/release/libjpeg-turbo.spec.in
No license file was found, but licenses were detected in source scan.

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Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/simd/jsimd_arm_neon.S
No license file was found, but licenses were detected in source scan.

/*
* jaricom.c
*
* Developed 1997-2009 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains probability estimation tables for common use in
* arithmetic entropy encoding and decoding routines.
*
* This data represents Table D.2 in the JPEG spec (ISO/IEC IS 10918-1

* and CCITT Recommendation ITU-T T.81) and Table 24 in the JBIG spec
* (ISO/IEC IS 11544 and CCITT Recommendation ITU-T T.82).
*/

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jaricom.c
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* jidctfst.c
*
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*
* This file contains a fast, not so accurate integer implementation of the
* inverse DCT (Discrete Cosine Transform). In the IJG code, this routine
* must also perform dequantization of the input coefficients.
*
* A 2-D IDCT can be done by 1-D IDCT on each column followed by 1-D IDCT
* on each row (or vice versa, but it's more convenient to emit a row at
* a time). Direct algorithms are also available, but they are much more
* complex and seem not to be any faster when reduced to code.
*
* This implementation is based on Arai, Agui, and Nakajima's algorithm for
* scaled DCT. Their original paper (Trans. IEICE E-71(11):1095) is in
* Japanese, but the algorithm is described in the Pennebaker & Mitchell
 * JPEG textbook (see REFERENCES section in file README). The following code
* is based directly on figure 4-8 in P&M.
* While an 8-point DCT cannot be done in less than 11 multiplies, it is
* possible to arrange the computation so that many of the multiplies are
* simple scalings of the final outputs. These multiplies can then be
* folded into the multiplications or divisions by the JPEG quantization
* table entries. The AA&N method leaves only 5 multiplies and 29 adds
* to be done in the DCT itself.
* The primary disadvantage of this method is that with fixed-point math,
* accuracy is lost due to imprecise representation of the scaled
* quantization values. The smaller the quantization table entry, the less
* precise the scaled value, so this implementation does worse with high-
* quality-setting files than with low-quality ones.
*/

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jidctfst.c
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```
/*
* jpeglib.h
*
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* Modified 2002-2009 by Guido Vollbeding.
* Modifications:
* Copyright (C) 2009-2011, 2013, D. R. Commander.
* For conditions of distribution and use, see the accompanying README file.
*
* This file defines the application interface for the JPEG library.
* Most applications using the library need only include this file,
* and perhaps jerror.h if they want to know the exact error codes.
*/
```

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jpeglib.h
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```
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* jdhuff.c
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*
* This file contains Huffman entropy decoding routines.
*
* Much of the complexity here has to do with supporting input suspension.
* If the data source module demands suspension, we want to be able to back
* up to the start of the current MCU.  To do this, we copy state variables
* into local working storage, and update them back to the permanent
* storage only upon successful completion of an MCU.
*/
```

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/jdhuff.c
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```
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* rdbmp.c
*
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```

* Modified 2009-2010 by Guido Vollbeding.
* Modifications:
* Modified 2011 by Siarhei Siamashka.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains routines to read input images in Microsoft "BMP"
* format (MS Windows 3.x, OS/2 1.x, and OS/2 2.x flavors).
* Currently, only 8-bit and 24-bit images are supported, not 1-bit or
* 4-bit (feeding such low-depth images into JPEG would be silly anyway).
* Also, we don't support RLE-compressed files.
*
* These routines may need modification for non-Unix environments or
* specialized applications. As they stand, they assume input from
* an ordinary stdio stream. They further assume that reading begins
* at the start of the file; start_input may need work if the
* user interface has already
 read some data (e.g., to determine that
* the file is indeed BMP format).
*
* This code contributed by James Arthur Boucher.
*/

Found in path(s):
* /opt/cola/permits/1105438051_1608299910.76/0/libjpeg-turbo-1.2.90-5.el7-1.src.rpm-cosi-expand-archive-UWi7FaRf/libjpeg-turbo-1.2.90.tar.gz-cosi-expand-archive-C8ga4kAj/libjpeg-turbo-1.2.90/rdbmp.c

1.150 linenoise 1.0

1.150.1 Available under license :

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1.151 hd-parm 9.38

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1.156 libxcrypt 4.4.10-10ubuntu4

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1.157 junixsocket-core 2.3.2

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1.159 flyway-spring5-test 6.4.0

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1.160 flyway-core 7.3.1

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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/logging/slf4j/Slf4jLog.java
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/saphana/SAPHANADatabaseType.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/sqlscript/SqlScriptExecutor.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/clazz/package-info.java
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1.161 sg3-utils 1.42

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Found in path(s):
* /opt/cola/permits/1135864176_1613618002.1/0/jul-to-slf4j-1-7-30-sources-1-jar/org/slf4j/bridge/SLF4JBridgeHandler.java

1.167 ehcache-107 3.8.1

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* /opt/cola/permits/1135872828_1613621005.88/0/ehcache-107-3-8-1-sources-1-jar/org/ehcache/jsr107/config/Jsr107Configuration.java
* /opt/cola/permits/1135872828_1613621005.88/0/ehcache-107-3-8-1-sources-1-jar/org/ehcache/jsr107/Eh107MXBean.java
* /opt/cola/permits/1135872828_1613621005.88/0/ehcache-107-3-8-1-sources-1-jar/org/ehcache/jsr107/ListenerResources.java
*
 /opt/cola/permits/1135872828_1613621005.88/0/ehcache-107-3-8-1-sources-1-jar/org/ehcache/jsr107/Eh107CompleteConfiguration.java
* /opt/cola/permits/1135872828_1613621005.88/0/ehcache-107-3-8-1-sources-1-jar/org/ehcache/jsr107/Eh107Configuration.java
* /opt/cola/permits/1135872828_1613621005.88/0/ehcache-107-3-8-1-sources-1-jar/org/ehcache/jsr107/Eh107CacheManager.java
* /opt/cola/permits/1135872828_1613621005.88/0/ehcache-107-3-8-1-sources-1-jar/org/ehcache/jsr107/internal/DefaultJsr107Service.java
* /opt/cola/permits/1135872828_1613621005.88/0/ehcache-107-3-8-1-sources-1-jar/org/ehcache/jsr107/DefaultConfigurationResolver.java
* /opt/cola/permits/1135872828_1613621005.88/0/ehcache-107-3-8-1-sources-1-jar/org/ehcache/jsr107/Eh107ReverseConfiguration.java
* /opt/cola/permits/1135872828_1613621005.88/0/ehcache-107-3-8-1-sources-1-jar/org/ehcache/jsr107/EventListenerAdaptors.java
* /opt/cola/permits/1135872828_1613621005.88/0/ehcache-107-3-8-1-sources-1-jar/org/ehcache/jsr107/config/package-info.java
*
 /opt/cola/permits/1135872828_1613621005.88/0/ehcache-107-3-8-1-sources-1-jar/org/ehcache/jsr107/internal/Jsr107CacheLoaderWriter.java
* /opt/cola/permits/1135872828_1613621005.88/0/ehcache-107-3-8-1-sources-1-jar/org/ehcache/jsr107/CloseUtil.java
* /opt/cola/permits/1135872828_1613621005.88/0/ehcache-107-3-8-1-sources-1-jar/org/ehcache/jsr107/Eh107CacheLoaderWriterProvider.java
* /opt/cola/permits/1135872828_1613621005.88/0/ehcache-107-3-8-1-sources-1-jar/org/ehcache/jsr107/package-info.java
* /opt/cola/permits/1135872828_1613621005.88/0/ehcache-107-3-8-1-sources-1-jar/org/ehcache/jsr107/CacheResources.java
* /opt/cola/permits/1135872828_1613621005.88/0/ehcache-107-3-8-1-sources-1-jar/org/ehcache/jsr107/Jsr107Service.java
* /opt/cola/permits/1135872828_1613621005.88/0/ehcache-107-3-8-1-sources-1-jar/org/ehcache/jsr107/internal/tck/Eh107MBeanServerBuilder.java
* /opt/cola/permits/1135872828_1613621005.88/0/ehcache-107-3-8-1-sources-1-jar/org/ehcache/jsr107/Eh107Expiry.java

*
/opt/cola/permits/1135872828_1613621005.88/0/ehcache-107-3-8-1-sources-1-jar/org/ehcache/jsr107/config/ConfigurationElementState.java
* /opt/cola/permits/1135872828_1613621005.88/0/ehcache-107-3-8-1-sources-1-jar/org/ehcache/jsr107/NullCompletionListener.java
* /opt/cola/permits/1135872828_1613621005.88/0/ehcache-107-3-8-1-sources-1-jar/org/ehcache/jsr107/EhcacheCachingProvider.java
* /opt/cola/permits/1135872828_1613621005.88/0/ehcache-107-3-8-1-sources-1-jar/org/ehcache/jsr107/internal/WrappedCacheLoaderWriter.java
* /opt/cola/permits/1135872828_1613621005.88/0/ehcache-107-3-8-1-sources-1-jar/org/ehcache/jsr107/config/Jsr107CacheConfiguration.java
* /opt/cola/permits/1135872828_1613621005.88/0/ehcache-107-3-8-1-sources-1-jar/org/ehcache/jsr107/Eh107CacheMXBean.java
* /opt/cola/permits/1135872828_1613621005.88/0/ehcache-107-3-8-1-sources-1-jar/org/ehcache/jsr107/Eh107IdentityCopier.java
* /opt/cola/permits/1135872828_1613621005.88/0/ehcache-107-3-8-1-sources-1-jar/org/ehcache/jsr107/Eh107CacheEntryEvent.java
*
/opt/cola/permits/1135872828_1613621005.88/0/ehcache-107-3-8-1-sources-1-jar/org/ehcache/jsr107/internal/Jsr107ServiceConfigurationParser.java
* /opt/cola/permits/1135872828_1613621005.88/0/ehcache-107-3-8-1-sources-1-jar/org/ehcache/jsr107/EhcacheExpiryWrapper.java
* /opt/cola/permits/1135872828_1613621005.88/0/ehcache-107-3-8-1-sources-1-jar/org/ehcache/jsr107/Eh107CacheStatisticsMXBean.java
* /opt/cola/permits/1135872828_1613621005.88/0/ehcache-107-3-8-1-sources-1-jar/org/ehcache/jsr107/ConfigurationMerger.java
* /opt/cola/permits/1135872828_1613621005.88/0/ehcache-107-3-8-1-sources-1-jar/org/ehcache/jsr107/internal/Jsr107CacheConfigurationParser.java
* /opt/cola/permits/1135872828_1613621005.88/0/ehcache-107-3-8-1-sources-1-jar/org/ehcache/jsr107/ExpiryPolicyToEhcacheExpiry.java
* /opt/cola/permits/1135872828_1613621005.88/0/ehcache-107-3-8-1-sources-1-jar/org/ehcache/jsr107/Eh107Cache.java
* /opt/cola/permits/1135872828_1613621005.88/0/ehcache-107-3-8-1-sources-1-jar/org/ehcache/jsr107/Unwrap.java
*
/opt/cola/permits/1135872828_1613621005.88/0/ehcache-107-3-8-1-sources-1-jar/org/ehcache/jsr107/Eh107CacheLoaderWriter.java

1.168 ehcache-api 3.8.1

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Found in path(s):
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/spi/service/ServiceProvider.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/event/package-info.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/spi/service/Service.java
*
 /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/UserManagedCache.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/package-info.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/expiry/Expirations.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/config/units/EntryUnit.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/config/SizedResourcePool.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/spi/service/ServiceDependencies.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/expiry/Duration.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/event/CacheEvent.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/spi/loaderwriter/BulkCacheLoadingException.java
*
 /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/config/Eviction.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/spi/persistence/StateRepository.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/spi/loaderwriter/CacheWritingException.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/spi/serialization/package-info.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/ValueSupplier.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/spi/resilience/RecoveryStore.java

* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/spi/copy/package-info.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/spi/serialization/StatefulSerializer.java
*
/opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/Status.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/config/Configuration.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/spi/loaderwriter/WriteBehindConfiguration.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/config/units/MemoryUnit.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/spi/copy/CopyProvider.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/StateTransitionException.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/expiry/ExpiryPolicy.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/CachePersistenceException.java
*
/opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/PersistentCacheManager.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/spi/loaderwriter/CacheLoaderWriterConfiguration.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/event/EventOrdering.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/config/Builder.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/config/ResourceType.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/event/EventType.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/spi/serialization/UnsupportedTypeException.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/spi/loaderwriter/CacheLoaderWriterProvider.java
*
/opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/spi/loaderwriter/CacheLoaderWriter.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/spi/copy/Copier.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/spi/loaderwriter/CacheLoadingException.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/spi/serialization/SerializationProvider.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/config/units/package-info.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-

jar/org/ehcache/spi/persistence/package-info.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/spi/resilience/package-info.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/spi/persistence/PersistableResourceService.java
*
 /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/event/CacheEventListener.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/spi/service/MaintainableService.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/spi/service/ServiceCreationConfiguration.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/config/ResourcePools.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/CacheManager.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/expiry/package-info.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/config/EvictionAdvisor.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/config/FluentConfigurationBuilder.java
*
 /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/expiry/Expiry.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/config/CacheRuntimeConfiguration.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/config/CacheConfiguration.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/spi/resilience/StoreAccessException.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/spi/resilience/ResilienceStrategyProvider.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/spi/loaderwriter/package-info.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/Cache.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/spi/service/ServiceConfiguration.java
*
 /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/spi/service/OptionalServiceDependencies.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/PersistentUserManagedCache.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/config/ResourcePool.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/spi/serialization/Serializer.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/spi/serialization/SerializerException.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-

jar/org/ehcache/spi/persistence/StateHolder.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/config/ResourceUnit.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/event/EventFiring.java
*
 /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/CacheIterationException.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/spi/service/package-info.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/spi/resilience/ResilienceStrategy.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/spi/loaderwriter/BulkCacheWritingException.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/spi/loaderwriter/WriteBehindProvider.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/config/package-info.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/spi/service/PluralService.java
* /opt/cola/permits/1135872726_1613620740.71/0/ehcache-api-3-8-1-sources-1-jar/org/ehcache/config/FluentCacheConfigurationBuilder.java

1.169 ehcache-impl 3.8.1

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* /opt/cola/permits/1135872533_1613620997.49/0/ehcache-impl-3-8-1-sources-1-jar/org/ehcache/impl/internal/store/offheap/portability/SerializerPortability.java

* /opt/cola/permits/1135872533_1613620997.49/0/ehcache-impl-3-8-1-sources-1-jar/org/ehcache/impl/internal/loaderwriter/writebehind/StripedWriteBehind.java
*
 /opt/cola/permits/1135872533_1613620997.49/0/ehcache-impl-3-8-1-sources-1-jar/org/ehcache/impl/internal/store/heap/holders/CopiedOnHeapValueHolder.java
* /opt/cola/permits/1135872533_1613620997.49/0/ehcache-impl-3-8-1-sources-1-jar/org/ehcache/impl/copy/ReadWriteCopier.java
* /opt/cola/permits/1135872533_1613620997.49/0/ehcache-impl-3-8-1-sources-1-jar/org/ehcache/impl/internal/store/heap/Backend.java
* /opt/cola/permits/1135872533_1613620997.49/0/ehcache-impl-3-8-1-sources-1-jar/org/ehcache/impl/internal/spi/loaderwriter/DefaultCacheLoaderWriterProviderFactory.java
* /opt/cola/permits/1135872533_1613620997.49/0/ehcache-impl-3-8-1-sources-1-jar/org/ehcache/impl/config/loaderwriter/writebehind/WriteBehindProviderConfiguration.java
* /opt/cola/permits/1135872533_1613620997.49/0/ehcache-impl-3-8-1-sources-1-jar/org/ehcache/impl/internal/events/StoreEvents.java
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* /opt/cola/permits/1135872533_1613620997.49/0/ehcache-impl-3-8-1-sources-1-jar/org/ehcache/impl/internal/store/offheap/OffHeapStore.java
* /opt/cola/permits/1135872533_1613620997.49/0/ehcache-impl-3-8-1-sources-1-jar/org/ehcache/config/builders/WriteBehindConfigurationBuilder.java
* /opt/cola/permits/1135872533_1613620997.49/0/ehcache-impl-3-8-1-sources-1-jar/org/ehcache/impl/config/BaseCacheConfiguration.java
*
/opt/cola/permits/1135872533_1613620997.49/0/ehcache-impl-3-8-1-sources-1-jar/org/ehcache/impl/serialization/PlainJavaSerializer.java
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1.170 ehcache-xml 3.8.1

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* /opt/cola/permits/1135872744_1613620816.93/0/ehcache-xml-3-8-1-sources-1-jar/org/ehcache/xml/service/DefaultCacheEventDispatcherConfigurationParser.java
* /opt/cola/permits/1135872744_1613620816.93/0/ehcache-xml-3-8-1-sources-1-jar/org/ehcache/xml/CoreServiceCreationConfigurationParser.java
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* /opt/cola/permits/1135872744_1613620816.93/0/ehcache-xml-3-8-1-sources-1-jar/org/ehcache/xml/XmlModel.java
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1.171 jakarta-annotation-api 1.3.5

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src/test/org/apache/commons/codec/language/DoubleMetaphoneTest.java
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1.174 ehcache 3.8.1

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* /opt/cola/permits/1135872409_1613620769.24/0/ehcache-3-8-1-sources-1-jar/META-INF/maven/org.ehcache.modules/ehcache-107/pom.xml
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* /opt/cola/permits/1135872409_1613620769.24/0/ehcache-3-8-1-sources-1-jar/org/ehcache/jsr107/DefaultConfigurationResolver.java

* /opt/cola/permits/1135872409_1613620769.24/0/ehcache-3-8-1-sources-1-jar/org/ehcache/core/spi/service/package-info.java
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* /opt/cola/permits/1135872409_1613620769.24/0/ehcache-3-8-1-sources-1-jar/org/ehcache/xml/model/CacheDefinition.java
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* /opt/cola/permits/1135872409_1613620769.24/0/ehcache-3-8-1-sources-1-jar/org/ehcache/core/spi/time/SystemTimeSource.java
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* /opt/cola/permits/1135872409_1613620769.24/0/ehcache-3-8-1-sources-1-jar/org/ehcache/core/statistics/ChainedOperationObserver.java
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* /opt/cola/permits/1135872409_1613620769.24/0/ehcache-3-8-1-sources-1-
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org.ehcache.jsr107.internal.Jsr107CacheConfigurationParser

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* /opt/cola/permits/1135872409_1613620769.24/0/ehcache-3-8-1-sources-1-jar/ehcache-107-ext.xsd
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* /opt/cola/permits/1135872409_1613620769.24/0/ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/classes/commonslang/reflect/MethodUtils.java
* /opt/cola/permits/1135872409_1613620769.24/0/ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/classes/commonslang/reflect/ConstructorUtils.java

1.175 sizeof 0.3.0

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Java ClassMate library was originally written by Tatu Saloranta (tatu.saloranta@iki.fi)

Other developers who have contributed code are:

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1.179 activation 1.2.2

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1.180 jakarta-validation-api 2.0.2

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1.181 hibernate-commons-annotations 5.1.0.Final

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1.183 javassist 3.24.0-GA

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* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/annotation/MemberValue.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/annotation/AnnotationMemberValue.java
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* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/annotation/ArrayMemberValue.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/annotation/LongMemberValue.java

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/*
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* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/tools/rmi/StubGenerator.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/compiler/ast/BinExpr.java
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* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-

jar/javassist/compiler/ast/Stmnt.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/annotation/NoSuchClassError.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/ClassClassPath.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/convert/TransformNewClass.java
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* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/util/proxy/ProxyFactory.java
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* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/ClassFileWriter.java
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1.184 mpdecimal 2.4.2

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1.185 jaxb-runtime 2.3.3

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We call this license the "Lesser" General Public License because it does Less to protect the user's freedom than the ordinary General Public License. It also provides other free software developers Less of an advantage over competing non-free programs. These disadvantages are the reason we use the ordinary General Public License for many libraries. However, the Lesser license provides advantages in certain special circumstances.

For example, on rare occasions, there may be a special need to encourage the widest possible use of a certain library, so that it becomes a de-facto standard. To achieve this, non-free programs must be allowed to use the library. A more frequent case is that a free library does the same job as widely used non-free libraries. In this case, there is little to gain by limiting the free library to free software only, so we use the Lesser General Public License.

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"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.

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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.

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.

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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

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Otherwise, if the work is a derivative of the Library, you may distribute the
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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 combine 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) Use a suitable shared library mechanism for linking with the Library. A suitable mechanism is one that (1) uses at run time a copy of the library already present on the user's computer system, rather than copying library functions into the executable, and (2) will operate
properly with a modified version of the library, if
the user installs one, as long as the modified version is interface-compatible with the version that the work was made with.

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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.

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TERMS AND CONDITIONS

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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.

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Go support for Protocol Buffers - Google's data interchange format

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1.202 swagger 2.1.9

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1.203 swagger-integration 2.1.9

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Bundle-Description: swagger-integration
Automatic-Module-Name: io.swagger.v3.oas.integration
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ses/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/swa
gger-integration
Import-Package: com.fasterxml.jackson.annotation;version="[2.12,3)",co
m.fasterxml.jackson.databind;version="[2.12,3)",com.fasterxml.jackson
.databind.annotation;version="[2.12,3)",io.github.classgraph;version=
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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-integ
ration
mode: development
Export-Package: io.swagger.v3.oas.integration;uses:="com.fasterxml.jac
kson.databind,io.swagger.v3.core.converter,io.swagger.v3.core.util,io
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ration.api;uses:="com.fasterxml.jackson.databind,io.swagger.v3.core.c
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Bundle-Name: swagger-integration
Bundle-Version:
2.1.9
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Build-Jdk: 1.8.0_282

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* /opt/cola/permits/1165124366_1631831566.71/0/swagger-integration-2-1-9-jar/META-INF/MANIFEST.MF

1.204 swagger-models 2.1.9

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* /opt/cola/permits/1165124349_1620941204.65/0/swagger-models-2-1-9-sources-jar/io/swagger/v3/oas/models/OpenAPI.java
* /opt/cola/permits/1165124349_1620941204.65/0/swagger-models-2-1-9-sources-jar/io/swagger/v3/oas/models/media/ObjectSchema.java
* /opt/cola/permits/1165124349_1620941204.65/0/swagger-models-2-1-9-sources-jar/io/swagger/v3/oas/models/PathItem.java
* /opt/cola/permits/1165124349_1620941204.65/0/swagger-models-2-1-9-sources-

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* /opt/cola/permits/1165124349_1620941204.65/0/swagger-models-2-1-9-sources-jar/io/swagger/v3/oas/models/security/SecurityRequirement.java

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1.206 springdoc-openapi-common 1.5.9

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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

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1.211 jctools-core 3.0.0

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Manifest-Version: 1.0
Bnd-LastModified: 1578049665284
Build-Jdk: 1.8.0_232
Built-By: yak
Bundle-Description: Java Concurrency Tools Core Library
Bundle-License: http://www.apache.org/licenses/LICENSE-2.0.txt
Bundle-ManifestVersion: 2
Bundle-Name: Java Concurrency Tools Core Library
Bundle-SymbolicName: org.jctools.core
Bundle-Version: 3.0.0
Created-By: Apache Maven Bundle Plugin
Export-Package: org.jctools.maps;version="3.0.0",org.jctools.util;vers
ion="3.0.0";uses:="sun.misc",org.jctools.queues;version="3.0.0";uses:
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g.jctools.queues.atomic;version="3.0.0";uses:="org.jctools.queues,org
.jctools.queues.spec"
Import-Package: sun.misc;resolution:=optional
Require-Capability: osgi.ee;filter:="(&(osgi.ee=JavaSE)(version=1.6))"
Tool: Bnd-4.2.0.201903051501

Found in path(s):
* /opt/cola/permits/1177956791_1625584358.42/0/jctools-core-3-0-0-5-jar/META-INF/MANIFEST.MF
No license file was found, but licenses were detected in source scan.

<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">
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</build>

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 </repository>
</distributionManagement>

<url>https://github.com/JCTools</url>
```

```
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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>
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 <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>

<prerequisites>
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</prerequisites>

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 <java.version>1.6</java.version>
 <java.test.version>1.8</java.test.version>

 <maven.compiler.source>${java.version}</maven.compiler.source>
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  <hamcrest.version>1.3</hamcrest.version>
  <junit.version>4.12</junit.version>
  <guava-testlib.version>21.0</guava-testlib.version>
 </properties>
</project>
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Found
in path(s):
* /opt/cola/permits/1177956791_1625584358.42/0/jctools-core-3-0-0-5-jar/META-INF/maven/org.jctools/jctools-core/pom.xml

1.212 flyway-commandline 7.3.1

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We call this license the "Lesser" General Public License because it does Less to protect the user's freedom than the ordinary General Public License. It also provides other free software developers Less of an advantage over competing non-free programs. These disadvantages are the reason we use the ordinary General Public License for many libraries. However, the Lesser license provides advantages in certain special circumstances.

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In other cases, permission to use a particular library in non-free programs enables a greater number of people to use a large body of free software. For example, permission to use the GNU C Library in non-free programs enables many more people to use the whole GNU operating system, as well as its variant, the GNU/Linux operating system.

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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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1.215 golang 1.8

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1.218 hd-parm 9.38

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1.221 @tensorflow/tfjs-core 3.11.0

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xId: number, batch: number, imageHeight: number, imageWidth: number,\n numChannels: number, outId:
number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmFlipLeftRight =
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imageHeight\n 'number', // imageWidth\n 'number', // numChannels\n 'number', // outId\n]);\n}\n\nexport
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{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:
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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):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/tf-backend-wasm.js
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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):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/backend_wasm.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/backend_wasm.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/backend_wasm.js
No license file was found, but licenses were detected in source scan.

{"version":3,"file":"Tanh.js","sourceRoot":"","sources":["../../src/kernels/Tanh.ts"],"names":[],"mappings":"AAAA;;;;;;;;;;;;;;GAeG;AACH,OAAO,EAAe,IAAI,EAAE,MAAM,uBAAuB,CAAC;AAEzD,OAAO,EAAE,uBAAuB,EAAE,MAAM,gBAAgB,CAAC;AACvD,MAAM,CAAC,MAAM,UAAU,GAAG,IAAI,CAAC,MAAM,CAAC,MAAM,UAAU,GAAG,IAAI,CAAC,IAAI,CAAC,CAAC,CAAC

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 * ===\n
*/\nimport {KernelConfig, Tanh} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const tanhConfig: KernelConfig = createUnaryKernelConfig(Tanh);\n"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Tanh.js.map
No license file was found, but licenses were detected in source scan.

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Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/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.

{"version":3,"file":"Sin.js","sourceRoot":"","sources":["../../src/kernels/Sin.ts"],"names":[],"mappings":"AAAA;;;;;;;;;;;;;;;GAeG;AACH,OAAO,EAAe,GAAG,EAAC,MAAM,uBAAuB,CAAC;AAExD,OAAO,EAAC,uBAAuB,EAAC,MAAM,gBAAgB,CAAC;AAEvD,MAAM,CAAC,MAAM,SAAS,GAAiB,uBAAuB,CAAC,GAAG,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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF 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';\nexport const sinConfig: KernelConfig = createUnaryKernelConfig(Sin);\n"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Sin.js.map
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;;;;;;;;;;;;;;;GAeG;AACH,OAAO,EAAe,GAAG,EAAC,MAAM,uBAAuB,CAAC;AAExD,OAAO,EAAC,uBAAuB,EAAC,MAAM,gBAAgB,CAAC;AAEvD,MAAM,CAAC,MAAM,SAAS,GAAiB,uBAAuB,CAAC,GAAG,CAAC,CAAC","sourcesContent":["/**\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, Tan} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const tanConfig: KernelConfig = createUnaryKernelConfig(Tan);\n"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Tan.js.map
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{"version":3,"file":"Transpose.js","sourceRoot":"","sources":["../../src/kernels/Transpose.ts"],"names":[],"mappings":"AAAA;;;;;;;;;;;;;;;;;GAiBG;AAEH,OAAO,EAAC,YAAY,EAAE,GAAG,EAAC,MAAM,uBAAuB,CAAC;AAExD,OAAO,EAAC,uBAAuB,EAAC,MAAM,gBAAgB,CAAC;AAEvD,MAAM,CAAC,MAAM,aAAa,GAAiB,uBAAuB,CAAC,GAAG,EAAE,YAAY,CAAC,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 copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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, Transpose} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\n\nexport const transposeConfig: KernelConfig = createUnaryKernelConfig(Transpose);\n"]}

4E;IAC5E,+CAA+C;IAC/C,MAAM,CAAC,YAAY,EAAE,IAAI,CAAC,GAAG,iBAAiB,CAAC,MAAM,CAAC,CAAC,CAAC,KAAK,EAAE,KAAK,CAAC,IAAI,CAAC,CAAC;IAE3E,IAAI,UAAU,GAAG,IAAI,CAAC;IACtB,KAAK,IAAI,CAAC,GAAG,CAAC,EAAE,CAAC,GAAG,IAAI,CAAC,MAAM,EAAE,CAAC,EAAE,EAAE;QACpC,IAAI,IAAI,CAAC,CAAC,CAAC,KAAK,CAAC,EAAE;YACjB,UAAU,GAAG,KAAK,CAAC;SACpB;KACF;IACD,MAAM,QAAQ,GAAG,eAAe,CAAC,MAAM,CAAC,CAAC,CAAC,KAAK,EAAE,KAAK,CAAC,IAAI,CAAC,CAAC;IAC7D,MAAM,CAAC,CAAC,GAAG;QACR,MAAM,EAAE,MAAM,EAAE,CAAC,MAAM,EAAE,MAAM,CAAC,CAAC,CAAC,CAAC,MAAM;QACzC,UAAU;KACX,CAAC;IACF,OAAO,CAAC,CAAC;AACX,CAAC;AAED,MAAM,UAAU,KAAK,CAAC,IAAkB;IACtC,MAAM,EAAE,MAAM,EAAE,GAAG,IAAI,CAAC;IACxB,MAAM,EAAE,MAAM,EAAE,GAAG,MAAM,CAAC,KAAK,CAAC;IAChC,MAAM,CAAC,GAAG,MAAM,CAAC,MAAM,CAAC,CAAC,CAAC,CAAC,MAAM,CAAC;IACl

'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\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\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"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Transpose.js.map
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{"version":3,"file":"Minimum.js","sourceRoot":"","sources":["../../src/kernels/Minimum.ts"],"names":[],"mappings":"AAAA;;;;;;;;;;;;;;;GAeG;AACH,OAAO,EAAe,OAAO,EAAC,MAAM,uBAAuB,CAAC;AAE5D,OAAO,EAAC,wBAAwB,EAAC,MAAM,iBAAiB,CAAC;AACzD,OAAO,EAAC,MAAM,qBAAqB,CAAC;AAEpC,OAAO,EAAC,MAAM,EAAE,aAAa,EAAC,MAAM,aAAa,CAAC;AAClD,OAAO,EAAC,MAAM,EAAE,aAAa,EAAC,MAAM,aAAa,CAAC;AAClD,OAAO,EAAC,MAAM,EAAE,aAAa,EAAC,MAAM,aAAa,CAAC;AAClD,OAAO,EAAC,MAAM,EAAE,aAAa,EAAC,MAAM,aAAa,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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF 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';\nconst supportsFullBroadcast = false;\nexport const minimumConfig: KernelConfig =\n createBinaryKernelConfig(Minimum, supportsFullBroadcast);\n"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Minimum.js.map

No license file was found, but licenses were detected in source scan.

{"version":3,"file":"PadV2.js","sourceRoot":"","sources":["../../src/kernels/PadV2.ts"],"names":[],"mappings":"AAAA;;;;;;;;;;;;;;;GAeG;AAEH,OAAO,EAA2B,KAAK,EAA2B,IAAI,EAAC,MAAM,uBAAuB,CAAC;AAIrG,OAAO,EAAC,IAAI,EAAC,MAAM,QAAQ,CAAC;AAE5B,OAAO,EAAC,QAAQ,EAAC,MAAM,SAAS,CAAC;AAEjC,OAAO,EAAC,SAAS,EAAC,MAAM,UAAU,CAAC;AAEnC,OAAO,EAAC,IAAI,EAAC,MAAM,QAAQ,CAAC;AAE5B

=== 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\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"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/PadV2.js.map
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* ===
*/

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/FloorDiv.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/setup_test.js
*
 /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/GatherNd.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/RotateWithOffset.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/types.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/LogicalAnd.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-

wasm/dist/kernels/ArgMax.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Cast.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Log.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/RealDiv.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Sum.js
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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Multiply.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Max.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/_FusedMatMul.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Exp.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Prelu.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/FusedConv2D.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Rsqrt.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/GreaterEqual.js
*
/opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Sub.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/ExpandDims.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/RealDiv.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/ArgMax.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/AvgPool.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Min.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Relu.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/FloorDiv.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/LeakyRelu.d.ts
*
/opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/binary_kernel.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/NonMaxSuppressionV5.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Greater.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Add.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Rsqrt.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Tanh.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Concat.d.ts

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/binary_kernel.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/GatherV2.d.ts
*
/opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/ScatterNd.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Sigmoid.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/GatherNd.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/BatchMatMul.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/NonMaxSuppressionV3.ts
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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/FusedDepthwiseConv2D.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Multiply.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/NonMaxSuppressionV5.ts
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/opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Prelu.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Cos.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/AddN.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Minimum.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/FlipLeftRight.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Log.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Tile.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/FusedConv2D.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/RealDiv.d.ts
*
/opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/LeakyRelu.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/DepthToSpace.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Tanh.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/unary_kernel.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/index.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/GreaterEqual.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Sub.d.ts

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/ResizeBilinear.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Maximum.ts
*
/opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/SquaredDifference.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Tanh.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/index_test.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/FusedConv2D.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Concat.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Greater.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/BatchMatMul.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Log.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/FusedBatchNorm.ts
*
/opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Unpack.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Transpose.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/AvgPool.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Add.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Less.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Reshape.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/ResizeBilinear.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/index_test.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Pow.d.ts
*
/opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Abs.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/NonMaxSuppressionV3.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Conv2D.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/LessEqual.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/binary_kernel.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/GatherNd.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/CropAndResize.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Tile.ts

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Sum.d.ts
*
 /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Relu6.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Square.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Max.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Square.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/types.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/unary_kernel.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/LeakyRelu.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Relu.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/SquaredDifference.d.ts
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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/ClipByValue.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/RotateWithOffset.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/FloorDiv.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/LogicalAnd.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Less.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Slice.js
*
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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Relu6.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/ClipByValue.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Prelu.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/FusedDepthwiseConv2D.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/ScatterNd.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/FlipLeftRight.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/BatchMatMul.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/MaxPool.js
*

/opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/CropAndResize.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Sum.ts
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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/GatherV2.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/FlipLeftRight.ts
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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/AddN.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/ClipByValue.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Sin.d.ts
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/opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Cos.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/_FusedMatMul.d.ts
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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Pow.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Conv2D.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/GatherV2.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Sigmoid.js

*
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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/ResizeBilinear.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Greater.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Max.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Reshape.d.ts
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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Reshape.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/PadV2.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/ArgMax.ts
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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Unpack.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Transpose.ts
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/opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/wasm-out/tfjs-backend-wasm.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/types.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Concat.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Transpose.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/AddN.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/ExpandDims.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/CropAndResize.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Maximum.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/MaxPool.ts

*
 /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Min.d.ts
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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/ExpandDims.d.ts
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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/NonMaxSuppression_util.js
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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Sigmoid.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/LessEqual.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-

wasm/dist/kernels/Maximum.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/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":"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 * @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// 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 * @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, 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 ${biasData.shape.length}.`);\n }\n biasId = biasData.id;\n }\n const preluActivationWeightsId = preluActivationWeights == null ?\n 0 :\n backend.dataIdMap.get(preluActivationWeights.dataId).id;\n const fusedActivation =\n FusableActivation[activation as {} as keyof typeof FusableActivation];\n if (fusedActivation == null) {\n throw new Error(\n `${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 * @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 * @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 {Abs, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\n\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 \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 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\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 License.\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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==========\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 * @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
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==========\n */\n\nimport {AddN, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {CppDType} 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, 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 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed
to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {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 * @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, KernelFunc, TensorInfo, Transpose, TransposeAttrs, TransposeInputs} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {identity} from './Identity';\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\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 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","/**\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 {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 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
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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 * @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 = 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. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance 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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  */\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 */\n\nimport {ArgMax, ArgMaxAttrs, ArgMaxInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {permuteAxesAndTranspose} from './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\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 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 *\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

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 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
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==========================================================================\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\nfunction 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,
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 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,
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
```

Int32Array(b3d.shape).buffer);\n\n wasmBatchMatMul(\n   a3dId, aShapeBytes, a3d.shape.length, b3dId,\n   bShapeBytes,\n   b3d.shape.length, transposeA, transposeB, outId);\n\n backend.disposeData(a3d.dataId);\n backend.disposeData(b3d.dataId);\n\n out.shape = outShape;\n return out;\n}\n\nexport const batchMatMulConfig: KernelConfig = {\n kernelName: BatchMatMul,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: batchMatMul 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, buffer, Slice, slice_util, util } from '@tensorflow/tfjs-core';\nimport { assertNotComplex } from '../cpu_util';\nexport function sliceImpl(vals, begin, size, shape, dtype) {\n   const isContinous = slice_util.isSliceContinous(shape, begin, size);\n   const length = util.sizeFromShape(size);\n   const xStrides = util.computeStrides(shape);\n   if (isContinous) {\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) :\n   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}\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}\nexport const sliceConfig = {\n   kernelName: Slice,\n   backendName: 'cpu',\n   kernelFunc: slice\n};\n//# sourceMappingURL=data:application/json; base64,eyJ2ZXJzaW9uIjozLCJmaWxlIjoiU2xpY2UuanMiLCJzb3VyY2VSb290IjoiIiwic291cmNlcyI6WyIuLi8uLi8uLi8uLi8uLi8uLi90ZmpzLWJhY2tlbmQtY3B1L3NyYy9rZXJuZWxzL1NsaWNlLnRzIl0sIm5hbWVzIjpbXSwibWFwcGluZ3MiOiJBQUFBOzs7Ozs7Ozs7Ozs7R0FlRzs7QUFBQSxPQUFPLEVBQUUsWUFBWSxFQUFFLE1BQU0sRUFBRSxLQUFLLEVBQUUsV0FBVyxFQUFFLElBQUksRUFBRSxNQUFNLHVCQUF1QjtBQUFBLE9BQU8sRUFBRSxnQkFBZ0IsRUFBRSxNQUFNLGFBQWE7QUFBQSxNQUFNLFVBQVUsUUFBUSxDQUFDLElBQUksRUFBRSxLQUFLLEVBQUUsSUFBSSxFQUFFLEtBQUssRUBBQUEsTUFBTSxXQUFXLEdBQUcsV0FBVyxDQUFDLEtBQUssRUFBRSxLQUFLLEVBQUUsSUFBSSxDQUFDO0FBQUEsTUFBTSxNQUFNLEdBQUcsSUFBSSxDQUFDLGNBQWMsQ0FBQyxLQUFLLENBQUM7QUFBQSxNQUFNLE1BQU0sT0FBTyxHQUFHLElBQUksQ0FBQyxlQUFlLENBQUMsS0FBSyxDQUFDO0FBQUEsTUFBTSxJQUFJLFVBQVUsRUFBRTtBQUFBLFFBQU0sTUFBTSxVQUFVLEdBQUcsV0FBVyxDQUFDLGlCQUFpQixDQUFDLEtBQUssRUFBRSxPQUFPLENBQUM7QUFBQSxRQUFNLElBQUksS0FBSyxLQUFLLFFBQVEsRUFBRTtBQUFBLFVBQVEsT0FBTyxJQUFJLENBQUMsS0FBSyxDQUFDLFVBQVUsRUFBRSxVQUFVLEdBQUcsTUFBTSxDQUFDO0FBQUEsUUFBQztBQUFBLFFBQU0sT0FBTyxJQUFJLENBQUMsUUFBUSxDQUFDLFVBQVUsRUFBRSxVQUFVLEdBQUcsTUFBTSxDQUFDO0FBQUEsTUFBQztBQUFBLE1BQU0sTUFBTSxXQUFXLEdBQUcsS0FBSyxLQUFLLFFBQVEsR0FBRyxZQUFZLENBQUMsc0JBQXNCLENBQUMsSUFBSSxDQUFDLEdBQUcsSUFBSTtBQUFBLE1BQU0sTUFBTSxLQUFLLEdBQUcsTUFBTSxDQUFDLEtBQUssRUFBRSxLQUFLLEVBQUUsV0FBVyxDQUFDO0FBQUEsTUFBTSxNQUFNLE1BQU0sR0FBRyxNQUFNLENBQUMsSUFBSSxFQUFFLEtBQUssQ0FBQztBQUFBLE1BQU0sS0FBSyxJQUFJLENBQUMsR0FBRyxDQUFDLEVBQUUsQ0FBQyxHQUFHLE1BQU0sQ0FBQyxJQUFJLEVBQUUsRUFBRSxDQUFDLEVBQUU7QUFBQSxRQUFNLE1BQU0sTUFBTSxHQUFHLE1BQU0sQ0FBQyxXQUFXLENBQUMsQ0FBQyxDQUFDO0FBQUEsUUFBTSxNQUFNLEtBQUssR0FBRyxNQUFNLENBQUMsR0FBRyxDQUFDLENBQUMsR0FBRyxFQUFFLENBQUMsS0FBSyxHQUFHLEdBQUcsS0FBSyxDQUFDLENBQUMsQ0FBQyxDQUFDO0FBQUEsUUFBTSxNQUFNLENBQUMsR0FBRyxDQUFDLEtBQUssQ0FBQyxHQUFHLEtBQUssQ0FBQyxFQUFFLEdBQUcsTUFBTSxDQUFDO0FBQUEsTUFBQztBQUFBLE1BQU0sSUFBSSxVQUFVLEVBQUU7QUFBQSxRQUFNLE9BQU8sWUFBWSxDQUFDLHNCQUFzQixDQUFDLE1BQU0sQ0FBQyxNQUFNLENBQUM7QUFBQSxNQUFDO0FBQUEsTUFBTSxPQUFPLE1BQU0sQ0FBQztBQUFBLElBQUM7QUFBQSxPQUFPLFNBQVMsS0FBSyxDQUFDLElBQUksRUFBRTtBQUFBLE1BQU0sTUFBTSxFQUFFLE1BQU0sRUFBRSxPQUFPLEVBQUUsS0FBSyxFQUFFLEdBQUcsSUFBSTtBQUFBLE1BQU0sTUFBTSxFQUFFLENBQUMsRUFBRSxHQUFHLE1BQU07QUFBQSxNQUFNLE1BQU0sRUFBRSxLQUFLLEVBQUUsSUFBSSxFQUFFLEdBQUcsS0FBSztBQUFBLE1BQU0sZ0JBQWdCLENBQUMsQ0FBQyxFQUFFLE9BQU8sQ0FBQztBQUFBLE1BQU0sTUFBTSxDQUFDLE1BQU0sRUFBRSxNQUFNLENBQUMsR0FBRyxXQUFXLENBQUMsZ0JBQWdCLENBQUMsQ0FBQyxFQUFFLEtBQUssRUFBRSxJQUFJLENBQUM7QUFBQSxNQUFNLFdBQVcsQ0FBQyxnQkFBZ0IsQ0FBQyxDQUFDLEVBQUUsTUFBTSxFQUFFLEtBQUssQ0FBQztBQUFBLE1BQU0sTUFBTSxJQUFJLEdBQUcsT0FBTyxDQUFDLElBQUksQ0FBQyxDQUFDLENBQUMsTUFBTTtBQUFBLE1BQU0sTUFBTSxPQUFPLEdBQUcsU0FBUyxDQUFDLElBQUksRUFBRSxNQUFNLEVBQUUsS0FBSyxFQUFFLENBQUMsQ0FBQyxLQUFLLEVBQUUsQ0FBQyxDQUFDLEtBQUssQ0FBQztBQUFBLE1BQU0sT0FBTyxPQUFPLENBQUMsY0FBYyxDQUFDLEtBQUssRUFBRSxDQUFDLENBQUMsS0FBSyxFQUFFLE9BQU8sQ0FBQztBQUFBLElBQUM7QUFBQSxPQUFPLE1BQU0sV0FBVyxHQUFHO0FBQUEsSUFBSSxVQUFVLEVBQUUsS0FBSztBQUFBLElBQUksV0FBVyxFQUFFLEtBQUs7QUFBQSxJQUFJLFVBQVUsRUFBRSxLQUFLO0FBQUEsRUFBSSxDQUFDO0FBQUEsT0FBTyxNQUFNLFdBQVcsR0FBRztBQUFBLElBQUksVUFBVSxFQUFFLEtBQUs7QUFBQSxJQUFJLFdBQVcsRUFBRSxLQUFLO0AAAUEsVUFBVSxFQUFFLEtBQUs7QUFBQSxFQUFJLENBQUMiLCJzb3VyY2VzQ29udGVudCI6WyIvKiBDb3B5cmlnaHQgMjAyMCBHb29nbGUgTExDLiBBbGwgUmlnaHRzIFJlc2VydmVkLlxuXG5MaWNlbnNlZCB1bmRlciB0aGUgQXBhY2hlIExpY2Vuc2UsIFZlcnNpb24gMi4wICh0aGUgXCJMaWNlbnNlXCIpO1xueW91IG1heSBub3QgdXNlIHRoaXMgZmlsZSBleGNlcHQgaW4gY29tcGxpYW5jZSB3aXRoIHRoZSBMaWNlbnNlLlxuWW91IG1heSBvYnRhaW4gYSBjb3B5IG9mIHRoZSBMaWNlbnNlIGF0XG5cbmh0dHA6Ly93d3cuYXBhY2hlLm9yZy9saWNlbnNlcy9MSUNFTlNFLTIuMFxuXG5Vbmxlc3MgcmVxdWlyZWQgYnkgYXBwbGljYWJsZSBsYXcgb3IgYWdyZWVkIHRvIGluIHdyaXRpbmcsIHNvZnR3YXJlXG5kaXN0cmlidXRlZCB1bmRlciB0aGUgTGljZW5zZSBpcyBkaXN0cmlidXRlZCBvbiBhbiBcIkFTIElTXCIgQkFTSVMsXG5XSVRIT1VUIFdBUlJBTlRJRVMgT1IgQ09ORElUSU9OUyBPRiBBTlkgS0lORCwgZWl0aGVyIGV4cHJlc3Mgb3IgaW1wbGllZC5cblNlZSB0aGUgTGljZW5zZSBmb3IgdGhlIHNwZWNpZmljIGxhbmd1YWdlIGdvdmVybmluZyBwZXJtaXNzaW9ucyBhbmRcbmxpbWl0YXRpb25zIHVuZGVyIHRoZSBMaWNlbnNlLlxuXG49PT09PT09PT09

DLEVBQUUsQ0FBQyxHQUFHLE1BQU0sQ0FBQyxJQUFJLEVBQUUsRUFBRSxDQUFDLEVBQUU7UUFDc
EMsTUFBTSxNQUFNLEdBQUcsTUFBTSxDQUFDLFVBQVUsQ0FBQyxDQUFDLENBQUMsQ0FBQztRQUN
wQyxNQUFNLEtBQUssR0FBRyxNQUFNLENBQUMsR0FBRyxDQUFDLENBQUMsR0FBVyxFQUFFLENBQ
UMsRUFBRSxFQUFFLENBQUMsR0FBRyxHQUtBQUssQ0FBQyxDQUFDLENBQUMsQ0FBQyxDQUF
DO1FBQzdELE1BQU0sQ0FBQyxHQUFHLENBQUMsS0FBSyxDQUFDLEdBQUcsQ0FBQyxDQUFDLENBQUMsQ0FBQyxDQUFDLENBQUMsQ0FBQyxDQUFDLENBQUMsQ0FBQyxDQUFDLENBQUMsQ0FBQ
sQ0FBQyxFQUFFLEdBQUcsQ0FBQyxDQUFDLENBQUMsQ0FBQyxDQUFDLENBQUMsQ0FBQyxDQUFDLENBQUMsQ0FBQyxDQUFDLENBQUMsQ0FBQyxDQUFDLENBQUMsQ0FBQyxDQUFDLENBQUMsR
QUFRLEVBQUU7UUFDdEIsT0FBTyxZQUFZZLENBQUMsc0JBQXNCLENBQUMsTUFBTSxDQUFDLE1BQ
WtCLENBQUMsQ0FBQztLQUN2RTtJQUNELE9BQU8sTUFBTSxDQUFDLE1BQU0sQ0FBQyxNQUFNLENBQUMsQ0FBQyxDQUFDLENBQUMsQ0FBQyxDQUFDLENBQUMsQ0FBQyxDQUFDLENBQUMsQ0FBQyxDQUFDLENBQUMsQ0FBQyxDQUFD

XG5cbiAgY29uc3QgZGVjb2RlZERhdGEgPSBkdHlwZSA9PT0gJ3N0cmluZycgP1xuICAgICAgYmFja2VuZF91dGlsLmZyb21VaW50OFRvU3RyaW5nQXJyYXkodmFscyBhcyBVaW50OEFycmF5W10pIDpcbiAgICAgIHZhbHMgYXMgVHlwZWRBcnJheTtcblxuICBjb25zdCBpbkJ1ZiA9IGJ1ZmZlcihzaGFwZSwgZHR5cGUsIGRlY29kZWREYXRhKTtcbiAgY29uc3Qgb3V0QnVmID0gYnVmZmVyKKHNpemUsIGR0eXBlKTtcbiAgY29uc3Qgb3V0TG9jID0gb3V0BuZGV4V G9Mb2MoaSk7XG4gaW5bal0pO1xuICAgIG91dEJ1ZiA9IG91dEJ1ZmZlcihzaGFwZSwgZHR5cGUsIGRlY29kZWREYXRhKTtcbiAgICBvdXRCdWYgPSBvdXRCdWYgPSBvdXRCdWYgPS

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\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 * @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 {backend_util, BatchToSpaceND, BatchToSpaceNDAttrs, BatchToSpaceNDInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {reshape} from './Reshape';\nimport {slice} from './Slice';\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: {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\nexport const batchToSpaceNDConfig: KernelConfig = {\n kernelName: BatchToSpaceND,\n backendName: 'wasm',\n kernelFunc: batchToSpaceND 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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a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {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\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 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, Ceil} from '@tensorflow/tfjs-core';\n\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\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 = $inputs.map(t => {\n      const innerSize = util.sizeFromShape(t.shape.slice(axis));\n      const shape = [-1, innerSize];\n
      return reshape({inputs: {x: t}, backend, attrs: {shape}});\n    });\n\n    const inputsValShapes = inputs2D.map(t => {\n      return {vals: backend.readSync(t.dataId), shape: t.shape};\n    });\n\n    // Concats 2d tensors along axis=1.\n    outShape =\n        backend_util.computeOutShape(inputs2D.map(t => t.shape), 1 /* axis */);\n    const simplyConcat = inputs2D[0].shape[0] === 1;\n    const outVals = concatImplCPU(\n        inputsValShapes, outShape, inputs[0].dtype,\n                    simplyConcat) as string[];\n\n    const finalOutShape =\n        backend_util.computeOutShape($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\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 Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance
 with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF 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, util } from '@tensorflow/tfjs-core';\nexport function concatImpl(inputs, outShape, dtype, simplyConcat) {\n    const outVals = util.getArrayFromDType(dtype, util.sizeFromShape(outShape));\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.set(input.vals,
```

offset);\n offset += size;\n });\n }\n else {\n let colOffset = 0;\n inputs.forEach(input => {\n const decodedData = dtype === 'string' ?\n backend_util.fromUint8ToStringArray(input.vals) :\n input.vals;\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 }\n colOffset += input.shape[1];\n });\n }\n return outVals;\n}\n//#
sourceMappingURL=data:application/json; base64,eyJ2ZXJzaW9uIjozLCJmaWxlIjoiQ29uY2F0X2ltcGwuanMiLC
Jzb3VyY2VSb290IjoiIiwic291cmNlcyI6WyIuLi8uLi8uLi8uLi8uLi8uLi90ZmpzLWJhY2tlbmQtY3B1L3NyYy9rZ
XJuZWxzL0NvbmNhdF9pbXBsLnRzIl0sIm5hbWVzIjpbXSwibWFwcGluZ3MiOiJBQUFBOzs7Ozs7Ozs7Ozs
s7R0FlRztBQUVILE9BQU8sRUFBQyxXVDLElBQUksRUFBQyxNQUFNLHVCQUF1QixDQUFDO0FBRTVDLE1BQU0sVUFBVSxVQUFVLENBQUMsTUFBb0IsRUFBRSxJQUFZO0lBQ3ZELE1BQU0sTUFBTSxHQUFHLE1BQU0sQ0FBQyxNQUFNLENBQUM7SUFDN0IsTUFBTSxLQUFLLEdBQUcsTUFBTSxDQUFDLEtBQUssQ0FBQztJQUMzQixNQUFNLFFBQVEsR0FBRyxNQUFNLENBQUMsUUFBUSxDQUFDO0lBQ2pDLE1BQU0sS0FBSyxHQUFHLE1BQU0sQ0FBQyxLQUFLLENBQUM7SUFDM0IsTUFBTSxRQUFRLEdBQUcsTUFBTSxDQUFDLFFBQVEsQ0FBQztJQUNqQyxNQUFNLFFBQVEsR0FBRyxNQUFNLENBQUMsUUFBUSxDQUFDO0lBQ2pDLE1BQU0sUUFBUSxHQUFHLE1BQU0sQ0FBQyxRQUFRLENBQUM7SUFDakMsTUFBTSxRQUFRLEdBQUcsTUFBTSxDQUFDLFFBQVEsQ0FBQztJQUNqQyxNQUFNLFFBQVEsR0FBRyxNQUFNLENBQUMsUUFBUSxDQUFDO0lBQ2pDLE1BQU0sUUFBUSxHQUFHLE1BQU0sQ0FBQyxRQUFRLENBQUM7SUFDakMsTUFBTSxRQUFRLEdBQUcsTUFBTSxDQUFDLFFBQVEsQ0FBQztJQUNqQyxNQUFNLFFBQVEsR0FBRyxNQUFNLENBQUMsUUFBUSxDQUFDO0lBQ2pDLE1BQU0sUUFBUSxHQUFHLE1BQU0sQ0FBQyxRQUFRLENBQUM7SUFDakMsTUFBTSxRQUFRLEdBQUcsTUFBTSxDQUFDLFFBQVEsQ0FBQztJQUNqQyxNQUFNLFFBQVEsR0FBRyxNQUFNLENBQUMsUUFBUSxDQUFDO0lBQ2pDLE1BQU0sUUFBUSxHQUFHLE1BQU0sQ0FBQyxRQUFRLENBQUM7SUFDakMsTUFBTSxRQUFRLEdBQUcsTUFBTSxDQUFDLFFBQVEsQ0FBQztJQUNqQyxNQUFNLFFBQVEsR0FBRyxNQUFNLENBQUMsUUFBUSxDQUFDO0lBQ2pDLE1BQU0sUUFBUSxHQUFHLE1BQU0sQ0FBQyxRQUFRLENBQUM7SUFDakMsTUFBTSxRQUFRLEdBQUcsTUFBTSxDQUFDLFFBQVEsQ0FBQztJQUNqQyxNQUFNLFFBQVEsR0FBRyxNQUFNLENBQUMsUUFBUSxDQUFDO0lBQ2pDLE1BQU0sUUFBUSxHQUFHLE1BQU0sQ0FBQyxRQUFRLENBQUM7SUFDakMsTUFBTSxRQUFRLEdBQUcsTUFBTSxDQUFDLFFBQVEsQ0FBQztJQUNqQyxNQUFNLFFBQVEsR0FBRyxNQUFNLENBQUMsUUFBUSxDQUFDO0lBQ2pDLE1BQU0sUUFBUSxHQUFHLE1BQU0sQ0FBQyxRQUFRLENBQUM7SUFDakMsTUFBTSxRQUFRLEdBQUcsTUFBTSxDQUFDLFFBQVEsQ0FBQztJQUNqQyxNQUFNLFFBQVEsR

cGUpKTtcblxuICBpZiAoc2ltcGx5Q29uY2F0ICYmIGR0eXBlICE9PSAnc3RyaW5nJykge1xuICAgIC8vIFVzZSBidWlsdC1pbiBUeXBlZEFycmF5LnNldCgpIG1ldGhvZCBmb3Igc3BlZWQuXG4gICAgbGV0IG9mZnNldCA9IDA7XG4gICAgaW5wdXRzLmZvckVhY2goaW5wdXQgPT4ge1xuICAgICAgY29uc3Qgc2l6ZSA9IHV0aWwuc2l6ZUZyb21TaGFwZShpbnB1dC5zaGFwZSk7XG4gICAgICBiYWNrZW5kLnNldCh0ZW5zb3JzQnlJZFtpbnB1dC5pZF0uZGF0YUlkLCBvZmZzZXQpO1xuICAgICAgb2Zmc2V0ICs9IHNpemU7XG4gICAgfSk7XG4gIH0gZWxzZSB7XG4gICAgY29uc3QgdG90YWxTaXplID0gdXRpbC5zaXplRnJvbVNoYXBlKHRlbnNvci5zaGFwZSk7XG4gICAgYmFja2VuZC5zZXQodGVuc29yLmRhdGFJZC5kYXRhSWQsIDAsIHRvdGFsU2l6ZSk7XG4gIH1cbiAgcmV0dXJuIHRlbnNvcjtcbn1cblxuZXhwb3J0IGNvbnN0IHNldHVwQ29uZzJkID0gKGJhY2tlbmQpID0+IHtcbiAgc2V0dXAoYmFja2VuZCk7XG59O1xuXG5leHBvcnQgY29uc3QgcmVzZXRDb252MmREZWJVZyA9IChiYWNrZW5kKSA9PiB7XG4gIHJlc2V0KGJhY2tlbmQpO1xufTtcblxuZXhwb3J0IGNvbnN0IGNvbnYyZCA9IChhcmdzKSA9PiB7XG4gIGNvbnN0IHtpbnB1dHMsIGJhY2tlbmQsIGF0dHJzfSA9IGFyZ3M7XG4gIGNvbnN0IHt4LCBmaWx0ZXJ9ID0gaW5wdXRzO1xuICBjb25zdCB4SWQgPSBiYWNrZW5kLmRhdGFJZE1hcC5nZXQoeC5kYXRhSWQpLmlkO1xuICBjb25zdCBmaWx0ZXJJZCA9IGJhY2tlbmQuZGF0YUlkTWFwLmdldChmaWx0ZXIuZGF0YUlkKS5pZDtcbiAgY29uc3Qge3N0cmlkZXMsIGRpbGF0aW9uLCBwYWQsIGRpbVJvdW5kaW5nTW9kZSwgZGF0YUZvcm1hdH0gPSBhdHRyczsiLCIvKipcbiAqIEBsaWNlbnNlXG4gKiBDb3B5cmlnaHQgMjAxOSBHb29nbGUgTExDLiBBbGwgUmlnaHRzIFJlc2VydmVkLlxuICogTGljZW5zZWQgdW5kZXIgdGhlIEFwYWNoZSBMaWNlbnNlLCBWZXJzaW9uIDIuMCAodGhlIFwiTGljZW5zZVwiKTtcbiAqIHlvdSBtYXkgbm90IHVzZSB0aGlzIGZpbGUgZXhjZXB0IGluIGNvbXBsaWFuY2Ugd2l0aCB0aGUgTGljZW5zZS5cbiAqIFlvdSBtYXkgb2J0YWluIGEgY29weSBvZiB0aGUgTGljZW5zZSBhdFxuICpcbiAqIGh0dHA6Ly93d3cuYXBhY2hlLm9yZy9saWNlbnNlcy9MSUNFTlNFLTIuMFxuICpcbiAqIFVubGVzcyByZXF1aXJlZCBieSBhcHBsaWNhYmxlIGxhdyBvciBhZ3JlZWQgdG8gaW4gd3JpdGluZywgc29mdHdhcmVcbiAqIGRpc3RyaWJ1dGVkIHVuZGVyIHRoZSBMaWNlbnNlIGlzIGRpc3RyaWJ1dGVkIG9uIGFuIFwiQVMgSVNcIiBCQVNJUyxcbiAqIFdJVEhPVVQgV0FSUkFOVElFUyBPUiBDT05ESVRJT05TIE9GIEFOWSBLSU5ELCBlaXRoZXIgZXhwcmVzcyBvciBpbXBsaWVkLlxuICogU2VlIHRoZSBMaWNlbnNlIGZvciB0aGUgc3BlY2lmaWMgbGFuZ3VhZ2UgZ292ZXJuaW5nIHBlcm1pc3Npb25zIGFuZFxuICogbGltaXRhdGlvbnMgdW5kZXIgdGhlIExpY2Vuc2UuXG4gKlxuICogPT09PT09PT09P

(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 */\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\nexport const conv2DBackpropInputConfig: KernelConfig = {\n kernelName: Conv2DBackpropInput,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: conv2DBackpropInput 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 {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","/**\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 {Cos, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\n\nexport const cosConfig: KernelConfig = createUnaryKernelConfig(Cos);\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 {Cosh, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\n\nexport const coshConfig: KernelConfig = createUnaryKernelConfig(Cosh);\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, 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\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\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 * @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

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 * 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 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
 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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}\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 Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 * 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 {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 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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==========\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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BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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
*/\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 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 {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 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 {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

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 the License.\n *
==========================================================================\n
*/\n\nimport {FloorDiv, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'./binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const floorDivConfig: KernelConfig =\n
createBinaryKernelConfig(FloorDiv, supportsFullBroadcast);\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
*/\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
```

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=== '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\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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:\n number, filterWidth: number,\n     biasId: number, padTop: number, padRight: number, padBottom: number,\n padLeft: number, isSamePad: number, dilationHeight: number,\n     dilationWidth: number, strideHeight: number, stride\nWidth: 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}\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\n 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 ${biasData.shape.length}.`);\n    }\n
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if (biasData.shape[0] !== outputChannels) {\n throw new Error(\n `FusedDepthwiseConv2D bias shape (${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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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\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 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 * @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, 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 {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 },\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 * @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, 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\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF 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';\n\nimport {createBinaryKernelConfig} from './binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const greaterConfig: KernelConfig =\n createBinaryKernelConfig(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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF 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';\n\nimport {createBinaryKernelConfig} from './binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const greaterEqualConfig: KernelConfig =\n createBinaryKernelConfig(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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {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\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\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, 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 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 *\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 LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 * 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, 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 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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';\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 //\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 * @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;\nexport const maximumConfig: KernelConfig =\n  createBinaryKernelConfig(Maximum, 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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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\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 * 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, KernelConfig, KernelFunc, Min, MinAttrs, MinInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {permuteAxesAndTranspose} from './kernel_utils';\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\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\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\nexport 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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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, 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\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

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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, Neg} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\nexport const negConfig: KernelConfig = createUnaryKernelConfig(Neg);\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
*/\n\nimport {BackendWasm} from '../backend_wasm';\n\n// Analogous to `struct Result` in
`non_max_suppression_impl.h`.\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
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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}\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 {} 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, 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 {} 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, 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,\n   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 * @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 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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.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 * @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, Pack, PackAttrs, PackInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm}\n 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
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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, 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, 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 * @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, 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 = 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 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, Pow} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = false;\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {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\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\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 '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\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 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, 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\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\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\nexport const resizeBilinearConfig: KernelConfig = {\n kernelName: ResizeBilinear,\n 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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License
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==========\n
*/\n\nimport {KernelConfig, KernelFunc, Range, RangeAttrs, TensorInfo} from '@tensorflow/tfjs-core';\n\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\n const out = backend.makeOutput([values.length], dtype);\n   const outVals = backend.typedArrayFromHeap(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 2020 Google LLC. All Rights

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==========\n */\nimport { util } from '@tensorflow/tfjs-core';\nexport function rangeImpl(start, stop, step, dtype) {\n const sameStartStop = start === stop;\n const increasingRangeNegativeStep = start < stop && step < 0;\n const decreasingRangePositiveStep = stop < start && step > 1;\n if (sameStartStop || increasingRangeNegativeStep ||\n decreasingRangePositiveStep) {\n return util.makeZerosTypedArray(0, dtype);\n }\n const numElements = Math.abs(Math.ceil((stop - start) / step));\n const values = util.makeZerosTypedArray(numElements, dtype);\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 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//# sourceMappingURL=data:application/json; base64,eyJ2ZXJzaW9uIjozLCJmaWxlIjoiUmFuZ2VfaW1wbC5qcyIsInNvdXJjZVJvb3QiOiIiLCJzb3VyY2VzIjpbIi4uLy4uLy4uLy4uLy4uLy4uL3RmanMtYmFja2VuZC1jcHUvc3JjL3tlcm5lbHMvUmFuZ2VfaW1wbC50cyJdLCJuYW1lcyI6W10sIm1hcHBpbmdzIjoiQUFBQTs7Ozs7Ozs7Ozs7O0dBZUc7QUFFSCxPQUFPLEVBQUUsSUFBSSxFQUFFLE1BQU0sdUJBQXVCLENBQUM7QUFFN0MsTUFBTSxVQUFVLFNBQVMsQ0FBQyxLQUFhLEVBQUUsSUFBWSxFQUFFLElBQVksRUFBRSxLQUFlO0lBQ3BFLE1BQU0sYUFBYSxHQUFHLEtBQUssS0FBSyxJQUFJLENBQUM7SUFDckMsTUFBTSwyQkFBMkIsR0FBRyxLQUFLLEdBQUcsSUFBSSxJQUFJLEdBQUcsQ0FBQyxDQUFDO0lBQ3pELE1BQU0sMkJBQTJCLEdBQUcsSUFBSSxHQUFHLEtBQUssSUFBSSxJQUFJLEdBQUcsQ0FBQyxDQUFDO0lBQzdELElBQUksQ0FBQyxhQUFhLElBQUksMkJBQTJCLElBQUk7UUFDakQsMkJBQTJCLENBQUMsRUFBRTtRQUM1QixPQUFPLElBQUksQ0FBQyx1QkFBdUIsQ0FBQyxDQUFDLEVBQUUsS0FBSyxDQUFDLENBQUM7SUFDaEQsQ0FBQztJQUNELE1BQU0sV0FBVyxHQUFHLElBQUksQ0FBQyxHQUFHLENBQUMsSUFBSSxDQUFDLElBQUksQ0FBQyxDQUFDLElBQUksR0FBRyxLQUFLLENBQUMsR0FBRyxJQUFJLENBQUMsQ0FBQyxDQUFDO0lBQzlELE1BQU0sTUFBTSxHQUFHLElBQUksQ0FBQyx1QkFBdUIsQ0FBQyxXQUFXLEVBQUUsS0FBSyxDQUFDLENBQUM7SUFDaEUsSUFBSSxJQUFJLEdBQUcsS0FBSyxJQUFJLElBQUksS0FBSyxDQUFDLEVBQUU7UUFDOUIsMENBQTBDO1FBQzFDLDJCQUEyQjtRQUMzQixJQUFJLEdBQUcsQ0FBQyxDQUFDLENBQUM7SUFDWixDQUFDO0lBQ0QsTUFBTSxDQUFDLENBQUMsQ0FBQyxHQUFHLEtBQUssQ0FBQztJQUNsQixLQUFLLElBQUksQ0FBQyxHQUFHLENBQUMsRUFBRSxDQUFDLEdBQUcsTUFBTSxDQUFDLE1BQU0sRUFBRSxDQUFDLEVBQUUsRUFBRTtRQUN0QyxNQUFNLENBQUMsQ0FBQyxDQUFDLEdBQUcsTUFBTSxDQUFDLENBQUMsR0FBRyxDQUFDLENBQUMsR0FBRyxJQUFJLENBQUM7SUFDbEMsQ0FBQztJQUNELE9BQU8sTUFBTSxDQUFDO0FBQ2hCLENBQUM7QUFDRCxNQUFNLFVBQVUsU0FBUyxDQUFDLEtBQWEsRUFBRSxJQUFZLEVBQUUsSUFBWSxFQUFFLEtBQWU7SUFDcEUsTUFBTSxhQUFhLEdBQUcsS0FBSyxLQUFLLElBQUksQ0FBQztJQUNyQyxNQUFNLDJCQUEyQixHQUFHLEtBQUssR0FBRyxJQUFJLElBQUksR0FBRyxDQUFDLENBQUM7SUFDekQsTUFBTSwyQkFBMkIsR0FBRyxJQUFJLEdBQUcsS0FBSyxJQUFJLElBQUksR0FBRyxDQUFDLENBQUM7SUFDN0QsSUFBSSxDQUFDLGFBQWEsSUFBSSwyQkFBMkIsSUFBSTtRQUNqRCwyQkFBMkIsQ0FBQyxFQUFFO1FBQzVCLE9BQU8sSUFBSSxDQUFDLHVCQUF1QixDQUFDLENBQUMsRUFBRSxLQUFLLENBQUMsQ0FBQztJQUNoRCxDQUFDO0lBQ0QsTUFBTSxXQUFXLEdBQUcsSUFBSSxDQUFDLEdBQUcsQ0FBQyxJQUFJLENBQUMsSUFBSSxDQUFDLENBQUMsSUFBSSxHQUFHLEtBQUssQ0FBQyxHQUFHLElBQUksQ0FBQyxDQUFDLENBQUM7SUFDOUQsTUFBTSxNQUFNLEdBQUcsSUFBSSxDQUFDLHVCQUF1QixDQUFDLFdBQVcsRUFBRSxLQUFLLENBQUMsQ0FBQztJQUNoRSxJQUFJLElBQUksR0FBRyxLQUFLLElBQUksSUFBSSxLQUFLLENBQUMsRUFBRTtRQUM5QiwwQ0FBMEM7UUFDMUMsMkJBQTJCO1FBQzNCLElBQUksR0FBRyxDQUFDLENBQUMsQ0FBQztJQUNaLENBQUM7SUFDRCxNQUFNLENBQUMsQ0FBQyxDQUFDLEdBQUcsS0FBSyxDQUFDO0lBQ2xCLEtBQUssSUFBSSxDQUFDLEdBQUcsQ0FBQyxFQUFFLENBQUMsR0FBRyxNQUFNLENBQUMsTUFBTSxFQUFFLENBQUMsRUFBRSxFQUFFO1FBQ3RDLE1BQU0sQ0FBQyxDQUFDLENBQUMsR0FBRyxNQUFNLENBQUMsQ0FBQyxHQUFHLENBQUMsQ0FBQyxHQUFHLElBQUksQ0FBQztJQUNsQyxDQUFDO0lBQ0QsT0FBTyxNQUFNLENBQUM7QUFDaEIsQ0FBQztBQUNELE1BQU0sVUFBVSxTQUFTLENBQUMsS0FBYSxFQUFFLElBQVksRUFBRSxJQUFZLEVBQUUsS0FBZTtJQUNwRSxNQUFNLGFBQWEsR0FBRyxLQUFLLEtBQUssSUFBSSxDQUFDO0lBQ3JDLE1BQU0sMkJBQTJCLEdBQUcsS0FBSyxHQUFHLElBQUksSUFBSSxHQUFHLENBQUMsQ0FBQztJQUN6RCxNQUFNLDJCQUEyQixHQUFHLElBQUksR0FBRyxLQUFLLElBQUksSUFBSSxHQUFHLENBQUMsQ0FBQztJQUM3RCxJQUFJLENBQUMsYUFBYSxJQUFJLDJCQUEyQixJQUFJO1FBQ2pELDJCQUEyQixDQUFDLEVBQUU7UUFDNUIsT0FBTyxJQUFJLENBQUMsdUJBQXVCLENBQUMsQ0FBQyxFQUFFLEtBQUssQ0FBQyxDQUFDO0lBQ2hELENBQUM7SUFDRCxNQUFNLFdBQVcsR0FBRyxJQUFJLENBQUMsR0FBRyxDQUFDLElBQUksQ0FBQyxJQUFJLENBQUMsQ0FBQyxJQUFJLEdBQUcsS0FBSyxDQUFDLEdBQUcsSUFBSSxDQUFDLENBQUMsQ0FBQztJQUM5RCxNQUFNLE1BQU0sR0FBRyxJQUFJLENBQUMsdUJBQXVCLENBQUMsV0FBVyxFQUFFLEtBQUssQ0FBQyxDQUFDO0lBQ2hFLElBQUksSUFBSSxHQUFHLEtBQUssSUFBSSxJQUFJLEtBQUssQ0FBQyxFQUFFO1FBQzlCLDBDQUEwQztRQUMxQywyQkFBMkI7UUFDM0IsSUFBSSxHQUFHLENBQUMsQ0FBQyxDQUFDO0lBQ1osQ0FBQztJQUNELE1BQU0sQ0FBQyxDQUFDLENBQUMsR0FBRyxLQUFLLENBQUM7SUFDbEIsS0FBSyxJQUFJLENBQUMsR0FBRyxDQUFDLEVBQUUsQ0FBQyxHQUFHLE1BQU0sQ0FBQyxNQUFNLEVBQUUsQ0FBQyxFQUFFLEVBQUU7UUFDdEMsTUFBTSxDQUFDLENBQUMsQ0FBQyxHQUFHLE1BQU0sQ0FBQyxDQUFDLEdBQUcsQ0FBQyxDQUFDLEdBQUcsSUFBSSxDQUFDO0lBQ2xDLENBQUM7SUFDRCxPQUFPLE1BQU0sQ0FBQztBQUNoQixDQUFDIiwibmFtZXMiOltdLCJtYXBwaW5ncyI6IkFBQUE7Ozs7Ozs7Ozs

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V3IEVycm9yKFxuICAgICAgICBgVGhlIGlucHV0IGRhdGEgaXMgbm90IGFuIGFjY2VwdGVkIHR5cGVkIGFycmF5LmAgK1xuICAgICAgICBgIFRoZSBkdHlwZSBpcyAke2R0eXBlfSwgYCArXG4gICAgICAgIGBidXQgdGhlIGlucHV0IGRhdGEgaXMgb2YgdHlwZSAke2RhdGEuY29uc3RydWN0b3IubmFtZX0uYCArXG4gICAgICAgIGAgUGxlYXNlIGNoYW5nZSB0aGUgaW5wdXQgZGF0YSB0eXBlIG9yIHNldCBgICtcbiAgICAgICAgYGB0aGlzLmNvbmZpZy5kZWJ1ZyA9IHRydWVgIHRvIGV2YWx1YXRlIHRoZSBzdHJpbmcgdmFsdWVzLmApO1xuICB9XG59XG5cbmV4cG9ydCBmdW5jdGlvbiBjcmVhdGVUeXBlZEFycmF5KFxuICAgIGR0eXBlOiBEYXRhVHlwZSwgc2l6ZTogbnVtYmVyLCBjb3B5ID0gZmFsc2UpOiBUeXBlZEFycmF5IHtcbiAgaWYgKGR0eXBlID09PSAnZmxvYXQzMicpIHtcbiAgICByZXR1cm4gbmV3IEZsb2F0MzJBcnJheShzaXplKTtcbiAgfSBlbHNlIGlmIChkdHlwZSA9PT0gJ2ludDMyJykge1xuICAgIHJldHVybiBuZXcgSW50MzJBcnJheShzaXplKTtcbiAgfSBlbHNlIGlmIChkdHlwZSA9PT0gJ2Jvb2wnKSB7XG4gICAgcmV0dXJuIG5ldyBVaW50OEFycmF5KHNpemUpO1xuICB9IGVsc2Uge1xuICAgIHRocm93IG5ldyBFcnJvcihgVW5rbm93biBkYXRhIHR5cGUgJHtkdHlwZX1gKTtcbiAgfVxufVxuXG5leHBvcnQgZnVuY3Rpb24gdHlwZWRBcnJheVRvQXJyYXkoXG4gICAgZGF0YTogVHlwZWRBcnJheSwgZHR5cGU6IERhdGFUeXBlLCBkZWJ1ZzogYm9vbGVhbik6IEFycmF5PG51bWJlcj4ge1xuICBpZiAoZHR5cGUgPT09ICdmbG9hdDMyJyAmJiBkYXRhIGluc3RhbmNlb2YgRmxvYXQzMkFycmF5KSB7XG4gICAgcmV0dXJuIEFycmF5LmZyb20oZGF0YSk7XG4gIH0gZWxzZSBpZiAoZHR5cGUgPT09ICdpbnQzMicgJiYgZGF0YSBpbnN0YW5jZW9mIEludDMyQXJyYXkpIHtcbiAgICByZXR1cm4gQXJyYXkuZnJvbShkYXRhKTtcbiAgfSBlbHNlIGlmIChkdHlwZSA9PT0gJ2Jvb2wnICYmIGRhdGEgaW5zdGFuY2VvZiBVaW50OEFycmF5KSB7XG4gICAgcmV0dXJuIEFycmF5LmZyb20oZGF0YSk7XG4gIH0gZWxzZSBpZiAoZHR5cGUgPT09ICdzdHJpbmcnICYmIGRhdGEgaW5zdGFuY2VvZiBVaW50OEFycmF5KSB7XG4gICAgLy8gRGVjb2RlIGJ5dGVzIGludG8gc3RyaW5nLlxuICAgIGlmICghZGVidWcpIHtcbiAgICAgIHRocm93IG5ldyBFcnJvcihcbiAgICAgICAgICAnRGVidWcgbW9kZSBpcyBub3QgZW5hYmxlZC4gUGxlYXNlIGNhbGwgYHRmLmVudigpLnNldCgnICtcbiAgICAgICAgICAnXCJERUJVR1wiLCB0cnVlKWAgdG8gZW5hYmxlIGRlYnVnIG1vZGUgdG8gZGVjb2RlIGJ5dGVzIGludG8gJyArXG4gICAgICAgICAgJ2EgdXRmLTggc3RyaW5nLicpO1xuICAgIH1cbiAgICBjb25zdCBkZWNvZGVyID0gbmV3IFRleHREZWNvZGVyKCd1dGYtOCcpO1xuICAgIHJldHVybiBbZGVjb2Rlci5kZWNvZGUoZGF0YSldO1xuICB9IGVsc2Uge1xuICAgIHRocm93IG5ldyBFcnJvcihcbiAgICAgICAgYFVua25vd24gZGF0YSB0eXBlICR7ZHR5cGV9IGAgK1xuICAgICAgICBgb3IgY29ycmVzcG9uZGluZyBpbnB1dCBkYXRhIGlzIG5vdCBhICR7ZHR5cGV9IHR5cGVkIGFycmF5LmApO1xuICB9XG59XG5cbmV4cG9ydCBmdW5jdGlvbiBzaW5nbGVBcnJheUJ1ZmZlclRvVHlwZWRBcnJheShcbiAgICBkYXRhOiBBcnJheUJ1ZmZlciwgZHR5cGU6IERhdGFUeXBlKTogVHlwZWRBcnJheSB7XG4gIGlmIChkdHlwZSA9PT0gJ2Zsb2F0MzInKSB7XG4gICAgcmV0dXJuIG5ldyBGbG9hdDMyQXJyYXkoZGF0YSk7XG4gIH0gZWxzZSBpZiAoZHR5cGUgPT09ICdpbnQzMicpIHtcbiAgICByZXR1cm4gbmV3IEludDMyQXJyYXkoZGF0YSk7XG4gIH0gZWxzZSBpZiAoZHR5cGUgPT09ICdib29sJykge1xuICAgIHJldHVybiBuZXcgVWludDhBcnJheShkYXRhKTtcbiAgfSBlbHNlIGlmIChkdHlwZSA9PT0gJ3N0cmluZycpIHtcbiAgICB0aHJvdyBuZXcgRXJyb3IoXG4gICAgICAgICdTaW5nbGUgc3RyaW5nIHRlbnNvcnMgY2Fubm90IGJlIGNyZWF0ZWQgZnJvbSBhIHR5cGVkIGFycmF5LicpO1xuICB9IGVsc2Uge1xuICAgIHRocm93IG5ldyBFcnJvcihcbiAgICAgICAgYFVua25vd24gZGF0YSB0eXBlICR7ZHR5cGV9IGAgK1xuICAgICAgICBgb3IgY29ycmVzcG9uZGluZyBpbnB1dCBkYXRhIGlzIG5vdCBhICR7ZHR5cGV9IHR5cGVkIGFycmF5LmApO1xuICB9XG59XG5cbmV4cG9ydCBmdW5jdGlvbiBzaW5nbGVUeXBlZEFycmF5VG9BcnJheShcbiAgICBkYXRhOiBUeXBlZEFycmF5LCBkdHlwZTogRGF0YVR5cGUsIGRlYnVnOiBib29sZWFuKTogQXJyYXk8bnVtYmVyPiB7XG4gIGlmIChkdHlwZSA9PT0gJ2Zsb2F0MzInICYmIGRhdGEgaW5zdGFuY2VvZiBGbG9hdDMyQXJyYXkpIHtcbiAgICByZXR1cm4gQXJyYXkuZnJvbShkYXRhKTtcbiAgfSBlbHNlIGlmIChkdHlwZSA9PT0gJ2ludDMyJyAmJiBkYXRhIGluc3RhbmNlb2YgSW50MzJBcnJheSkge1xuICAgIHJldHVybiBBcnJheS5mcm9tKGRhdGEpO1xuICB9IGVsc2UgaWYgKGR0eXBlID09PSAnYm9vbCcgJiYgZGF0YSBpbnN0YW5jZW9mIFVpbnQ4QXJyYXkpIHtcbiAgICByZXR1cm4gQXJyYXkuZnJvbShkYXRhKTtcbiAgfSBlbHNlIGlmIChkdHlwZSA9PT0gJ3N0cmluZycgJiYgZGF0YSBpbnN0YW5jZW9mIFVpbnQ4QXJyYXkpIHtcbiAgICAvLyBEZWNvZGUgYnl0ZXMgaW50byBzdHJpbmcuXG4gICAgaWYgKCFkZWJ1Zykge1xuICAgICAgdGhyb3cgbmV3IEVycm9yKFxuICAgICAgICAgICdEZWJ1ZyBtb2RlIGlzIG5vdCBlbmFibGVkLiBQbGVhc2UgY2FsbCBgdGYuZW52KCkuc2V0KCcgK1xuICAgICAgICAgICdcIkRFQlVHXCIsIHRydWUpYCB0byBlbmFibGUgZGVidWcgbW9kZSB0byBkZWNvZGUgYnl0ZXMgaW50byAnICtcbiAgICAgICAgICAnYSB1dGYtOCBzdHJpbmcuJyk7XG4gICAgfVxuICAgIGNvbnN0IGRlY29kZXIgPSBuZXcgVGV4dERlY29kZXIoJ3V0Zi04Jyk7XG4gICAgcmV0dXJuIFtkZWNvZGVyLmRlY29kZShkYXRhKV07XG4gIH0gZWxzZSB7XG4gICAgdGhyb3cgbmV3IEVycm9yKFxuICAgICAgICBgVW5rbm93biBkYXRhIHR5cGUgJHtkdHlwZX0gYCArXG4gICAgICAgIGBvciBjb3JyZXNwb25kaW5nIGlucHV0IGRhdGEgaXMgbm90IGEgJHtkdHlwZX0gdHlwZWQgYXJyYXkuYCk7XG4gIH1cbn1cblxuLyoqIFJldHVybiB0aGUgY29tcHV0ZWQgYnl0ZXMgb2YgdGhlIGdpdmVuIHR5cGVkIGFycmF5LiAqL1xuZXhwb3J0IGZ1bmN0aW9uIHR5cGVkQXJyYXlUb0J5dGVzKGFycmF5OiBUeXBlZEFycmF5KTogVWludDhBcnJheSB7XG4gIGlmIChhcnJheSBpbnN0YW5jZW9mIFVpbnQ4QXJyYXkpIHtcbiAgICByZXR1cm4gYXJyYXk7XG4gIH0gZWxzZSB7XG4gICAgY29uc3QgYnl0ZXMgPSBuZXcgVWludDhBcnJheShhcnJheS5idWZmZXIsIGFycmF5LmJ5dGVPZmZzZXQsIGFycmF5LmJ5dGVMZW5ndGgpO1xuICAgIC8vIENvcHkgdGhlIGJ5dGVzIGludG8gYSBuZXcgYXJyYXkgaWYgdGhlIHNpemUgZG9lc24ndCBtYXRjaC5cbiAgICBpZiAoYnl0ZXMubGVuZ3RoICE9PSBhcnJheS5idWZmZXIuYnl0ZUxlbmd0aCkge1xuICAgICAgcmV0dXJuIG5ldyBVaW50OEFycmF5KGJ5dGVzKTtcbiAgICB9XG4gICAgcmV0dXJuIGJ5dGVzO1xuICB9XG59XG5cbmV4cG9ydCBmdW5jdGlvbiBzaXplRnJvbVNoYXBlKHNoYXBlOiBudW1iZXJbXSkge1xuICBpZiAoc2hhcGUubGVuZ3RoID09PSAwKSB7XG4gICAgLy8gU2NhbGFyLlxuICAgIHJldHVybiAxO1xuICB9XG4gIGxldCBzaXplID0gc2hhcGVbMF07XG4gIGZvciAobGV0IGkgPSAxOyBpIDwgc2hhcGUubGVuZ3RoOyBpKyspIHtcbiAgICBzaXplICo9IHNoYXBlW2ldO1xuICB9XG4gIHJldHVybiBzaXplO1xufVxuXG5leHBvcnQgZnVuY3Rpb24gaXNTY2FsYXJTaGFwZShzaGFwZTogbnVtYmVyW10pIHtcbiAgcmV0dXJuIHNoYXBlLmxlbmd0aCA9PT0gMDtcbn1cblxuZXhwb3J0IGZ1bmN0aW9uIGFycmF5QnVmZmVyVG9UeXBlZEFycmF5KFxuICAgIGRhdGE6IEFycmF5QnVmZmVyLCBkdHlwZTogRGF0YVR5cGUsIGNvcHkgPSBmYWxzZSk6IFR5cGVkQXJyYXkge1xuICBpZiAoZHR5cGUgPT09ICdmbG9hdDMyJyAmJiBkYXRhIGluc3RhbmNlb2YgRmxvYXQzMkFycmF5ICYmICFjb3B5KSB7XG4gICAgcmV0dXJuIGRhdGE7XG4gIH0gZWxzZSBpZiAoZHR5cGUgPT09ICdpbnQzMicgJiYgZGF0YSBpbnN0YW5jZW9mIEludDMyQXJyYXkgJiYgIWNvcHkpIHtcbiAgICByZXR1cm4gZGF0YTtcbiAgfSBlbHNlIGlmIChkdHlwZSA9PT0gJ2Jvb2wnICYmIGRhdGEgaW5zdGFuY2VvZiBVaW50OEFycmF5ICYmICFjb3B5KSB7XG4gICAgcmV0dXJuIGRhdGE7XG4gIH0gZWxzZSBpZiAoZHR5cGUgPT09ICdib29sJyAmJiBkYXRhIGluc3RhbmNlb2YgVWludDhBcnJheSAmJiAhY29weSkge1xuICAgIC8vIENvbnZlcnQgMSB0byB0cnVlLCBhbmQgYWxsIG90aGVyIHZhbHVlcyB0byBmYWxzZS5cbiAgICBjb25zdCBib29sRGF0YSA9IG5ldyBVaW50OEFycmF5KGRhdGEubGVuZ3RoKTtcbiAgICBmb3IgKGxldCBpID0gMDsgaSA8IGJvb2xEYXRhLmxlbmd0aDsgKytpKSB7XG4gICAgICBpZiAoZGF0YVtpXSA9PT0gMSkge1xuICAgICAgICBib29sRGF0YVtpXSA9IDE7XG4gICAgICB9XG4gICAgfVxuICAgIHJldHVybiBib29sRGF0YTtcbiAgfSBlbHNlIGlmIChkdHlwZSA9PT0gJ2Zsb2F0MzInICYmIGRhdGEgaW5zdGFuY2VvZiBJbnQzMkFycmF5ICYmICFjb3B5KSB7XG4gICAgcmV0dXJuIG5ldyBGbG9hdDMyQXJyYXkoZGF0YSk7XG4gIH0gZWxzZSBpZiAoZHR5cGUgPT09ICdpbnQzMicgJiYgZGF0YSBpbnN0YW5jZW9mIEZsb2F0MzJBcnJheSAmJiAhY29weSkge1xuICAgIC8vIFRydW5jYXRlIGZsb2F0IHZhbHVlcy5cbiAgICByZXR1cm4gbmV3IEludDMyQXJyYXkoZGF0YSk7XG4gIH0gZWxzZSBpZiAoZHR5cGUgIT09ICdzdHJpbmcnICYmIGRhdGEgaW5zdGFuY2VvZiBVaW50OEFycmF5ICYmICFjb3B5KSB7XG4gICAgLy8gVGhpcyBoYXBwZW5zIHdoZW4gd2UgdXNlIHN0b3JhZ2UgdG8gcGFzcyBhIHR5cGVkIGFycmF5IGluIG5vZGUuXG4gICAgcmV0dXJuIGRhdGE7XG4gIH0gZWxzZSBpZiAoY29weSkge1xuICAgIGNvbnN0IGJ1ZmZlciA9IGNyZWF0ZVR5cGVkQXJyYXkoZHR5cGUsIGRhdGEuYnl0ZUxlbmd0aCk7XG4gICAgY29uc3QgYnl0ZXMgPSBuZXcg

WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 '@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 * ==========\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 2019

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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, KernelFunc, scatter_util, ScatterNd, ScatterNdAttrs, ScatterNdInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {CppDType} 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\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\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 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, Round} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from './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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF 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';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport
const rsqrtConfig: KernelConfig = createUnaryKernelConfig(Rsqrt);\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, 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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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, 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 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\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, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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, 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\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 * @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
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==\n
*/\nimport {KernelConfig, Sin} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const sinConfig: KernelConfig = createUnaryKernelConfig(Sin);\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 {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';\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\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 < 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
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';\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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} 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\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 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';\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 License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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';\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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} from './binary_kernel';\nconst supportsFullBroadcast = true;\nexport const squaredDifferenceConfig: KernelConfig =\n createBinaryKernelConfig(SquaredDifference, 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, slice_util, StridedSlice, StridedSliceAttrs, StridedSliceInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\n\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\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 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 * @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\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\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, 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 * @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, Sub} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = true;\nexport const subConfig: KernelConfig =\n createBinaryKernelConfig(Sub, 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 */\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\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 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, Tan} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const tanConfig: KernelConfig =
createUnaryKernelConfig(Tan);\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, Tanh} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const tanhConfig: KernelConfig = createUnaryKernelConfig(Tanh);\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, 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: 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 '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\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 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\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}, 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\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 './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 * @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, 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\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/IHkBZlHETpA/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","\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 (\nfunction(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&&!ENVIRONMENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var ENVIRONMENT_IS_PTHREAD=Module[\"ENVIRONMENT_IS_PTHREAD\"]||false;if(ENVIRONMENT_IS_PTHREAD){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
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[idx++]&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){wasmMemory=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;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){addOnPreRun(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\"].length){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\"](runDependencies)}}function removeRunDependency(id){runDependencies--;if(Module[\"monitorRunDependencies\"]){Module[\"monitorRunDependencies\"](runDependencies)}if(runDependencies==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.error(\"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\"][\"I\"];wasmModule=module;if(!ENVIRONMENT_IS_PTHREAD){var numWorkersToLoad=PThread.unusedWorkers.length;PThread.unusedWorkers.forEach(function(w){PThread.loadWasmModuleToWorker(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(wasmBinaryFile)&&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(){__emscripten_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,EBADF: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,ECHRNG:106,EL2NSYNC:156,EL3HLT:107,EL3RST:108,ELNRNG:109,EUNATCH:110,ENOCSI:111,EL2HLT:112,EDEADLK:16,ENOLCK:46,EBADE: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,ENOTSOCK: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:14

8,EILSEQ:25,EOVERFLOW:61,ECANCELED:11,ENOTRECOVERABLE:56,EOWNERDEAD:62,ESTRPIPE:135};function
_emscripten_futex_wake(addr,count){if(addr<=0||addr>GROWABLE_HEAP_I8().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.pthreads[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.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);__emscripten_thread_init(tb,!ENVIRONMENT_IS_WORKER,1);_emscripten_register_main_browser_thread_id(tb)},initWorker:function(){},pthreads:{},threadExitHandlers:[],setThreadStatus:function(){},runExitHandlers:function(){while(PThread.threadExitHandlers.length>0){PThread.threadExitHandlers.pop()()}if(ENVIRONMENT_IS_PTHREAD&&_pthread_self())___pthread_tsd_run_dtors()},runExitHandlersAndDeinitThread:function(tb,exitCode){Atomics.store(GROWABLE_HEAP_U32(),tb+56>>2,1);Atomics.store(GROWABLE_HEAP_U32(),tb+60>>2,0);PThread.runExitHandlers();Atomics.store(GROWABLE_HEAP_U32(),tb+4>>2,exitCode);Atomics.store(GROWABLE_HEAP_U32(),tb+0>>2,1);_emscripten_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_PTHREAD){postMessage({\"cmd\":\"exit\"})}}},threadCancel:function(){PThread.runExitHandlersAndDeinitThread(_pthread_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)}}PThread.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=[]},freeThreadData:function(pthread){if(!pthread)return;if(pthread.threadInfoStruct){var 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.pthreads[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.pthreads[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 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.pthreads[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 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);return 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.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
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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_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
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
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exts=GLctx.getSupportedExtensions()||[];exts.forEach(function(ext){if(ext.indexOf(\"lose_context\")<0&&ext.indexOf(\"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)],\"premultipliedAlpha\":!!GROWABLE_HEAP_I32()[a+(16>>2)],\"preserveDrawingBuffer\":!!GROWABLE_HEAP_I32()[a+(20>>2)],\"powerPreference\":__emscripten_webgl_power_preferences[powerPreference],\"failIfMajorPerformanceCaveat\":!!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()[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)})}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 __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
___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\"][\"_\"]).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
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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

_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

_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\"]
=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

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__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[\"_emscripten_tls_init\"]=Module[\"asm\"][\"wb\"]).apply(null,arguments)};var
__emscripten_thread_init=Module[\"__emscripten_thread_init\"]=function(){return(__emscripten_thread_init=Module[\"__emscripten_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
_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\"]=10512;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){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()}if(Module[\"setStatus\"]){Module[\"setStatus\"](\"Running...\");setTimeout(function(){setTimeout(function(){Module[\"setStatus\"](\"\")},1);doRun()},1)}else{doRun()}}Module[\"run\"]=run;function
exit(status,implicit){if(implicit&&noExitRuntime&&status===0){return}if(!implicit){if(ENVIRONMENT_IS_PTHREAD){postMessage({\"cmd\":\"exitProcess\",\"returnCode\":status});throw
 new
ExitStatus(status)}else{}}if(noExitRuntime){}else{PThread.terminateAllThreads();EXITSTATUS=status;exitRuntime();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})();\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&&!ENVIRONMENT_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=nodePath[\"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[\"argv\"].slice(2);process[\"on\"](\"uncaughtException\",function(ex){if(!(ex instanceof ExitStatus)){throw ex}});process[\"on\"](\"unhandledRejection\",abort);quit_=function(status){process[\"exit\"](status)};Module[\"inspect\"]=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){scriptDirectory=self.location.href}else if(typeof document!==\"undefined\"&&document.currentScript){scriptDirectory=document.currentScript.src}if(_scriptDir){scriptDirectory=_scriptDir}if(scriptDirectory.indexOf(\"blob:\")!==0){scriptDirectory=scriptDirectory.substr(0,scriptDirectory.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]}}moduleOverrides=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[idx++]&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
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+=\"\";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\"];updateGlobalBufferAndViews(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(wasmBinaryFile)&&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,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\":_fd_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=Module[\"_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\"]=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=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\"][\"
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\"][\"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\"]).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,arguments)};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
_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\"][\"R
a\"]).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(nu
ll,arguments)};var
_free=Module[\"_free\"]=function(){return(_free=Module[\"_free\"]=Module[\"asm\"][\"Ua\"]).apply(null,argument
s)};var
___errno_location=Module[\"___errno_location\"]=function(){return(___errno_location=Module[\"___errno_locati

on\"]=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(){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})();\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 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 ${dtype}`);\n }\n }\n}\n\nfunction createInstantiateWasmFunc(path: string) {\n // this will be replace by rollup plugin patchWechatWebAssembly in\n // minprogram's output.\n // tslint:disable-next-line:no-any\n return (imports: any, callback: any) => {\n util.fetch(path, {credentials: 'same-origin'}).then((response) => {\n if (!response['ok']) {\n imports.env.a(`failed to load wasm binary file at '${path}'`);\n }\n response.arrayBuffer().then(binary => {\n WebAssembly.instantiate(binary, imports).then(output => {\n callback(output.instance, output.module);\n });\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 * 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   [`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, ['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 ;\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, 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\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 intialized.\n */\nexport function getThreadsCount(): number {\n if (actualThreadsCount === -1) {\n throw new Error(`WASM
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);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\"]()){}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 *
==\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';\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":["CppDType","FusableActivation","wasmFusedMatMul","fusedMatMulConfig","kernelNa
me","_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","wasmTranspose","identityConfig","Identity","transpose","_a","perm","newPerm","push","minValIdx","j","reducedShape","permIsNoOp","outShape","inShape","Array","computeOutShape","cloned","permBytes","xShapeBytes","wasmAll","transposeConfig","Transpose","permuteAxesAndTranspose","axis","xShape","xRank","originalAxes","parseAxisParam","axes","permutedAxes","getAxesPermutation","xTransposed","inputWasTransposed","getInnerMostAxes","transposed","wasmAny","allConfig","All","keepDims","inputId","input","inputRank","assertAxesAreInnerMostDims","_b","reduceShape","reduceSize","disposeData","expandShapeToKeepDim","anyConfig","Any","wasmAvgPool","argMaxConfig","ArgMax","transposedId","slice","outerSize","innerSize","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","$shape","inferFromImplicitShape","assert","incRef","wasmBatchMatMul","reshapeConfig","Reshape","batchMatMulConfig","BatchMatMul","aRank","bRank","innerShapeA","innerShapeB","outerShapeA","outerShapeB","outerDimsA","outerDimsB","batchDimA","batchDimB","batchDimsCompatible","concat","b3dShape","a3d","b3d","a3dId","b3dId","Math","max","sliceImpl","vals","begin","size","isContinous","slice_util","isSliceContinous","xStrides","computeStrides","flatOffset","computeFlatOffset","subarray","decodedData","fromUint8ToStringArray","inBuf","outBuf","outLoc","indexToLoc","inLoc","idx","fromStringArrayToUint8","values","begin_","size_","xVals","readSync","outData","stringBytes","res","sliceImplCPU","outVals","rank","xStride","outOffset","beginI","beginJ","endI","xOffset","slice2d","xStride1","xStride2","beginK","endJ","slice3d","xStride3","endK","beginL","k","slice4d","sliceConfig","Slice","batchToSpaceNDConfig","BatchToSpaceND","blockShape","crops","prod","reduce","reshaped","getReshaped","permuted","getPermuted","reshapedPermuted","getReshapedPermuted","sliceBeginCoords","getSliceBeginCoords","sliceSize","getSliceSize","xReshaped","result","cast","wasmClip","castConfig","Cast","ceilConfig","Ceil","clipByValueConfig","ClipByValue","clipValueMin","clipValueMax","t","$inputs","filter","shapes","assertParamsConsistent","inputs2D","inputsValShapes","simplyConcat","outVals_1","getArrayFromDType","offset","forEach","colOffset","tIdx","row","resIdx","col","concatImplCPU","finalOutShape","sumInnerDims","innerDims","innerDim","inOffset","wasmConv2d","concatConfig","Concat","wasmConv2DBackpropInput","conv2DConfig","Conv2D","filterId","dilations","$dataFormat","convertConv2DDataFormat","computeConv2DInfo","inputChannels","outputChannels","outChannels","isSamePad","type","InterpolationMethod","wasmCropAndResize","conv2DBackpropInputConfig","Conv2DBackpropInput","dy","inputShape","batchSize","inHeight","inWidth","outHeight","outWidth","topPad","leftPad","isChannelsLast","dxStrides","dyStrides","fltS0","fltS1","fltS2","xBatchStride","xRowStride","xColStride","xChannelStride","yBatchStride","yRowStride","yColStride","yChannelStride","dyId","cosConfig","Cos","coshConfig","Cosh","wasmCumsum","cropAndResizeConfig","CropAndResize","castedData","method","extrapolationValue","cropSize","image","boxes","boxInd","numBoxes","cropHeight","cropWidth","imagesData","imagesId","boxesId","boxIndId","imagesShapeBytes","wasmDepthToSpace","cumsumConfig","Cumsum","exclusive","reverse","permutation","permutedX","permutedAxis","permutedOut","finalDim","permutedXId","permutedOutId","getUndoAxesPermutation","wasmDepthwiseConv2d","depthToSpaceConfig","DepthToSpace","blockSize","outputHeight","outputWidth","outputDepth","outputShape","xStridesBytes","outputShapeBytes","outStridesBytes","depthwiseConv2dNativeConfig","DepthwiseConv2dNative","$dilations","eluConfig","Elu","equalConfig","Equal","expConfig","Exp","expandDims","dim","$dim","splice","expandDimsConfig","ExpandDims","fill","value","wasmFlipLeftRight","fillConfig","Fill","wasmBatchNorm","flipLeftRightConfig","FlipLeftRight","imageId","batch","imageHeight","imageWidth","numChannels","floorConfig","Floor","floorDivConfig","FloorDiv","wasmFusedConv2d","fusedBatchNormConfig","FusedBatchNorm","varianceEpsilon","mean","variance","scale","meanId","varianceId","offsetId","scaleId","wasmFusedDepthwiseConv2d","fusedConv2DConfig","FusedConv2D","wasmGather

Nd","fusedDepthwiseConv2DConfig","FusedDepthwiseConv2D","wasmGather","gatherNdConfig","GatherNd","pa
rams","indices","resultShape","numSlices","indicesShape","sliceRank","indicesId","stridesBytes","gatherV2Config
","GatherV2","batchDims","parsedAxis","indicesVals","axisDim","index","shapeInfo","segment_util","collectGath
erOpShapeInfo","flattenX","dimSize","indicesSize","flattenIndex","flattenOutputShape","stridesSize","greaterConfi
g","Greater","greaterEqualConfig","GreaterEqual","wasmMax","leakyReluConfig","LeakyRelu","alpha","lessConfi
g","Less","lessEqualConfig","LessEqual","logConfig","Log","logicalAndConfig","LogicalAnd","wasmMaxPool","
maxConfig","Max","maximumConfig","Maximum","wasmMean","maxPoolConfig","MaxPool","wasmMin","mean
Config","Mean","reductionAxes","castedInput","MirrorPaddingMode","wasmMirrorPad","minConfig","Min","mini
mumConfig","Minimum","mirrorPadConfig","MirrorPad","paddings","mode","p","prePaddingsFlat","padTuple","p
ostPaddingsFlat","prePaddingsBytes","postPaddingsBytes","multiplyConfig","Multiply","negConfig","Neg","parse
ResultStruct","resOffset","HEAPU8","pSelectedIndices","selectedSize","pSelectedScores","pValidOutputs","_free",
"nonMaxSuppressionV3Config","NonMaxSuppressionV3","iouThreshold","maxOutputSize","scoreThreshold","sco
res","scoresId","nonMaxSuppressionV4Config","NonMaxSuppressionV4","padToMaxOutputSize","wasmOneHot",
"nonMaxSuppressionV5Config","NonMaxSuppressionV5","softNmsSigma","notEqualConfig","NotEqual","oneHot
Config","OneHot","depth","onValue","offValue","onesLikeConfig","OnesLike","wasmPadV2","packConfig","Pack
","assertShapesMatch","intermediateTensorInfos","expandedT","wasmPrelu","padV2Config","PadV2","constantVal
ue","powConfig","Pow","wasmProd","preluConfig","Prelu","weightsId","wasmResizeBilinear","prodConfig","Prod
","rangeConfig","Range","start","stop","step","makeZerosTypedArray","numElements","abs","ceil","rangeImplCP
U","realDivConfig","RealDiv","reluConfig","Relu","relu6Config","Relu6","wasmReverse","resizeBilinearConfig","
ResizeBilinear","images","alignCorners","halfPixelCenters","newHeight","newWidth","oldHeight","oldWidth","xD
ata","wasmRotate","reverseConfig","Reverse","dims","axesBytes","outShapeBytes","wasmScatterNd","rotateWith
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No license file was found, but licenses were detected in source scan.

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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,\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 result;\n}\n\nexport const batchToSpaceNDConfig: KernelConfig = {\n kernelName: BatchToSpaceND,\n backendName: 'wasm',\n kernelFunc: batchToSpaceND as {} as KernelFunc\n};\n"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/BatchToSpaceND.js.map
No license file was found, but licenses were detected in source scan.

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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"]}

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No license file was found, but licenses were detected in source scan.

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* limitations under the License.
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/opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/prelu_impl.cc
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/LeakyRelu.h
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/ArgMax.cc
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/LessEqual.cc

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/prelu_impl.h
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/FloorDiv.cc
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/Relu.cc
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/LeakyRelu.cc
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/ResizeBilinear.h
*
/opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/binary.h
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/ClipByValue_test.cc
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/sigmoid_impl.cc
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/backend.h
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/_FusedMatMul.cc
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/AvgPool.cc
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/MaxPool.h
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/RealDiv.cc
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/opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/GreaterEqual.cc
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/DepthwiseConv2dNative.h
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/Maximum.cc
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{"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/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/

c/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 *
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==========\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 * @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, 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 ${biasData.shape.length}.`);\n }\n biasId = biasData.id;\n }\n const preluActivationWeightsId = preluActivationWeights == null ?\n 0 :\n backend.dataIdMap.get(preluActivationWeights.dataId).id;\n const fusedActivation =\n FusableActivation[activation as {} as keyof typeof FusableActivation];\n if (fusedActivation == null) {\n throw new Error(\n `${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 * @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 {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 =\n 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 LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {Abs, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\n\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

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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\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 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\n return {kernelName, backendName: 'wasm', setupFunc, kernelFunc};\n}\n","/**\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 * @license\n
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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 {CppDType} 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, 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 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {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 * @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';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {identity} from './Identity';\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\nexport function transpose(\n args:\n {inputs: TransposeInputs, backend: BackendWasm, attrs: TransposeAttrs}):\n TensorInfo {\n const {inputs, backend, attrs} = args;\n\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\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","/**\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\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 = 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. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on 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 {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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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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==========\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==========\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';\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 LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {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 * @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, 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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under
the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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\nfunction 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, 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 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,
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 Int32Array(b3d.shape).buffer);\n\n  wasmBatchMatMul(\n      a3dId,
aShapeBytes, a3d.shape.length, b3dId, bShapeBytes,\n      b3d.shape.length, transposeA, transposeB, outId);\n\n
backend.disposeData(a3d.dataId);\n  backend.disposeData(b3d.dataId);\n\n  out.shape = outShape;\n  return
out;\n}\n\nexport const batchMatMulConfig: KernelConfig = {\n  kernelName: BatchMatMul,\n  backendName:
'wasm',\n  setupFunc: setup,\n  kernelFunc: batchMatMul 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
*/\nimport { backend_util, util } from '@tensorflow/tfjs-core';\nexport function concatImpl(inputs, outShape, dtype,
simplyConcat) {\n    const outVals = util.getArrayFromDType(dtype, util.sizeFromShape(outShape));\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.set(input.vals, offset);\n            offset += size;\n        });\n    }\n    else {\n        let colOffset = 0;\n
inputs.forEach(input => {\n            const decodedData = dtype === 'string' ?\n
```

backend_util.fromUint8ToStringArray(input.vals) :\n input.vals;\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 }\n colOffset += input.shape[1];\n });\n }\n return outVals;\n}\n//#
sourceMappingURL=data:application/json; base64,eyJ2ZXJzaW9uIjozLCJmaWxlIjoiQ29uY2F0X2ltcGwuanMiLCJzb3VyY2VSb290IjoiIiwic291cmNlcyI6WyIuLi8uLi8uLi8uLi8uLi8uLi90ZmpzLWJhY2tlbmQtY3B1L3NyYy9rZXJuZWxzL0NvbmNhdF9pbXBsLnRzIl0sIm5hbWVzIjpbXSwibWFwcGluZ3MiOiJBQUFBOzs7Ozs7Ozs7Ozs7R0FlRztBQUVIRztBQUVBQyxxQ0FFQUMsYUFFQUMsaUJBRUFDLGlCQUVBQyxpQkFFQUMsaUJBRUFDLGlCQUVBQyxpQkFFQUMsaUJBRUFDLGlCQUVBQyxpQk

dWlsdC1pbiBUeXBlZEFycmF5LnNldCgpIG1ldGhvZCBmb3Igc3BlZWQuXG4gICAgbGV0IG9mZnNldCA9IDA
7XG4gICAgaW5wdXRzLmZvckVhY2goaW5wdXQgPT4ge1xuICAgICAgY29uc3Qgc2l6ZSA9IHV0aWwuc2l6Z
UZyb21TaGFwZShpbnB1dC5zaGFwZSk7XG5cbiAgICAgIChvdXRWYWxIGFzIFR5cGVkQXJyYXkpLnNldCh
pbnB1dC52YWxIGFzIFR5cGVkQXJyYXksIG9mZnNldCk7XG4gICAgICBvZmZzZXQgKz0gc2l6ZTtcbiAgICB
9KTtcbiAgfSBlbHNlIHtcbiAgICBsZXQgY29sT2Zmc2V0ID0gMDtcblxuICAgIGlucHV0cy5mb3JFYWNoKG
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CAgICBiYWNrZW5kX3V0aWwuZnJvbVVpbnQ4VG9TdHJpbmdBcnJheShpbnB1dC52YWxIGFzIFVpbnQ4QX
JyYXlbXSkgOlxuICAgICAgICAgICAgICAgIGlucHV0LnZhbHMgYXMgVHlwZWRBcnJheTtcblxuICAgICAgIHRJZ
HggPSAwO1xuXG4gICAgICBmb3IgKGxldCByb3cgPSAwOyByb3cgPCBpbnB1dC5zaGFwZVswXTsgKytyb3cp
IHtcbiAgICAgICAgY29uc3QgcmVzSWR4ID0gcm93ICogb3V0U2hhcGVbMV0gKyBjb2xPZmZzZXQ7XG4gICA
gICAgICAgY29uc3QgcmVzSWR4ID0gcm93ICogb3V0U2hhcGVbMV0gKyBjb2xPZmZzZXQ7XG4gICA
gICAgICAgICAgICAgICAg

xDQUFDLEdBQUcsSUFBSSxDQUFDO0tBQ2xDO0lBQ0QsT0FBTyxNQUFNLENBQUM7QUFDaEIsQ0FBQyIsInNvdXJjZXNDb250ZW50IjpbIi8qKlxuICogQGxpY2Vuc2VcbiAqIENvcHlyaWdodCAyMDIwIEdvb2dsZSBMTEMuIEFsbCBSaWdodHMgUmVzZXJ2ZWQuXG4gKiBMaWNlbnNlZCB1bmRlciB0aGUgQXBhY2hlIExpY2Vuc2UsIFZlcnNpb24gMi4wICh0aGUgXCJMaWNlbnNlXCIpO1xuICogeW91IG1heSBub3QgdXNlIHRoaXMgZmlsZSBleGNlcHQgaW4gY29tcGxpYW5jZSB3aXRoIHRoZSBMaWNlbnNlLlxuICogWW91IG1heSBvYnRhaW4gYSBjb3B5IG9mIHRoZSBMaWNlbnNlIGF0XG4gKlxuICogaHR0cDovL3d3dy5hcGFjaGUub3JnL2xpY2Vuc2VzL0xJQ0VOU0UtMi4wXG4gKlxuICogVW5sZXNzIHJlcXVpcmVkIGJ5IGFwcGxpY2FibGUgbGF3IG9yIGFncmVlZCB0byBpbiB3cml0aW5nLCBzb2Z0d2FyZVxuICogZGlzdHJpYnV0ZWQgdW5kZXIgdGhlIExpY2Vuc2UgaXMgZGlzdHJpYnV0ZWQgb24gYW4gXCJBUyBJUyIgQkFTSVMsXG4gKiBXSVRIT1VUIFdBUlJBTlRJRVMgT1IgQ09ORElUSU9OUyBPRiBBTlkgS0lORCwgZWl0aGVyIGV4cHJlc3Mgb3IgaW1wbGllZC5cbiAqIFNlZSB0aGUgTGljZW5zZSBmb3IgdGhlIHNwZWNpZmljIGxhbmd1YWdlIGdvdmVybmluZyBwZXJtaXNzaW9uc1xuICogYW5kXG4gKiBsaW1pdGF0aW9ucyB1bmRlciB0aGUgTGljZW5zZS5cbiAqXG4gKiA9PT09PT09PT09

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}\nexport const sliceConfig = {\n   kernelName: Slice,\n   backendName: 'cpu',\n   kernelFunc:
slice\n};\n//#
sourceMappingURL=data:application/json; base64,eyJ2ZXJzaW9uIjozLCJmaWxlIjoiU2xpY2UuanMiLCJzb3VyY2
VSb290IjoiIiwic291cmNlcyI6WyIuLi8uLi8uLi8uLi8uLi8uLi90ZmpzLWJhY2tlbmQtY3B1L3NyYy9rZXJuZWxzL
1NsaWNlLnRzIl0sIm5hbWVzIjpbXSwibWFwcGluZ3MiOiJBQUFBOzs7Ozs7Ozs7Ozs7R0FlRztBQUVILE9
BQU8sRUFBQyxZQUFZLEVBQWlCLE1BQU0sc0RUFBc0MsMsS0FBSyxFUFFLFVBQVUsRUFBbUQsSUFBSSxSSx
FQUFDLE1BQU0sdUJBQXVCLENBQUM7QUFnIsTUFBTSxXQUFXLEdBQUcsVUFBVSxDQUFDLE1BQU0sRUFBRSxDQUFDLE1
GdCQUFnQixDQUFDLE1BQUssRUFBRSxLQUFLLEVBQUUsSUFBSSxDQUFDLE1BQU0sRUFBRSxDQUFDLE1BQU0sRUFBRSxDQ
TSxNQUFNLEdBQUcsSUFBSSxDQUFDLGFBQWEsQ0FBQyxJQUFJLENBQUMsQ0FBQztJQUN4QyxNQUF
NLFFBQVEsR0FBRyxJQUFJLENBQUMsY0FBYyxDQUFDLEtBQUssQ0FBQyxDQUFDLEtBQUssRUFBRSxDQUFDLE1BQUks
V0FBVyxFQUFFO1FBQ2YsTUFBTSxVQUFVLEdBQUcsVUFBVSxDQUFDLGlCQUFpQixDQUFDLE1BQUss
RUFBRSxRQUFRLENBQUMsQ0FBQztJQUFJLEtBQUssS0FBSyxRQUFRLEVBQUU7WUFDdEIsTUFBTSxJIs
T0FBUSxJQUFxQixDQUFDLE1BQUssRUFBRSxLQUFLLEVBQUUsUUFBUSxHQUFHLENBQUMsQ0FBQyxDQUFDLEtBQUssRUFB
QUFDO1NBQ3RCO1FBRUQsT0FBUSxJQUFtQixDQUFDLE1BQUssRUFBRSxLQUFLLEVBQUUsUUFBUSxHQUFHLENBQUMsQ
HQUFHLE1BQU0sQ0FBQyxDQUFDLEtBQUssRUFBRSxLQUFLLEVBQUUsUUFBUSxHQUFHLENBQUMsQ0FBQztBQUMzQyxNQ
QUFDO1NBQ3RCO1FBRUQsT0FBUSxJQUFtQixDQUFDLE1BQUssRUFBRSxLQUFLLEVBQUUsUUFBUSxHQUFHLENBQUMsQ
0FBQztBQUMzQyxNQUFNLFVBQVUsUUFBUSxDQUFDLENBQVMsRUFBRSxDQUFTO0lBQzNDLE9BQU8sQ0FBQyxHQ
VBQUUsS0FBSyxFQUFFLFFBQVEsR0FBRyxDQUFDLENBQUMsQ0FBQztBQUMzQyxNQUFNLFVBQVUsUUFBUSxDQUFDLE
HQUFHLE1BQU0sQ0FBQyxDQUFDLEtBQUssRUFBRSxLQUFLLEVBQUUsUUFBUSxHQUFHLENBQUMsQ0FBQztBQUMzQyxNQ
QUFDO1NBQ3RCO1FBRUQsT0FBUSxJQUFtQixDQUFDLE1BQUssRUFBRSxLQUFLLEVBQUUsUUFBUSxHQUFHLENBQUMsQ

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nNlIGF0XG4gKlxuICogaHR0cDovL3d3dy5hcGFjaGUub3JnL2xpY2Vuc2VzL0xJQ0VOU0UtMi4wXG4gKlxuIC
ogVW5sZXNzIHJlcXVpcmVkIGJ5IGFwcGxpY2FibGUgbGF3IG9yIGFncmVlZCB0byBpbiB3cml0aW5nLCBzb2
Z0d2FyZVxuICogZGlzdHJpYnV0ZWQgdW5kZXIgdGhlIExpY2Vuc2UgaXMgZGlzdHJpYnV0ZWQgb24gYW4g
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EtJTkQsIGVpdGhlciBleHByZXNzIG9yIGltcGxpZWQuXG4gKiBTZWUgdGhlIExpY2Vuc2UgZm9yIHRoZSBzc
GVjaWZpYyBsYW5ndWFnZSBnb3Zlcm5pbmcgcGVybWlzc2lvbnMgYW5kXG4gKiBsaW1pdGF0aW9ucyB1bm
RlciB0aGUgTGljZW5zZS5cbiAqID09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09P
T09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09XG4gKi9cblxuaW1wb3J0IHtiYWNrZW5kX3V0aWwsIE
JhY2tlbmRWYWx1ZXMsIGJ1ZmZlciwgRGF0YVR5cGUsIEtlcm5lbENvbmZpZywgS2VybmVsRnVuYywgU2xp
Y2UsIHNsaWNlX3V0aWwsIFNsaWNlQXR0cnMsIFNsaWNlSW5wdXRzLCBUZW5zb3JJbmZvLCBUeXBlZEF
ycmF5LCB1dGlsfSBmcm9tICdAdGVuc29yZmxvdy90ZmpzLWNvcmUnO1xuXG5pbXBvcnQge01hdGhCYWNr
ZW5kQ1BVfSBmcm9tICcuLi9iYWNrZW5kX2NwdSc7XG5pbXBvcnQge2Fzc2VydE5vdENvbXBsZXh9IGZyb2
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W5kVmFsdWVzLCBiZWdpbjogbnVtYmVyW10sIHNpemU6IG51bWJlcltdLCBzaGFwZTogbnVtYmVyW10sXG
4gICAgZHR5cGU6IERhdGFUeXBlKTogQmFja2VuZERhdHVlcyB7XG4gIGNvbnN0IGlzQ29udGlub3VzID0gc2
xpY2VfdXRpbC5pc1NsaWNlQ29udGlub3VzKHNoYXBlLCBiZWdpbiwgc2l6ZSk7XG4gIGNvbnN0IGxlbmd0aC
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HJpZGVzKHNoYXBlKTtcbiAgY29uc3QgeFN0cmlkZXMgPSB1dGlsLmNvbXB1dGVTdHJpZGVzKHNoYXBlLCB0cn
VlKTtcblxuICBpZiAoaXNNb250aW5vdXMpIHtcbiAgICAvLyBDb250aW5vdXMgc2xpY2UgaXMgc2ltcGxlIGlm
IHRoZSBzbGljZSBpcyBvbmUgY29udGlub3VzIHJlZ2lvbiBvZiB0aGUgb3JpZ2luYWwgYXJyYXkuXG4gICAgY2
9uc3QgZGVjb2RlZERhdGEgPSBkdHlwZSA9PT0gJ3N0cmluZycgP1xuICAgICAgICAg

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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';\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 isContinous = slice_util.isSliceContinous(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 (isContinous) {\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.typedArrayFromHeap(out);\n      outVals.set(\n          (xVals as TypedArray)\n              .subarray(flatOffset, flatOffset + util.sizeFromShape(size_)));\n    }\n\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\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\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 * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n
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'./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\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\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 License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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';\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 // Concats 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,

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inputs[0].dtype,\n                    simplyConcat) as string[];\n\n    const finalOutShape =\n backend_util.computeOutShape($inputs.map(t => t.shape), axis);\n\n    out.shape = finalOutShape;\n    const outData = backend.dataIdMap.get(out.dataId);\n    outData.stringBytes =\n backend_util.fromStringArrayToUint8(outVals);\n\n    inputs2D.forEach(t => backend.disposeData(t.dataId));\n\n return out;\n  }\n\n  const\n  batchDim = util.sizeFromShape($inputs[0].shape.slice(0, axis));\n  let sumInnerDims = 0;\n  const innerDims =\n $inputs.map(input => {\n    const innerDim = util.sizeFromShape(input.shape.slice(axis));\n    sumInnerDims +=\n innerDim;\n    return innerDim;\n  });\n  const inVals = $inputs.map(input =>\n backend.typedArrayFromHeap(input));\n  const outVals = backend.typedArrayFromHeap(out);\n  for (let b = 0; b <\n batchDim; b++) {\n    let outOffset = b * sumInnerDims;\n    for (let i = 0; i < inVals.length; i++) {\n      const\n innerDim = innerDims[i];\n      const inOffset = b * innerDim;\n      const vals = inVals[i].subarray(inOffset,\n inOffset + innerDim);\n      outVals.set(vals, outOffset);\n      outOffset += innerDim;\n    }\n  }\n  return\n 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 2019 Google LLC. All Rights\n 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 *\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 {backend_util, Conv2D, Conv2DAttrs, Conv2DInputs, KernelConfig, KernelFunc, Tensor4D} from\n '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmConv2d: (\n    xId:\n number, batchSize: number, inputHeight: number, inputWidth: number,\n    filterId: number, filterHeight: number,\n filterWidth: number, padTop: number,\n    padRight: number,\n  padBottom: number, padLeft: number, isSamePad: number,\n    dilationHeight: number, dilationWidth: number,\n strideHeight: number,\n    strideWidth: number, inputChannels: number, outputChannels: number,\n    outId:\n number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmConv2d = backend.wasm.cwrap(Conv2D,\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',  //\n padTop\n    'number',  // padRight\n    'number',  // padBottom\n    'number',  // padLeft\n    'number',  // isSamePad\n\n  'number',  // dilationHeight\n    'number',  // dilationWidth\n    'number',  // strideHeight\n    'number',  //\n strideWidth\n    'number',  // inputChannels\n    'number',  // outputChannels\n    'number',  // outId\n\n ]);\n}\n\nfunction conv2d(\n    args: {inputs: Conv2DInputs, backend: BackendWasm, attrs:\n  Conv2DAttrs}) {\n  const {inputs, attrs, backend} = args;\n\n  const {x, filter} = inputs;\n  const xId =\n backend.dataIdMap.get(x.dataId).id;\n  const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n  const {strides,\n 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,\n      pad, dimRoundingMode, false,\n $dataFormat);\n\n  const filterHeight = convInfo.filterHeight;\n  const filterWidth = convInfo.filterWidth;\n  const\n padTop = convInfo.padInfo.top;\n  const padRight = convInfo.padInfo.right;\n  const padBottom =\n convInfo.padInfo.bottom;\n  const padLeft = convInfo.padInfo.left;\n  const dilationHeight =\n convInfo.dilationHeight;\n  const dilationWidth = convInfo.dilationWidth;\n  const strideHeight =\n convInfo.strideHeight;\n  const strideWidth = convInfo.strideWidth;\n  const inputChannels\n  = convInfo.inChannels;\n  const outputChannels = convInfo.outChannels;\n  const isSamePad =\n convInfo.padInfo.type === 'SAME' ? 1 : 0;\n\n  if (convInfo.dataFormat !== 'channelsLast') {\n    throw new\n Error(\n        `wasm backend Conv2D does not support dataFormat:'` +\n        `${convInfo.dataFormat}'. Please use\n 'channelsLast'.`);\n  }\n\n  const out = backend.makeOutput(convInfo.outShape, 'float32');\n  const outId =
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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 ==\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\nexport const conv2DBackpropInputConfig: KernelConfig = {\n kernelName: Conv2DBackpropInput,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: conv2DBackpropInput 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
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==========\n */\n\nimport {Cos, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\n\nexport const cosConfig: KernelConfig = createUnaryKernelConfig(Cos);\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
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==========\n */\nimport {Cosh, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\n\nexport const coshConfig: KernelConfig = createUnaryKernelConfig(Cosh);\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
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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","/**\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, 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\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\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 * @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 {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","/**\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, 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 Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n
 *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF 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 =\n createBinaryKernelConfig(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 copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 * @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} 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 * @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\n * to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n
 *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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';\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 ==========\n */\n\nimport {FloorDiv, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from './binary_kernel';\n\nconst supportsFullBroadcast = false;\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 use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n *
 distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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';\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 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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';\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\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

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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\nexport 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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
 OR CONDITIONS OF ANY 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}\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\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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\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 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 * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may
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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 {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 },\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
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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 {Greater, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'./binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const greaterConfig: KernelConfig =\n
createBinaryKernelConfig(Greater, supportsFullBroadcast, 'bool');\n","/**\n * @license\n * Copyright 2019 Google
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Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *

http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF 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';\n\nimport {createBinaryKernelConfig} from './binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const greaterEqualConfig: KernelConfig =\n createBinaryKernelConfig(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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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';\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\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF 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, 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
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==========\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 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 * 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, 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 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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, 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\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\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, 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 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 *\n ===\n */\nimport {KernelConfig, Maximum} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const maximumConfig: KernelConfig =\n createBinaryKernelConfig(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 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';\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 //\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 ${x.dtype}.`);\n\n const {filterSize, strides, pad, dimRoundingMode} = attrs;\n const convInfo = backend_util.computePool2DInfo(\n   x.shape, filterSize, strides, 1 /* dilations */, pad, dimRoundingMode);\n\n const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n\n const inputChannels = convInfo.inChannels;\n const outputChannels = convInfo.outChannels;\n\n if (convInfo.dataFormat !== 'channelsLast') {\n   throw new Error(\n   `wasm backend does not support dataFormat:` +\n   `'${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 * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you
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==========\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\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 * 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, KernelConfig, KernelFunc, Min, MinAttrs, MinInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from '../backend_wasm';\n\nimport {permuteAxesAndTranspose} from './kernel_utils';\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\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\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 * @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';\nconst supportsFullBroadcast = false;\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\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\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
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==\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
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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","/**\n * @license\n
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==\n
*/\n\nimport {BackendWasm} from '../backend_wasm';\n\n// Analogous to `struct Result` in
`non_max_suppression_impl.h`.\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
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 * ==\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\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: NonMaxSuppressionV3,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: kernelFunc as {} as KernelFunc,\n};\n","/**\n * @license\n * Copyright 2020
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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}\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 {} 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 {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 Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License
 is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF 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 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the
 License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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, 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 * @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, 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 * @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, 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
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==========\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, 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
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*/\nimport {KernelConfig, Pow} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = false;\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 * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 = 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 License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {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\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\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 '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\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 *
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*/\n\nimport {KernelConfig, KernelFunc, Range, RangeAttrs, TensorInfo} from '@tensorflow/tfjs-core';\n\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\n const out = backend.makeOutput([values.length], dtype);\n const outVals = backend.typedArrayFromHeap(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 *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n
* distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS 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, RealDiv} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from './binary_kernel';\n\nconst supportsFullBroadcast = true;\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 *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n
* distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF 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, Relu} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\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 *
==========\n
*/\nimport {KernelConfig, Relu6} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\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 *
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*/\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\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\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\nexport const resizeBilinearConfig: KernelConfig = {\n kernelName: ResizeBilinear,\n 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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS 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, 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 * ==========\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] = 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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF 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 {createUnaryKernelConfig} from './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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF 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';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {CppDType} 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\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\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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\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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/\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 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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*/\nimport {KernelConfig, Sin} from '@tensorflow/tfjs-core';\n\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 \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS 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, 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\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 * @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 *

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==========\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';\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\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 < 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 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\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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';\nexport const sqrtConfig: KernelConfig = createUnaryKernelConfig(Sqrt);\n","/**\n * @license\n * Copyright 2019 Google LLC. All Rights
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==========\n */\nimport {KernelConfig, Square} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from './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 2.0 (the \"License\");\n
* you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF 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 * @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, 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\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 Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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';\n\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\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 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 * @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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==========\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 * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed
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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
{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\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, 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 * @license\n * Copyright 2021 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 *
==========\n
*/\nimport {KernelConfig, Tan} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\nexport const
tanConfig: KernelConfig = createUnaryKernelConfig(Tan);\n","/**\n * @license\n * Copyright 2019 Google LLC.
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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: 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 */\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\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 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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OF ANY 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\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}, 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 {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
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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';\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 {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 * @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\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/IHkBZlHETpA/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","\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 (\nfunction(WasmBackendModuleThreadedSimd) {\n WasmBackendModuleThreadedSimd = WasmBackendModuleThreadedSimd || {};\n\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
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.substr(0,scriptDirectory.lastIndexOf(\"/\")+1)}else{scriptDirectory=\"\"}if(ENVIRONMENT_IS_NODE){read_=function
shell_read(filename,binary){if(!nodeFS)nodeFS=require(\"fs\");if(!nodePath)nodePath=require(\"path\");filename=nodePath[\"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]}}moduleOverrides=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;err(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[idx++]&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){wasmMemory=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;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){addOnPreRun(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\"].length){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\"](runDependencies)}}function removeRunDependency(id){runDependencies--;if(Module[\"monitorRunDependencies\"]){Module[\"monitorRunDependencies\"](runDependencies)}if(runDependencies==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.error(\"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\"][\"I\"];wasmModule=module;if(!ENVIRONMENT_IS_PTHREAD){var numWorkersToLoad=PThread.unusedWorkers.length;PThread.unusedWorkers.forEach(function(w){PThread.loadWasmModuleToWorker(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(wasmBinaryFile)&&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(){__emscripten_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,EBADF: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,ECHRNG:106,EL2NSYNC:156,EL3HLT:107,EL3RST:108,ELNRNG:109,EUNATCH:110,ENOCSI:111,EL2HLT:112,EDEADLK:16,ENOLCK:46,EBADE: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,ENOTSOCK: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,EOVERFLOW:61,ECANCELED:11,ENOTRECOVERABLE:56,EOWNERDEAD:62,ESTRPIPE:135};function _emscripten_futex_wake(addr,count){if(addr<=0||addr>GROWABLE_HEAP_I8().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.pthreads[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.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);__emscripten_thread_init(tb,!ENVIRONMENT_IS_WORKER,1);_emscripten_register_main_browser_thread_id(tb)},initWorker:function(){},pthreads:{},threadExitHandlers:[],setThreadStatus:function(){},runExitHandlers:function(){while(PThread.threadExitHandlers.length>0){PThread.threadExitHandlers.pop()()}if(ENVIRONMENT_IS_PTHREAD&&_pthread_self())___pthread_tsd_run_dtors()},runExitHandlersAndDeinitThread:function(tb,exitCode){Atomics.store(GROWABLE_HEAP_U32(),tb+56>>2,1);Atomics.store(GROWABLE_HEAP_U32(),tb+60>>2,0);PThread.runExitHandlers();Atomics.store(GROWABLE_HEAP_U32(),tb+4>>2,exitCode);Atomics.store(GROWABLE_HEAP_U32(),tb+0>>2,1);_emscripten_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_PTHREAD){postMessage({\"cmd\":\"exit\"})}}},threadCancel:function(){PThread.runExitHandlersAndDeinitThread(_pthread_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)}}PThread.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=[]},freeThreadData:function(pthread){if(!pthread)return;if(pthread.threadInfoStruct){var 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.pthreads[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.pthreads[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

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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
mory,\"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.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
```

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 _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
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
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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,argsList)){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.deferredCalls.splice(i,1);--i}}},canPerformEventHandlerRequests:function(){return JSEvents.inEventHandler&&JSEvents.currentEventHandler.allowsDeferredCalls},runDeferredCalls:function(){if(!JSEvents.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,eventTypeString){for(var i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==target&&(!eventTypeString||eventTypeString==JSEvents.eventHandlers[i].eventTypeString)){JSEvents._removeHandler(i--)}}},_removeHandler:function(i){var h=JSEvents.eventHandlers[i];h.target.removeEventListener(h.eventTypeString,h.eventListenerFunc,h.useCapture);JSEvents.eventHandlers.splice(i,1)},registerOrRemoveHandler:function(eventHandler){var jsEventHandler=function jsEventHandler(event){++JSEvents.inEventHandler;JSEvents.currentEventHandler=eventHandler;JSEvents.runDeferredCalls();eventHandler.handlerFunc(event);JSEvents.runDeferredCalls();--JSEvents.inEventHandler};if(eventHandler.callbackfunc){eventHandler.eventListenerFunc=jsEventHandler;eventHandler.target.addEventListener(eventHandler.eventTypeString,jsEventHandler,eventHandler.useCapture);JSEvents.eventHandlers.push(eventHandler);JSEvents.registerRemoveEventListeners()}else{for(var i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==eventHandler.target&&JSEvents.eventHandlers[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,targetThread,637534208,eventHandlerFunc,eventData,varargs);stackRestore(stackTop)},getTargetThreadForEventCallback:function(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()[varargs+8>>2]=height;__emscripten_call_on_thread(0,targetThread,657457152,0,targetCanvasPtr,varargs);stackRestore(stackTop)}function _emscripten_set_offscreencanvas_size_on_target_thread(targetThread,targetCanvas,width,height){targetCanvas=targetCanvas?UTF8ToString(targetCanvas):\"\";_emscripten_set_offscreencanvas_size_on_target_thread_js(targetThr

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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
_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
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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.enableExtensionsByDefault){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(contextHandle){return GL.contexts[contextHandle]},deleteContext:function(contextHandle){if(GL.currentContext===GL.contexts[contextHandle])GL.currentContext=null;if(typeof JSEvents===\"object\")JSEvents.removeAllHandlersOnTarget(GL.contexts[contextHandle].GLctx.canvas);if(GL.contexts[contextHandle]&&GL.contexts[contextHandle].GLctx.canvas)GL.contexts[contextHandle].GLctx.canvas.GLctxObject=undefined;_free(GL.contexts[contextHandle].handle);GL.contexts[contextHandle]=null},initExtensions:function(context){if(!context)context=GL.currentContext;if(context.initExtensionsDone)return;context.initExtensionsDone=true;var GLctx=context.GLctx;__webgl_enable_ANGLE_instanced_arrays(GLctx);__webgl_enable_OES_vertex_array_object(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.indexOf(\"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)],\"premultipliedAlpha\":!!GROWABLE_HEAP_I32()[a+(16>>2)],\"preserveDrawingBuffer\":!!GROWABLE_HEAP_I32()[a+(20>>2)],\"powerPreference\":__emscripten_webgl_power_preferences[powerPreference],\"failIfMajorPerformanceCaveat\":!!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()[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)})}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 __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()[status>>2]=threadExitCode;Atomics.store(GROWABLE_HEAP_U32(),thread+64>>2,1);if(!ENVIRONMENT_IS_PTHREAD)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_thread_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_write,_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_logical_cores,\"u\":_emscripten_receive_on_main_thread_js,\"q\":_emscripten_resize_heap,\"v\":_emscripten_set_canvas_element_size,\"i\":_emscripten_set_current_thread_status,\"s\":_emscripten_set_thread_name,\"w\":_emscripten_webgl_create_context,\"l\":_fd_close,\"n\":_fd_seek,\"g\":_fd_write,\"o\":initPthreadsJS,\"a\":wasmMemory||Module[\"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
_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\"][\"o

a\"]).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
_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\"]=Mo

dule[\"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
_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(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\"]
=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(__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[\"_emscript
en_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

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__emscripten_allow_main_runtime_queued_calls=Module[\"__emscripten_allow_main_runtime_queued_calls\"]=10512;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){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()}if(Module[\"setStatus\"]){Module[\"setStatus\"](\"Running...\");setTimeout(function(){setTimeout(function(){Module[\"setStatus\"](\"\")},1);doRun()},1)}else{doRun()}}Module[\"run\"]=run;function
exit(status,implicit){if(implicit&&noExitRuntime&&status===0){return}if(!implicit){if(ENVIRONMENT_IS_PTHREAD){postMessage({\"cmd\":\"exitProcess\",\"returnCode\":status});throw new
ExitStatus(status)}else{}}if(noExitRuntime){}else{PThread.terminateAllThreads();EXITSTATUS=status;exitRuntime();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","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
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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_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){globalEval(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&&!ENVIRONMENT_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=nodePath[\"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[\"argv\"].slice(2);process[\"on\"](\"uncaughtException\",function(ex){if(!(ex instanceof ExitStatus)){throw ex}});process[\"on\"](\"unhandledRejection\",abort);quit_=function(status){process[\"exit\"](status)};Module[\"inspect\"]=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){scriptDirectory=self.location.href}else if(typeof document!==\"undefined\"&&document.currentScript){scriptDirectory=document.currentScript.src}if(_scriptDir){scriptDirectory=_scriptDir}if(scriptDirectory.indexOf(\"blob:\")!==0){scriptDirectory=scriptDirectory.substr(0,scriptDirectory.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]}}moduleOverrides=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[idx++]&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){addOnPreRun(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\"].length){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[\"monitorRunDependencies\"](runDependencies)}}function removeRunDependency(id){runDependencies--;if(Module[\"monitorRunDependencies\"]){Module[\"monitorRunDependencies\"](runDependencies)}if(runDependencies==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;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.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\"];updateGlobalBufferAndViews(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(wasmBinaryFile)&&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,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\":_fd_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=Module[\"_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\"]=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,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
_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=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
_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

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_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
_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
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_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
return WasmBackendModule.ready\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 *
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*/\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 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
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}\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 ${dtype}`);\n    }\n  }\n}\n\nfunction createInstantiateWasmFunc(path: string) {\n  // this will be replace by rollup plugin patchWechatWebAssembly in\n  // minprogram's output.\n  // tslint:disable-next-line:no-any\n  return (imports: any, callback: any) => {\n    util.fetch(path, {credentials: 'same-origin'}).then((response) => {\n      if (!response['ok']) {\n        imports.env.a(`failed to load wasm binary file at '${path}'`);\n      }\n      response.arrayBuffer().then(binary => {\n        WebAssembly.instantiate(binary, imports).then(output => {\n          callback(output.instance, output.module);\n        });\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 * 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
```

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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:\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\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 ;\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, 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\n if (typeof prefixOrFileMap === 'string') {\n wasmPathPrefix = prefixOrFileMap;\n } else {\n wasmFileMap = prefixOrFileMap;\n const missingPaths =\n
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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 intialized.\n */\nexport function getThreadsCount(): number {\n if (actualThreadsCount === -1) {\n throw new Error(`WASM backend not initialized.`);\n }\n return actualThreadsCount;\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 * @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 './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';\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","sliceImplCPU","Slice","BatchToSpaceND","Cast","Ceil","ClipByValue","concatImplCPU","Concat","Conv2D","Conv2DBackpropInput","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","Rsqrt","ScatterNd","Select","Sigmoid","Sin","Softmax","SpaceToBatchND","SplitV","Sqrt","Square","SquaredDifference","Step","StridedSlice","Sub","Sum","Tan","Tanh","Tile","TopK","Transform","Unpack","ZerosLike","registerKernel","env","tslib_1.__extends","DataStorage","engine","KernelBackend","tslib_1.__awaiter","registerBackend"],"mappings":";;;;;;;;;;;;;;;;;;;;;AAAA;;;;;;;;;;;;;;;;AAiBA;AACA,IAAY,QAAMX;AAAN,WAAWA,EAAAA,EAAAA,EAAA

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C,,IAAI,,CAAC,,IAAI,,CAAC,,cAAc,,CAAC,,EAAE,,EAAE,,IAAI,,EAAE,,YAAY,,CAAC,,CAAC;SACvD;QACD,,OAA
O,,EAAC,,MAAM,,QAAA,A,,EAAE,,KAAK,,OAAA,A,,EAAE,,KAAK,,OAAA,A,,EAAC,,CAAC;KAC/B;IAED,wCAAkB,,GA
AlB,,UAAmB,,EAAkC;YAAjC,,gBAAK,,EAAE,,gBAAK,,EAAE,,kBAAM;QAEtC,,IAAM,,MAAM,,GAAG,,IAAI,,CAA
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AI,,CAAC,,aAAa,,CAAC,,KAAK,,CAAC,,CAAC;QACvC,,QAAQ,,EAAE,,KAAK;YACX,,SAAS,,gBAAK,,CAAC,,gBAAK,,CAAC,,
,YAAY,,CAAC,,MAAM,,EAAE,,YAAY,,EAAE,,IAAI,,CAAC,,CAAC;YACtD,,KAAK,,OAAA,A,;gBACV,,CAAC,,gBAAK,,CAAC,,
,YAAY,,CAAC,,MAAM,,EAAE,,YAAY,,EAAE,,IAAI,,CAAC,,CAAC;YACpD,,KAAK,,MAAM;gBACT,,CAAC,,gBAAK,,CAAC,,
,YAAY,,CAAC,,MAAM,,EAAE,,YAAY,,EAAE,,IAAI,,CAAC,,CAAC;YACpD;gBACE,,MAAM,,IAAI,,KAAK,,CAAC,,m
BAAiB,,KAAA,O,,CAAC,,CAAC,,SAAC,7C;KACF;IACH,kBAAC;AAAD,CA3KA,CAAiC,gBAAgB,sBAAa,GA2K7D,CAAC,CAAC,CAAC

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Found in path(s):
*
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No license file was found, but licenses were detected in source scan.

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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\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 {} as KernelFunc,\n};\n"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/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;IAClB,WAAW,EAAE,MAM;IACnB,SAAS,EAAE,KAAK;IAChB,UAAU,EAAE,MA0B;CACvC,CAAC","sourcesContent":["/**\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, 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"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/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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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):
* /opt/cola/permits/1234600203_1638277742.68/0/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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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 (isContinous) {\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.typedArrayFromHeap(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.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\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\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"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Slice.js.map
No license file was found, but licenses were detected in source scan.

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MAAM,UAAU,MAAM,CACpB,IAAsE;IAEtE,MAAM,EAAC,MAAM,EAAE,OAAO,EAAE,KAAK,EAAC,GAAAG,IAAI,CAAC;IACtC,MAAM,EAAC,CAAC,EAAC,GAAG,MAAM,CAAC;IACnB,MAAM,EAAC,IAAI,EAAE,SAAS,EAAE,OAAO,EAAC,GAAG,KAAK,CAAC;IACzC,MAAM,KAAK,GAAG,CAAC,CAAC,KAAK,CAAC,CAAC,MAAM,CAAC;IAE7B,IAAI,CAAC,MAAM,CAAC,CAAC,CAAC,CAAC,KAAK,KAAK,SAAS,IAAI,CAAC,CAAC,KAAK,KAAK,OAAO,EACtD,GAAG,EAAE,CAAC,2BAA2B,CAAC,CAAC,CAAC,KAAK,8BAA8B,CAAC,CAAC;IAC1E,2CAA2C;IAC3C,MAAM,WAAW,GAAG,YAAY,CAAC,kBAAkB,CAAC,CAAC,IAAI,CAAC,CAAC,EAAE,KAAK,CAAC,CAAC,CAAC;IACnE,IAAI,SAAS,GAAG,CAAC,CAAC;IAClB,IAAI,WAAW,KAAK,IAAI,EAAE;QACxB,SAAS,GAAG,WAAW,CAAC,CAAC,CAAC,CAAC

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"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/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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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"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Transform.js.map
No license file was found, but licenses were detected in source scan.

{"version":3,"file":"Multiply.js","sourceRoot":"","sources":["../../src/kernels/Multiply.ts"],"names":[],"mappings":"AAAA;;;;;;;;;;;;;;;GAeG;AAEH,OAAO,EAAe,QAAQ,EAAC,MAAM,uBAAuB,CAAC;AAE7D,OAAO,EAAC,wBAAwB,EAAC,MAAM,iBAAiB,CAAC;AAEzD,MAAM,qBAAqB,GAAG,IAAI,CAAC;AAEnC,MAAM,CAAC,MAAM,cAAc,GAAG,CAAC,EAAC,QAAQ,EAAE,UAAU,EAAE,MAAM,EAAE,MAAM,EAAE

* @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 {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\nexport const clipByValueConfig: KernelConfig = {\n kernelName: ClipByValue,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: clip as {} as KernelFunc\n};\n"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/ClipByValue.js.map
No license file was found, but licenses were detected in source scan.

{"version":3,"file":"Sigmoid.js","sourceRoot":"","sources":["../../src/kernels/Sigmoid.ts"],"names":[],"mappings":"AAAA;;;;;;;;;;;;;;;GAeG;AAEH,OAAO,EAA2B,OAAO,EAA6B,IAAI,EAAC,MAAM,uBAAuB,CAAC;AAIzG,IAAI,QAAA8C,CAAC;AAEnD,SAAS,KAAK,CAAC,OAAoB;IACjC,QAAQ,GAAG,QAAQ,GAAG,OAAO,CAAC,IAAI,CAAC,KAAK,CAAC,KAAK,CAAC,QAAQ,CAAC,KAAK,CAAC,QAAQ,CAAC,KAAK,CAAC,QAAQ

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"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Sigmoid.js.map
No license file was found, but licenses were detected in source scan.

{"version":3,"file":"backend_wasm.js","sourceRoot":"","sources":["../src/backend_wasm.ts"],"names":[],"mappings":"AAAA;;;;;;;;;;;;;;;GAeG;AACH,OAAO,cAAc,CAAC;AAEtB,OAAO,EAAkC,WAAW,EAAY,eAAe,EAAE,MAAM,EAAE,GAAG,EAAE,aAAa,EAAc,IAAI,EAAE,MAAM,EAAE,OAAO,EAAE,kBAAkB,EAAE,MAAM,EAAE,uBAAuB,EAAE,CAAC;AAI5L,OAAO,EAAC,uBAAuB,EAAC,MAAM,gBAAgB,CAAC;AAEvD,MAAM,CAAC,IAAI,QAAQ,GAAG,KAAK,CAAC;AAE5B,MAAM,CAAC,IAAI,UAAU,GAAG,KAAK,CAAC;AAE9

,IAAI,CAAC,IAAI,CAAC,KAAK,CAAC,IAAI,CAAC,YAAY,CAAC,CAAC;YACnC,IAAI,CAAC,IAAI,CAAC,IAAI,CAAC,WAAW,CAAC,IAAI,CAAC,EAAE,CAAC,CAAC;YACpC,IAAI,CAAC,SAAS,CAAC,MAAM,CAAC,MAAM,CAAC,CAAC;SAC/B;QACD,OAAO,IAAI,CAAC;IACd,CAAC;IAED,yCAAyC;IACzC,QAAQ,CAAC,MAAM;QACb,IAAI,IAAI,CAAC,SAAS,CAAC,GAAG,CAAC,MAAM,CAAC,MAAM,CAAC,EAAE;YAC9B,MAAM,UAAU,CAAC,IAAI,CAAC,SAAS,CAAC,GAAG,CAAC,MAAM,CAAC,MAAM,CAAC,CAAC;SAC5D;QACD,IAAI,CAAC,SAAS,CAAC,GAAG,CAAC,MAAM,CAAC,MAAM,CAAC,EAAE;YAC/B,MAAM,UAAU,CAAC,IAAI,CAAC,SAAS,CAAC,GAAG,CAAC,MAAM,CAAC,MAAM,CAAC,CAAC;SAC5D;QACD,OAAO,IAAI,CAAC,SAAS,CAAC,GAAG,CAAC,MAAM,CAAC,MAAM,CAAC,CAAC;IAC7C,CAAC;IAED,uEAAuE;IACvE,WAAW;IACX,eAAe,CAAC,MAAM,CAAC;QACnB,MAAM,CAAC

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```
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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 */\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 as backend_util.TypedArray).buffer,\n              (values as backend_util.TypedArray).byteOffset,\n              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) *\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   */\n  disposeData(dataId: DataId, force = false): boolean {\n    if (this.dataIdMap.has(dataId)) {\n      const data = this.dataIdMap.get(dataId);\n      data.refCount--;\n\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
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}\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 ${dtype}`);\n   }\n }\n}\n\nfunction createInstantiateWasmFunc(path: string) {\n // this will be replace by rollup plugin patchWechatWebAssembly in\n // minprogram's output.\n // tslint:disable-next-line:no-any\n return (imports: any, callback: any) => {\n   util.fetch(path, {credentials: 'same-origin'}).then((response) => {\n   if (!response['ok']) {\n   imports.env.a(`failed to load wasm binary file at '${path}'`);\n   }\n   response.arrayBuffer().then(binary => {\n   WebAssembly.instantiate(binary, imports).then(output => {\n   callback(output.instance, output.module);\n   });\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 * 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   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

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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:\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, ['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 ;\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, 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\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 intialized.\n */\nexport function getThreadsCount(): number {\n if (actualThreadsCount === -1) {\n throw new Error(`WASM backend not initialized.`);\n }\n return actualThreadsCount;\n}\n"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/backend_wasm.js.map
No license file was found, but licenses were detected in source scan.

{"version":3,"file":"Unpack.js","sourceRoot":"","sources":["../../src/kernels/Unpack.ts"],"names":[],"mappings":"AAAA;;;;;;;;;;;;;;;GAeG;AAEH,OAAO,EAAuC,MAAM,EAA4B,MAAM,uBAAuB,CAAC;AAI9G,OAAO,EAAC,KAAK,EAAC,MAAM,SAAS,CAAC;AAE9B,SAAS,MAAM,CACX,CAAC,EAAE,CAAC,EAAE,CAAC,EAAE

*\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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\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}, 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"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Unpack.js.map
No license file was found, but licenses were detected in source scan.

{"version":3,"file":"AddN.js","sourceRoot":"","sources":["../../src/kernels/AddN.ts"],"names":[],"mappings":"AAAA;;;;;;;;;;;;;;;GAAeG;AAEH,OAAO,EAAC,IAAI,EAAEwC,IAAI,EAAC,MAAM,uBAAuB,CAAC;AAIvF,OAAO,EAAC,QAAQ,EAAC,MAAM,SAAS,CAAC;AAEjC,IAAI,QAAQ,CAAC;AAEb,SAAS,CAAC;AAED,SAAS,IAAIC,QAAQ,CAAC,OAAO,CAAC,CAAC,CAAC

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, 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"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/AddN.js.map
No license file was found, but licenses were detected in source scan.

{"version":3,"file":"Less.js","sourceRoot":"","sources":["../../src/kernels/Less.ts"],"names":[],"mappings":"AAAA;;;;;;;;;;;;;GAeG;AACH,OAAO,EAAe,IAAI,EAAC,MAAM,uBAAuB,CAAC;AAEzD,OAAO,EAAC,wBAAwB,EAAC,MAAM,iBAAiB,CAAC;AACzD,MAAM,qBAAqB,GAAG,KAAK,CAAC;AACpC,MAAM,CAAC,MAAM,UAAU,GAAG,IAAI,CAAC,IAAI,EAAE,qBAAqB,EAAE,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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF 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, Less} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const lessConfig: KernelConfig =\n createBinaryKernelConfig(Less, supportsFullBroadcast, 'bool');\n"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Less.js.map
No license file was found, but licenses were detected in source scan.

{"version":3,"file":"SpaceToBatchND.js","sourceRoot":"","sources":["../../src/kernels/SpaceToBatchND.ts"],"names":[],"mappings":"AAAA;;;;;;;;;;;;;;;GAeG;AAEH,OAAO,EAAC,YAAY,EAAE,IAAI,EAAC,MAAM,uBAAuB,CAAC;AAEzD,OAAO,EAAC,wBAAwB,EAAC,MAAM,iBAAiB,CAAC;AACzD,MAAM,qBAAqB,GAAG,IAAI,CAAC;AACnC,MAAM,CAAC,MAAM,kBAAkB,GAAG,IAAI,CAAC,YAAY,EAAE,qBAAqB,EAAE,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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF 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, SpaceToBatchND} from '@tensorflow/tfjs-core';\n\nimport {createSimpleUnaryKernelConfig} from './unary_kernel';\nconst supportsFullBroadcast = true;\nexport const spaceToBatchNDConfig = createSimpleUnaryKernelConfig(SpaceToBatchND, supportsFullBroadcast);\n"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/SpaceToBatchND.js.map
No license file was found, but licenses were detected in source scan.

{"version":3,"file":"SplitV.js","sourceRoot":"","sources":["../../src/kernels/SplitV.ts"],"names":[],"mappings":"AAAA;;;;;;;;;;;;;GAaG;AAEH,OAAO,EAAC,YAAY,EAAE,MAAM,EAAC,MAAM,uBAAuB,CAAC;AAE3D,OAAO,EAAC,wBAAwB,EAAC,MAAM,iBAAiB,CAAC;AACzD,MAAM,qBAAqB,GAAG,IAAI,CAAC;AACnC,MAAM,CAAC,MAAM,YAAY,GAAG,IAAI,CAAC,MAAM,EAAE,qBAAqB,EAAE,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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF 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, Split} from '@tensorflow/tfjs-core';\n\nimport {createSimpleUnaryKernelConfig} from './unary_kernel';\nconst supportsFullBroadcast = true;\nexport const splitConfig = createSimpleUnaryKernelConfig(Split, supportsFullBroadcast);\n"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/SplitV.js.map
No license file was found, but licenses were detected in source scan.

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result;\n}\n\nexport const spaceToBatchNDConfig: KernelConfig = {\n kernelName: SpaceToBatchND,\n backendName: 'wasm',\n kernelFunc: spaceToBatchND as {} as KernelFunc\n};\n"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/SpaceToBatchND.js.map
No license file was found, but licenses were detected in source scan.

{"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","../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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT
 WARRANTIES OR CONDITIONS OF ANY 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 * @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, 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 ${biasData.shape.length}.`);\n   }\n   biasId = biasData.id;\n }\n const preluActivationWeightsId = preluActivationWeights == null ?\n   0 :\n backend.dataIdMap.get(preluActivationWeights.dataId).id;\n const fusedActivation =\n FusableActivation[activation as {} as keyof typeof FusableActivation];\n if (fusedActivation == null) {\n   throw new Error(\n   `${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 * @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 {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 * @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 * @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, 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 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\nreturn {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 License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF 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 = createBinaryKernelConfig(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 {CppDType} 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, 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 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF 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 * @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, KernelFunc, TensorInfo, Transpose, TransposeAttrs, TransposeInputs} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {identity} from './Identity';\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\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 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","/**\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\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 = 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. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance 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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==\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
/\n\nimport {ArgMax, ArgMaxAttrs, ArgMaxInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {permuteAxesAndTranspose} from './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\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 LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not

use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {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 * @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, 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
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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
 {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\nfunction 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,
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 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,
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
```

Int32Array(b3d.shape).buffer);\n\n wasmBatchMatMul(\n   a3dId, aShapeBytes, a3d.shape.length, b3dId,
bShapeBytes,\n   b3d.shape.length, transposeA, transposeB, outId);\n\n backend.disposeData(a3d.dataId);\n
backend.disposeData(b3d.dataId);\n\n out.shape =
 outShape;\n return out;\n}\n\nexport const batchMatMulConfig: KernelConfig = {\n kernelName:
BatchMatMul,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: batchMatMul 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
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License.\n *
==\n
*/\nimport { backend_util, util } from '@tensorflow/tfjs-core';\nexport function
 concatImpl(inputs, outShape, dtype, simplyConcat) {\n   const outVals = util.getArrayFromDType(dtype,
util.sizeFromShape(outShape));\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.set(input.vals, offset);\n   offset += size;\n   });\n   }\n
else {\n   let colOffset = 0;\n   inputs.forEach(input => {\n   const decodedData = dtype === 'string' ?\n
          backend_util.fromUint8ToStringArray(input.vals) :\n   input.vals;\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
    }\n   colOffset += input.shape[1];\n   });\n   }\n   return outVals;\n}\n//#
sourceMappingURL=data:application/json; base64,eyJ2ZXJzaW9uIjozLCJmaWxlIjoiQ29uY2F0X2ltcGwuanMiLC
Jzb3VyY2VSb290IjoiIiwic291cmNlcyI6WyIuLi8uLi8uLi8uLi8uLi8uLi90ZmpzLWJhY2tlbmQtY3B1L3NyYy9rZ
XJuZWxzL0NvbmNhdF9pbXBsLnRzIl0sIm5hbWVzIjpbXSwibWFwcGluZ3MiOiJBQUFBOzs7Ozs7Ozs7Oz
s7R0FlRztBQUVILE9BQU8sRUFBQyxZQUFZLEVBQUUsSUFBSSxFQUFDLE1BQU0sdUJBQXVCO0FBRXpD
xFQUFFLFlBQXFCO0FBQ3hDLE1BQU0sT0FBTyxT0FBTyxxHQUFHLHlBQUksQ0FBQyxxpQkFBaUIsQ0FBQyxpQkFBaUIsQ0FBQyxxLQUFFLLL
EVBQUUsUSUFBSSxSxDQUFDLGFBQWEsQ0FBQyxqRQUFRLENBQUMsQ0FBQyxxDQUFDO0lBRTVFLElBQUk
sWUFBWSxJQUFJLEtBQUssS0FBSyxqRQUFRLEVBQUU7UUFDdEMxELElBQUksTUFB
TSxHQUFHLENBQUMsQ0FBQztRQUNmLE1BQU0sQ0FBQyxPQUFPLENBQUMsR0FBRyxDQUFDLENBQUMsQ0FBQyxDQUFDLENBQUMsQ0FBQyxDQUFDLENBQUMsQ0FBQyxDQUFDLENBQUMsQ
U7WUFDckIsTUFBTSxJLEdBQUcsQ0FBQyxSUFBSSxSxDQUFDLGFBQWEsQ0FBQyxLQUFLLLENBQUMsS0FBSy
xDQUFDLENBQUM7NUMsT0FBQyxHQUFHLENBQUMsQ0FBQyxHQUFHLENBQUMsQ0FBQyxHQUFHLENBQUMsQ0FBQyxHQUFHLENBQUMsQ0FBQyxHQUFHLENBQUMsQ0FBQyxHQUFHLENBQUMsQ
BQUUsTUFBTSxxJQUFJLEtBQUssS0FBSyxqRQUFRLEVBQUU7UUFDdEMxELElBQUksTUFBTSxHQUFHLENBQUMsQ0FBQztRQUNmLE1BQU0sQ0FBQyxPQUFPLENBQUMsR0FBRyxDQUFDLENBQUMsQ0FBQyxDQUFDLENBQUMsQ0FBQyxDQUFDLENBQUMsQ
U7WUFDckIsTUFBTSxJLEdBQUcsQ0FBQyxSUFBSSxSxDQUFDLGFBQWEsQ0FBQyxLQUFLLLENBQUMsS0FBSy
xDQUFDLENBQUM7NUMsT0FBQyxHQUFHLENBQUMsQ0FBQyxHQUFHLENBQUMsQ0FBQyxHQUFHLENBQUMsQ0FBQyxHQUFHLENBQUMsQ0FBQyxHQUFHLENBQUMsQ0FBQyxHQUFHLENBQUMsQ
BQUUsTUFBTSxxSUFBSSxSxDQUFDLGFBQWEsQ0FBQyxLQUFLLLENBQUMsS0FBSyxDQUFDLENBQUM7NUMsT

BTyxPQUFPLENBQUM7QUFDakIsQ0FBQyIsInNvdXJjZXNDb250ZW50IjpbIi8qKlxuICogQGxpY2Vuc2VcbiAqIENvcHlyaWdodCAyMDIwIEdvb2dsZSBMTEMuIEFsbCBSaWdodHMgUmVzZXJ2ZWQuXG4gKiBMaWNlbnNlZCB1bmRlciB0aGUgQXBhY2hlIExpY2Vuc2UsIFZlcnNpb24gMi4wIChoZSBMaWNlbnNlXCIpO1xuICogeW91IG1heSBub3QgdXNlIHRoaXMgZmlsZSBleGNlcHQgaW4gY29tcGxpYW5jZSB3aXRoIHRoZSBMaWNlbnNlLlxuICogWW91IG1heSBvYnRhaW4gYSBjb3B5IG9mIHRoZSBMaWNlbnNlIGF0XG4gKlxuICogICAgIGh0dHA6Ly93d3cuYXBhY2hlLm9yZy9saWNlbnNlcy9MSUNFTlNFLTIuMFxuICpcbiAqIFVubGVzcyByZXF1aXJlZCBieSBhcHBsaWNhYmxlIGxhdyBvciBhZ3JlZWRcbiAqIHRvIGluIHdyaXRpbmcsIHNvZnR3YXJlXG4gKiBkaXN0cmlidXRlZCB1bmRlciB0aGUgTGljZW5zZSBpcyBkaXN0cmlidXRlZCBvbiBhbiBcIkFTIElTXCIgQkFTSVMsXG4gKiBXSVRIT1VUIFdBUlJBTlRJRVMgT1IgQ09ORElUSU9OUyBPRiBBTlkgS0lORCwgZWl0aGVyIGV4cHJlc3Mgb3IgaW1wbGllZC5cbiAqIFNlZSB0aGUgTGljZW5zZSBmb3IgdGhlIHNwZWNpZmljIGxhbmd1YWdlIGdvdmVybmluZyBwZXJtaXNzaW9uc1xuICogYW5kIGxpbWl0YXRpb25zIHVuZGVyIHRoZSBMaWNlbnNlLlxuICovXG5pbXBvcnQgeyB1dGlsIH0gZnJvbSAnQHRlbnNvcmZsb3cvdGZqcy1jb3JlJztcbmV4cG9ydCBmdW5jdGlvbiByYW5nZUltcGwoc3RhcnQsIHN0b3AsIHN0ZXAsIGR0eXBlKSB7XG4gICAgY29uc3Qgc2FtZVN0YXJ0U3RvcCA9IHN0YXJ0ID09PSBzdG9wO1xuICAgIGNvbnN0IGluY3JlYXNpbmdSYW5nZU5lZ2F0aXZlU3RlcCA9IHN0YXJ0IDwgc3RvcCAmJiBzdGVwIDwgMDtcbiAgICBjb25zdCBkZWNyZWFzaW5nUmFuZ2VQb3NpdGl2ZVN0ZXAgPSBzdGFydCA+IHN0b3AgJiYgc3RlcCA+IDE7XG4gICAgaWYgKHNhbWVTdGFydFN0b3AgfHwgaW5jcmVhc2luZ1JhbmdlTmVnYXRpdmVTdGVwIHx8XG4gICAgICAgIGRlY3JlYXNpbmdSYW5nZVBvc2l0aXZlU3RlcCkge1xuICAgICAgICByZXR1cm4gdXRpbC5tYWtlWmVyb3NUeXBlZEFycmF5KDAsIGR0eXBlKTtcbiAgICB9XG4gICAgY29uc3QgbnVtRWxlbWVudHMgPSBNYXRoLmFicyhNYXRoLmNlaWwoKHN0b3AgLSBzdGFydCkgLyBzdGVwKSk7XG4gICAgY29uc3QgdmFsdWVzID0gdXRpbC5tYWtlWmVyb3NUeXBlZEFycmF5KG51bUVsZW1lbnRzLCBkdHlwZSk7XG4gICAgaWYgKHN0b3AgPCBzdGFydCAmJiBzdGVwID09PSAxKSB7XG4gICAgICAgIC8vIEF1dG8gYWRqdXN0

the 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 < values.length; i++) {\n values[i] = values[i - 1] + step;\n }\n return values;\n}\n//# sourceMappingURL=data:application/json; base64,eyJ2ZXJzaW9uIjozLCJmaWxlIjoiUmFuZ2VfaW1wbC5qcyIsInNvdXJjZVJvb3QiOiIiLCJzb3VyY2VzIjpbIi4uLy4uLy4uLy4uLy4uLy4uL3RmanMtYmFja2VuZC1jcHUvc3JjL2tlcm5lbHMvUmFuZ2VfaW1wbC50cyJdLCJuYW1lcyI6W10sIm1hcHBpbmdzIjoiQUFBQTs7Ozs7Ozs7Ozs7O0dBZUc7QUFFFSCxPQUFPLEVBQWMsSUFBSSxFQUFFLFdBQVcsRUFBRSxNQUFNLEVBQUUsTUFBTSxFQUFFLE1BQU0s

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==\n
*/\nimport { backend_util, buffer, Slice, slice_util, util } from '@tensorflow/tfjs-core';\nimport { assertNotComplex } from '../cpu_util';\nexport function sliceImpl(vals, begin, size, shape, dtype) {\n   const isContinous = slice_util.isSliceContinous(shape, begin, size);\n   const length = util.sizeFromShape(size);\n   const xStrides = util.computeStrides(shape);\n   if (isContinous) {\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) :\n   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}\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}\nexport const sliceConfig = {\n   kernelName: Slice,\n   backendName: 'cpu',\n   kernelFunc: slice\n};\n//#
sourceMappingURL=data:application/json; base64,eyJ2ZXJzaW9uIjozLCJmaWxlIjoiU2xpY2UuanMiLCJzb3VyY2VSb290IjoiIiwic291cmNlcyI6WyIuLi8uLi8uLi8uLi8uLi8uLi90ZmpzLWJhY2tlbmQtY3B1L3NyYy9rZXJuZWxzL1NsaWNlLnRzIl0sIm5hbWVzIjpbXSwibWFwcGluZ3MiOiJBQUFBOzs7Ozs7Ozs7Ozs7R0FlRztBQUU8sRUFBQyxlLEVBQUMsZUFBQyxFQUFDLEVBQUMsRUFBQyxFQUFDLEVBQUMsRUFBQyxFQUFDLEVBQUMsR

UMsRUFBRSxFQUFFLENBQUMsR0FBRyxHQUFHLEtBQUssQ0FBQyxDQUFDLENBQUMsQ0FBQyxDQUF
DO1FBQzdELE1BQU0sQ0FBQyxHQUFHLENBQUMsS0FBSyxDQUFDLEdBQUcsQ0FBQyxHQUFHLEtBQUs
sQ0FBQyxFQUFFLEdBQUcsTUFBTSxDQUFDLENBQUM7S0FDNM7SUFFRCxJQUFJLEtBQUssS0FBSyxR
QUFRLEVBQUU7UUFDdEIsT0FBTyxZQUFZLENBQUMsc0JBQXNCLENBQUMsTUFBTSxDQUFDLE1BQ
WtCLENBQUMsQ0FBQztLQUN2RTtJQUNELE9BQU8sTUFBTSxDQUFDLE1BQW9CLENBQUM7QUFDckM
sQ0FBQztBQUVELE1BQU0sVEFBVSxSxLQUFLLENBQ2pCLE9BQU8sTUFBTSxDQUFDLE1BQW9CLENBQUM
NLEVBQUUsT0FBTyxFQUEtBQUssRUFBQyxDQUFDLENBQUMsQ0FBQztBQUNqQyxNQUFNLFVBQVUsSUFBSSxDQUNoQixPQUFPLE1BQU0sQ0FBQyxNQUFNLENBQUMsTUFBTSxDQUFDLENBQUMsQ0FBQyxDQUFDLENBQUMsQ0FBQyxDQUFDLENBQUMsQ0FBQy

REYXRhKTtcbiAgY29uc3Qgb3V0QnVmID0gYnVmZmVyKHNpemUsIGR0eXBlKTtcbiAgZm9yIChsZXQgaSA9IDA7IGkgPCBvdXRCdWYuc2l6ZTsgKytpKSB7XG4gICAgY29uc3Qgb3V0TG9jID0gb3V0QnVmLmluZGV4VG9Mb2MoaSk7XG4gICAgY29uc3QgaW5Mb2MgPSBvdXRMb2MubWFwKChpZHg6IG51bWJlciwgaikgPT4gaWR4ICsgYmVnaW5bal0pO1xuICAgIGNvbnN0IGluSWR4ID0gaW5wdXQuZ2V0KC4uLmluLCAyKTtcbiAgICBvdXQuc2V0KGluSWR4LCAuLi5vdXRMb2MsIDIpO1xuICB9XG4gIHJldHVybiBvdXQudG9UeXBlZEFycmF5KCk7XG59XG5cbmZ1bmN0aW9uIHNsaWNlSW1wbENQVShcbiAgICBhcmdzOiB7aW5wdXRzOiBTbGljZUlucHV0cywgYXR0cnM6IFNsaWNlQXR0cnMsIGJhY2tlbmQ6IEJhY2tlbmRXYXNtfSkge1xuICBjb25zdCB7aW5wdXRzOiB7eH0sIGF0dHJzOiB7YmVnaW4sIHNpemV9LCBiYWNrZW5kfSA9IGFyZ3M7XG5cbiAgY29uc3QgW2JlZ2luXywgc2l6ZV9dID0gc2xpY2VfdXRpbC5wYXJzZVNsaWNlUGFyYW1zKHgsIGJlZ2luLCBzaXplKTtcblxuICBjb25zdCBpc0NvbnRpbm91cyA9IHNsaWNlX3V0aWwuaXNTbGljZUNvbnRpbm91cyh4LnNoYXBlLCBiZWdpbl8sIHNpemVfKTtcbiAgY29uc3QgeFZhbHMgPSBiYWNrZW5kLnJlYWRTeW5jKHguZGF0YUlkKTtcbiAgY29uc3Qgb3V0ID0gYmFja2VuZC5tYWtlT3V0cHV0KHNpemVfLCB4LmR0eXBlKTtcbiAgY29uc3QgeFN0cmlkZXMgPSB1dGlsLmNvbXB1dGVTdHJpZGVzKHguc2hhcGUpO1xuICBjb25zdCBvdXREYXRhID0gYmFja2VuZC5kYXRhSWRNYXAuZ2V0KG91dC5kYXRhSWQpO1xuXG4gIGlmIChpc0NvbnRpbm91cykge1xuICAgIGNvbnN0IGZsYXRPZmZzZXQgPSBzbGljZV91dGlsLmNvbXB1dGVGbGF0T2Zmc2V0KGJlZ2luXywgeFN0cmlkZXMpO1xuXG4gICAgaWYgKHguZHR5cGUgPT09ICdzdHJpbmcnKSB7XG4gICAgICBvdXREYXRhLnN0cmluZ0J5dGVzID1cbiAgICAgICAgICAoeFZhbHMgYXMgVWludDhBcnJheVtdKVxuICAgICAgICAgICAgICAuc2xpY2UoZmxhdE9mZnNldCwgZmxhdE9mZnNldCArXG4gICAgICAgICAgICAgICAgICB1dGlsLnNpemVGcm9tU2hhcGUoc2l6ZV8pKTtcbiAgICB9IGVsc2Uge1xuICAgICAgY29uc3Qgb3V0VmFscyA9IGJhY2tlbmQudHlwZWRBcnJheUZyb21IZWFwKG91dCk7XG4gICAgICBvdXRWYWxzLnNldChcbiAgICAgICAgICAoeFZhbHMgYXMgVHlwZWRBcnJheSlcbiAgICAgICAgICAgICAgLnN1YmFycmF5KGZsYXRPZmZzZXQsIGZsYXRPZmZzZXQgK1xuICAgICAgICAgICAgICAgICAgdXRpbC5zaXplRnJvbVNoYXBlKHNpemVfKSkpO1xuICAgIH1cblxuICAgIHJldHVybiBvdXQ7XG4gIH1cblxuICBpZiAoeC5kdHlwZSA9PT0gJ3N0cmluZycpIHtcbiAgICBjb25zdCByZXMgPVxuICAgICAgICBzbGljZUltcGxDUFUoeFZhbHMsIGJlZ2luXywgc2l6ZV8sIHguc2hhcGUsIHguZHR5cGUpO1xuICAgIG91dERhdGEuc3RyaW5nQnl0ZXMgPSByZXMgYXMgVWludDhBcnJheVtdO1xuICAgIHJldHVybiBvdXQ7XG4gIH1cblxuICBjb25zdCBvdXRWYWxzID0gYmFja2VuZC50eXBlZEFycmF5RnJvbUhlYXAob3V0KTtcbiAgY29uc3QgcmFuayA9IHguc2hhcGUubGVuZ3RoO1xuICBpZiAocmFuayA9PT0gMikge1xuICAgIHNsaWNlMmQoXG4gICAgICAgIHhWYWxzIGFzIFR5cGVkQXJyYXksIHhTdHJpZGVzWzBdLCBvdXRWYWxzLCBiZWdpbl8gYXMgW251bWJlciwgbnVtYmVyXSxcbiAgICAgICAgc2l6ZV8gYXMgW251bWJlciwgbnVtYmVyXSk7XG4gIH0gZWxzZSBpZiAocmFuayA9PT0gMykge1xuICAgIHNsaWNlM2QoXG4gICAgICAgIHhWYWxzIGFzIFR5cGVkQXJyYXksIHhTdHJpZGVzWzBdLCB4U3RyaWRlc1sxXSwgb3V0VmFscyxcbiAgICAgICAgYmVnaW5fIGFzIFtudW1iZXIsIG51bWJlciwgbnVtYmVyXSwgc2l6ZV8gYXMgW251bWJlciwgbnVtYmVyLCBudW1iZXJdKTtcbiAgfSBlbHNlIGlmIChyYW5rID09PSA0KSB7XG4gICAgc2xpY2U0ZChcbiAgICAgICAgeFZhbHMgYXMgVHlwZWRBcnJheSwgeFN0cmlkZXNbMF0sIHhTdHJpZGVzWzFdLCB4U3RyaWRlc1syXSwgb3V0VmFscyxcbiAgICAgICAgYmVnaW5fIGFzIFtudW1iZXIsIG51bWJlciwgbnVtYmVyLCBudW1iZXJdLFxuICAgICAgICBzaXplXyBhcyBbbnVtYmVyLCBudW1iZXIsIG51bWJlciwgbnVtYmVyXSk7XG4gIH0gZWxzZSB7XG4gICAgY29uc3QgcmVzID1cbiAgICAgICAgc2xpY2VJbXBsQ1BVKHhWYWxzLCBiZWdpbl8sIHNpemVfLCB4LnNoYXBlLCB4LmR0eXBlKSBhcyBUeXBlZEFycmF5O1xuICAgIG91dFZhbHMuc2V0KHJlcyk7XG4gIH1cblxuICByZXR1cm4gb3V0O1xufVxuXG5mdW5jdGlvbiBzbGljZTJkKFxuICAgIHhWYWxzOiBiYWNrZW5kX3V0aWwuVHlwZWRBcnJheSwgeFN0cmlkZTogbnVtYmVyLFxuICAgIG91dFZhbHM6IGJhY2tlbmRfdXRpbC5UeXBlZEFycmF5LCBiZWdpbjogW251bWJlciwgbnVtYmVyXSxcbiAgICBzaXplOiBbbnVtYmVyLCBudW1iZXJdKTogdm9pZCB7XG4gIGxldCBvdXRPZmZzZXQgPSAwO1xuICBjb25zdCBiZWdpbkkgPSBiZWdpblswXTtcbiAgY29uc3QgYmVnaW5KID0gYmVnaW5bMV07XG4gIGNvbnN0IGVuZEkgPSBiZWdpbkkgKyBzaXplWzBdO1xuICBmb3IgKGxldCBpID0

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\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 * @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 {backend_util, BatchToSpaceND, BatchToSpaceNDAttrs, BatchToSpaceNDInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {reshape} from './Reshape';\nimport {slice} from './Slice';\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: {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\nexport const batchToSpaceNDConfig: KernelConfig
 = {\n kernelName: BatchToSpaceND,\n backendName: 'wasm',\n kernelFunc: batchToSpaceND 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 {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\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 Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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, Ceil} from '@tensorflow/tfjs-core';\n\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\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\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 License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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, 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 = $inputs.map(t => {\n const innerSize = util.sizeFromShape(t.shape.slice(axis));\n const shape = [-1, innerSize];\n return reshape({inputs: {x: t}, backend, attrs: {shape}});\n });\n\n const inputsValShapes = inputs2D.map(t => {\n return {vals: backend.readSync(t.dataId), shape: t.shape};\n });\n\n // Concats 2d tensors
along axis=1.\n outShape =\n backend_util.computeOutShape(inputs2D.map(t => t.shape), 1 /* axis */);\n const simplyConcat = inputs2D[0].shape[0] === 1;\n const outVals = concatImplCPU(\n inputsValShapes, outShape, inputs[0].dtype,\n simplyConcat) as string[];\n\n const finalOutShape =\n backend_util.computeOutShape($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\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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, 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
*/\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\nexport const conv2DBackpropInputConfig: KernelConfig = {\n kernelName: Conv2DBackpropInput,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: conv2DBackpropInput 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 {Cos, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\n\nexport const cosConfig: KernelConfig = createUnaryKernelConfig(Cos);\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 {Cosh, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\n\nexport const coshConfig: KernelConfig = createUnaryKernelConfig(Cosh);\n","/**\n *

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*/\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","/**\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\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\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\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 * @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 */\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","/**\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 {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',\n   // 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,\n   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

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under the License.\n *
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*/\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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agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF 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 =\n
createBinaryKernelConfig(Equal, supportsFullBroadcast, 'bool');\n","/**\n * @license\n * Copyright 2019 Google
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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 {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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law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS 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 {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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law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS 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} 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 * @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 {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 compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF 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","/**\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 {FloorDiv, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from './binary_kernel';\n\nconst supportsFullBroadcast = false;\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

use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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';\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 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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';\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:\n 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

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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 (${outputChannels})`);\n    }\n    biasId = biasData.id;\n  }\n\n  const filterHeight =
convInfo.filterHeight;\n  const filterWidth = convInfo.filterWidth;\n  const padTop = convInfo.padInfo.top;\n  const
padRight = convInfo.padInfo.right;\n  const padBottom = convInfo.padInfo.bottom;\n  const padLeft =
convInfo.padInfo.left;\n  const dilationHeight = convInfo.dilationHeight;\n  const dilationWidth =
convInfo.dilationWidth;\n  const strideHeight = convInfo.strideHeight;\n  const strideWidth =
convInfo.strideWidth;\n
  const inputChannels = convInfo.inChannels;\n  const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n
const batchSize = convInfo.batchSize;\n  const inHeight = convInfo.inHeight;\n  const inWidth =
convInfo.inWidth;\n\n  if (dataFormat !== 'NHWC') {\n    throw new Error(\n        `wasm backend FusedConv2D
does not support dataFormat:'` +\n        `${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\nexport 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
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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, 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}\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\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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

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  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
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 * @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
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==========================================================================\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 {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    },\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
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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
*/\nimport {Greater, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'./binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const greaterConfig: KernelConfig =\n
createBinaryKernelConfig(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 *\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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CONDITIONS OF 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';\n\nimport {createBinaryKernelConfig}
from './binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const greaterEqualConfig: KernelConfig =\n
createBinaryKernelConfig(GreaterEqual, supportsFullBroadcast, 'bool');\n","/**\n * @license\n * Copyright 2019
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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\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 *

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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 {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\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\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, 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 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 *\n ===\n*/\nimport {KernelConfig, Maximum} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const maximumConfig: KernelConfig =\n   createBinaryKernelConfig(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 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';\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 //\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 * @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, 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\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 * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
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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';\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\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\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 * @license\n * Copyright 2019 Google
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==\n
*/\nimport {KernelConfig, Minimum} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from

'./binary_kernel';\nconst supportsFullBroadcast = false;\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
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 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\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 copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\"
 BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF 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
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*/\n\nimport {BackendWasm} from '../backend_wasm';\n\n// Analogous to `struct Result` in
`non_max_suppression_impl.h`.\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 * @license\n * Copyright 2019 Google LLC. All Rights
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==========\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\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:
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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==========\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\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 {} 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 {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\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 Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const notEqualConfig: KernelConfig =\n createBinaryKernelConfig(NotEqual, supportsFullBroadcast, 'bool');\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, 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 * @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, 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 * @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';\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n
 * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS 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, 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, 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 * @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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==========\n */\nimport {KernelConfig, Pow} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = false;\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 * Unless required by
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==========\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 = 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 License.\n * You may obtain a copy of the License at\n *
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==========\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 {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\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\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 'prod', reductionAxes, input.shape.length);\n const [outShape, reduceShape]\n =\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\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
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*/\n\nimport {KernelConfig, KernelFunc, Range, RangeAttrs, TensorInfo} from '@tensorflow/tfjs-core';\n\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\n const
out = backend.makeOutput([values.length], dtype);\n const outVals = backend.typedArrayFromHeap(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 *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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, RealDiv} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from './binary_kernel';\n\nconst supportsFullBroadcast = true;\nexport const realDivConfig: KernelConfig =\n createBinaryKernelConfig(RealDiv, supportsFullBroadcast);\n","/**\n * @license\n * Copyright 2019 Google LLC.

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==========\n
*/\nimport {KernelConfig, Relu} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\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 *
==========\n
*/\nimport {KernelConfig, Relu6} from '@tensorflow/tfjs-core';\n\nimport
{createUnaryKernelConfig} from './unary_kernel';\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\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\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\nexport const resizeBilinearConfig: KernelConfig = {\n kernelName: ResizeBilinear,\n

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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 '@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 * ==========\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS
OF 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 {createUnaryKernelConfig} from './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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF 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';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {CppDType} 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\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\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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, 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:\n 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 * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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, Sigmoid, SigmoidInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm}\n 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 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\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, software\n * distributed under the License is distributed on 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 {KernelConfig, Sin} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\nexport const sinConfig: KernelConfig = createUnaryKernelConfig(Sin);\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
*/\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\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 * @license\n * Copyright 2021 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
*/\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';\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\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 <
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

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
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==========\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *
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==========\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 License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n
* distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF 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 * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version

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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 * @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, 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\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 Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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, slice_util, StridedSlice, StridedSliceAttrs, StridedSliceInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\n\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\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 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 * @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, Sub} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = true;\nexport const subConfig: KernelConfig =\n createBinaryKernelConfig(Sub, 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 */\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\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   =\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 * @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
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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, Tan} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const tanConfig: KernelConfig = createUnaryKernelConfig(Tan);\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, Tanh} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const tanhConfig: KernelConfig = createUnaryKernelConfig(Tanh);\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, 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\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 Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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, 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: 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   '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\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 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, 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\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}, backend});\n }\n return outs.map(({dataId, dtype}) => ({dataId, dtype,\n   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 {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 * ==========\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
'./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 *
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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 {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/IHkBZlHETpA/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","\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
(\nfunction(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=nodePath[\"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[\"argv\"].slice(2);process[\"on\"](\"uncaughtException\",function(ex){if(!(ex instanceof ExitStatus)){throw ex}});process[\"on\"](\"unhandledRejection\",abort);quit_=function(status){process[\"exit\"](status)};Module[\"inspect\"]=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){scriptDirectory=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.substr(0,scriptDirectory.lastIndexOf(\"/\")+1)}else{scriptDirectory=\"\"}if(ENVIRONMENT_IS_NODE){read_=function shell_read(filename,binary){if(!nodeFS)nodeFS=require(\"fs\");if(!nodePath)nodePath=require(\"path\");filename=nodePath[\"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]}}moduleOverrides=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;err(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[idx++]&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){wasmM
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 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=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+=\"\";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\"][\"I\"];wasmModule=module;if(!ENVIRONMENT_IS_PTHREAD){var numWorkersToLoad=PThread.unusedWorkers.length;PThread.unusedWorkers.forEach(function(w){PThread.loadWasmModuleToWorker(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(wasmBinaryFile)&&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(){__emscripten_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,EBADF: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,ECHRNG:106,EL2NSYNC:156,EL3HLT:107,EL3RST:108,ELNRNG:109,EUNATCH:110,ENOCSI:111,EL2HLT:112,EDEADLK:16,ENOLCK:46,EBADE: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,ENOTSOCK: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,E

PROTONOSUPPORT: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,EOVERFLOW:61,ECANCELED:11,ENOTRECOVERABLE:56,EOWNERDEAD:62,ESTRPIPE:135};function _emscripten_futex_wake(addr,count){if(addr<=0||addr>GROWABLE_HEAP_I8().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.pthreads[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.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);__emscripten_thread_init(tb,!ENVIRONMENT_IS_WORKER,1);_emscripten_register_main_browser_thread_id(tb)},initWorker:function(){},pthreads:{},threadExitHandlers:[],setThreadStatus:function(){},runExitHandlers:function(){while(PThread.threadExitHandlers.length>0){PThread.threadExitHandlers.pop()()}if(ENVIRONMENT_IS_PTHREAD&&_pthread_self())___pthread_tsd_run_dtors()},runExitHandlersAndDeinitThread:function(tb,exitCode){Atomics.store(GROWABLE_HEAP_U32(),tb+56>>2,1);Atomics.store(GROWABLE_HEAP_U32(),tb+60>>2,0);PThread.runExitHandlers();Atomics.store(GROWABLE_HEAP_U32(),tb+4>>2,exitCode);Atomics.store(GROWABLE_HEAP_U32(),tb+0>>2,1);_emscripten_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_PTHREAD){postMessage({\"cmd\":\"exit\"})}}},threadCancel:function(){PThread.runExitHandlersAndDeinitThread(_pthread_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)}}PThread.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=[]},freeThreadData:function(pthread){if(!pthread)return;if(pthread.threadInfoStruct){var 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.pthreads[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.pthreads[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 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.pthreads[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 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);return 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.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.eventHandlers[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,targetThread,637534208,eventHandlerFunc,eventData,varargs);stackRestore(stackTop)},getTargetThreadForEventCallback:function(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()[varargs+8>>2]=height;__emscripten_call_on_thread(0,targetThread,657457152,0,targetCanvasPtr,varargs);stackRestore(stackTop)}function _emscripten_set_offscreencanvas_size_on_target_thread(targetThread,targetCanvas,width,height){targetCanvas=targetCanvas?UTF8ToString(targetCanvas):\"\";_emscripten_set_offscreencanvas_size_on_target_thread_js(targetThread,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_HEAP_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&&prevViewport[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_on_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)return _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

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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
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,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
()[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
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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.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.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

\"+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()[status>>2]=threadExitCode;Atomics.store(GROWABLE_HEAP_U32(),thread+64>>2,1);if(!ENVIRONMENT_IS_PTHREAD)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_thread_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_write,_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_logical_cores,\"u\":_emscripten_receive_on_main_thread_js,\"q\":_emscripten_resize_heap,\"v\":_emscripten_set_canvas_element_size,\"i\":_emscripten_set_current_thread_status,\"s\":_emscripten_set_thread_name,\"w\":_emscripten_webgl_create_context,\"l\":_fd_close,\"n\":_fd_seek,\"g\":_fd_write,\"o\":initPthreadsJS,\"a\":wasmMemory||Module[\"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
_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,argument

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,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
_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\"]
=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(__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[\"_emscript
en_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\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
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()}}}';","\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&&!ENVIRONMENT_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=nodePath[\"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[\"argv\"].slice(2);process[\"on\"](\"uncaughtException\",function(ex){if(!(ex instanceof ExitStatus)){throw ex}});process[\"on\"](\"unhandledRejection\",abort);quit_=function(status){process[\"exit\"](status)};Module[\"inspect\"]=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){scriptDirectory=self.location.href}else if(typeof document!==\"undefined\"&&document.currentScript){scriptDirectory=document.currentScript.src}if(_scriptDir){scriptDirectory=_scriptDir}if(scriptDirectory.indexOf(\"blob:\")!==0){scriptDirectory=scriptDirectory.substr(0,scriptDirectory.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
++]=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){addOnPreRun(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\"].length){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[\"monitorRunDependencies\"](runDependencies)}}function removeRunDependency(id){runDependencies--;if(Module[\"monitorRunDependencies\"]){Module[\"monitorRunDependencies\"](runDependencies)}if(runDependencies==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;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.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\"];updateGlobalBufferAndViews(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(wasmBinaryFile)&&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,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\":_fd_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=Module[\"_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\"]=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
_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

_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
_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
___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 return WasmBackendModule.ready\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 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 ${dtype}`);\n }\n}\n\nfunction createInstantiateWasmFunc(path: string) {\n // this will be replace by rollup plugin patchWechatWebAssembly in\n // minprogram's output.\n // tslint:disable-next-line:no-any\n return (imports: any, callback: any) => {\n util.fetch(path, {credentials: 'same-origin'}).then((response) => {\n if (!response['ok']) {\n imports.env.a(`failed to load wasm binary file at '${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 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, 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:\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\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 ;\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, 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\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\ncustomFetch = 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 intialized.\n */\nexport function getThreadsCount(): number {\n if (actualThreadsCount === -1) {\n throw new Error(`WASM backend not initialized.`);\n }\n return actualThreadsCount;\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 * @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 './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';\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":["setup","wasmFunc","sliceImplCPU","concatImplCPU","supportsFullBroadcast","setupFunc","kernelFunc","rangeImplCPU","require$$0","require$$1","require$$2","global","require$$3","require$$4","wasmFactoryThreadedSimd","wasmFactory"],"mappings":";;;;;;;;;;;;;;;;;;;;;;AAAA;;;;;;;;;;;;;;;AAiBA;AACA,IAAY,QAMX;AAND,WAAY,QAAQ;IAClB,6CAAW,CAAA;IACX,yCAAS,CAAA;IACT,uCAAQ,CAAA;IACR,2CAAU,CAAA;IACV,iDAAa,CAAA;AACf,CAAC,EANW,QAAQ,KAAR,QAAQ,QAMnB;AAED;AACA,IAAY,iBAAQX;AARD,WAAY,iBAAiB;IAC3B,6DAAU,CAAA;IACV,yDAAQ,CAAA;IACR,2DAAS,CAAA;IACT,2DAAS,CAAA;IACT,mEAAa,CAAA;IACb,+DAAW,CAAA;IACX,uDAAO,CAAA;IACP,2CAAK,CAAA;IACL,iDAAQ,CAAA;AACV,CAAC,EARW,iBAAiB,KAAjB,iBAAiB,QAQ5B;;;;;;;;;;;;;;;;;;;

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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, 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 Int32Array(b3d.shape).buffer);\n\n wasmBatchMatMul(\n   a3dId, aShapeBytes, a3d.shape.length, b3dId, bShapeBytes,\n   b3d.shape.length, transposeA, transposeB,
  outId);\n\n backend.disposeData(a3d.dataId);\n backend.disposeData(b3d.dataId);\n\n out.shape = outShape;\n return out;\n}\n\nexport const batchMatMulConfig: KernelConfig = {\n kernelName: BatchMatMul,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: batchMatMul as {} as KernelFunc\n};\n"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/BatchMatMul.js.map
No license file was found, but licenses were detected in source scan.

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==========\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\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\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\nexport const resizeBilinearConfig: KernelConfig = {\n kernelName: ResizeBilinear,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc:\n resizeBilinear as {} as KernelFunc\n};\n"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/ResizeBilinear.js.map
No license file was found, but licenses were detected in source scan.

{"version":3,"file":"Cosh.js","sourceRoot":"","sources":["../../src/kernels/Cosh.ts"],"names":[],"mappings":"AAAA;;;;;;;;;;;;;;GAeG;AACH,OAAO,EAAC,IAAI,EAAE,MAAM,uBAAuB,CAAC;AAEzD,OAAO,EAAC,uBAAuB,EAAE,MAAM,gBAAgB,CAAC;AAExD,MAAM,CAAC,IAAM,UAAU,GAAe,uBAAuB,CAAC,IAAI,CAAC,CAAC","sourcesContent":["/**\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 {Cosh, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\n\nexport const coshConfig: KernelConfig = createUnaryKernelConfig(Cosh);\n"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/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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Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/LogicalAnd.js.map
No license file was found, but licenses were detected in source scan.

{"version":3,"file":"GatherNd.js","sourceRoot":"","sources":["../../src/kernels/GatherNd.ts"],"names":[],"mappings":"AAAA;;;;;;;;;;;;;;;GAeG;AAEH,OAAO,EAAC,WAAW,EAAE,QAAQ,EAA2C,MAAM,uBAAuB,CAAC;AAItG,OAAO,EAAC,QAAQ,EAAE,MAAM,EAAC,MAAM,cAAc,CAAC;AAE9C,MAAM,CAAC,MAAM,UAAU,GAAG,CAAC,CAAC;AAE5B

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"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/GatherNd.js.map
No license file was found, but licenses were detected in source scan.

{"version":3,"file":"Reshape.js","sourceRoot":"","sources":["../../src/kernels/Reshape.ts"],"names":[],"mappings":"AAAA;;;;;;;;;;;;;;GAeG;AAEH,OAAO,EAA2B,OAAO,EAA+B,IAAI,EAAC,MAAM,uBAAuB,CAAC;AAI3G,MAAM,UAAU,OAAO,CACnB,IAAwE;IAC1E,MAAM,EAAC,MAAM,EAAC,CAAC,EAAC,MAAM,EAAC,MAAM,EAAE,KAAK,EAAC,GAAG,IAAI,CAAC;IAC7B,MAAM,EAAC,CAAC,EAAC,MAAM,EAAC,CAAC,EAAC,MAAM,EAAC,GAAG,MAAM,CAAC;IACnB,MAAM,EAAC,KAAK,EAAC,GAAG,CAAC,CAAC,KAAK,CAAC;IAEtB,MAAM,KAAK,GAAG,IAAI,CAAC,eAAe,CAAC,KAAK,EAAE,KAAK,CAAC,CAAC;IAEjD,MAAM,MAAM,GAAG,IAAI,CAAC,0BAA0B,CAAC,KAAK,EAAE,KAAK,CAAC,CAAC;IAE7D,IAAI,CAAC,MAAM,CACP,KAAK,KAAK,IAAI,CAAC,eAAe,CAAC,MAAM,CAAC,EACtC,GAAG,EAAE,CAAC,gBAAgB,KAAK,CAAC,KAAK,cAAc,CAAC,CAAC,KAAK,GAAG,CAAC;QAC1D,wBAAwB,CAAC,CAAC;IAE9B,+DAA+D;IAC/D,IAAI,CAAC,OAAO,CAAC,MAAM,CAAC,CAAC,CAAC,KAAK,CAAC,CAAC;IAE7B,OAAO,EAAC,MAAM,EAAE,CAAC,CAAC,KAAK,EAAE,KAAK,EAAE,MAAM,EAAE,CAAC,CAAC,KAAK,EAAC,CAAC;AAC1D,CAAC;AAED,MAAM,CAAC,MAAM,aAAa,GAAiB,EAAC,UAAU,EAAE,SAAS,EAAE,MAAM,EAAE,OAAO,EAAC,CAAC","sourcesContent":["/**\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"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Reshape.js.map
No license file was found, but licenses were detected in source scan.

{"version":3,"file":"Concat.js","sourceRoot":"","sources":["../../src/kernels/Concat.ts"],"names":[],"mappings":"AAAA;;;;;;;;;;;;;;GAeG;AAEH,OAAO,EAAC,YAAY,EAAE,MAAM,EAAE,OAAO,EAAC,MAAM,uBAAuB,CAAC;

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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 {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 = $inputs.map(t => {\n const innerSize = util.sizeFromShape(t.shape.slice(axis));\n const shape = [-1, innerSize];\n return reshape({inputs: {x: t}, backend, attrs: {shape}});\n });\n\n const inputsValShapes = inputs2D.map(t => {\n return {vals: backend.readSync(t.dataId), shape: t.shape};\n });\n\n // Concats 2d tensors along axis=1.\n outShape =\n backend_util.computeOutShape(inputs2D.map(t => t.shape), 1 /* axis */);\n const simplyConcat = inputs2D[0].shape[0] === 1;\n const outVals = concatImplCPU(\n inputsValShapes, outShape, inputs[0].dtype,\n simplyConcat) as string[];\n\n const finalOutShape =\n backend_util.computeOutShape($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\nexport const concatConfig: KernelConfig = {\n kernelName: Concat,\n backendName: 'wasm',\n kernelFunc: concat as {} as KernelFunc,\n};\n"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Concat.js.map
No license file was found, but licenses were detected in source scan.

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Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Select.js.map
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* ===*/

Found in path(s):
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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/Elu.h
*
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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/Tan.cc
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/Cosh.cc
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/elu_impl.h
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/sin_cos_workaround.h
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/Any.cc
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/elu_impl.cc
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/All.cc
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/MirrorPad.cc
*
/opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/sin_cos_workaround.cc
No license file was found, but licenses were detected in source scan.

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*/\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"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/types.js.map
No license file was found, but licenses were detected in source scan.

{"version":3,"file":"RealDiv.js","sourceRoot":"","sources":["../../src/kernels/RealDiv.ts"],"names":[],"mappings":"AAAA;;;;;;;;;;;;;;GAeG;AAEH,OAAO,EAAe,OAAO,EAAC,MAAM,uBAAuB,CAAC;AAE5D,OAAO,EAAC,wBAAwB,EAAC,MAAM,iBAAiB,CAAC;AAEzD,MAAM,qBAAqB,GAAG,IAAI,CAAC;AACnC,MAAM,CAAC,MAAM,aAAa,GAAiB;IACzC,UAAU,EAAE,OAAO;IACnB,UAAU,EAAE,qBAAqB;IACjC,UAAU,EAAE,CAAC,wBAAwB,CAAC;CACvC,CAAC"}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/RealDiv.js.map
No license file was found, but licenses were detected in source scan.

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Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/GreaterEqual.js.map
No license file was found, but licenses were detected in source scan.

{"version":3,"file":"FusedBatchNorm.js","sourceRoot":"","sources":["../../src/kernels/FusedBatchNorm.ts"],"names":[],"mappings":"AAAA;;;;;;;;;;;;;;;GAeG;AAEH,OAAO,EAAC,cAAc,EAAmF,IAAI,EAAC,MAAM,uBAAuB,CAAC;AAI5I,IAAI,aAAgE,CAAC;AAErE,SAAS,KAAK,CAAC,OAAoB;IACjC,aAAa,GAAG,OAAO,CAAC,IAAI,CAAC,KAAK,CAAC,CAAC,OAAO,CAAC,cAAc,EAAE,IAAI,EAAE,CAAC,QAAQ,EAAE,QAAQ,EAAE,QAAQ,EAAE

out;\n}\n\nexport const fusedBatchNormConfig: KernelConfig = {\n kernelName: FusedBatchNorm,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: fusedBatchNorm as {} as KernelFunc\n};\n"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/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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* ==
*/

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/test_node.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/test_node.d.ts
*
 /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/test_node.js
No license file was found, but licenses were detected in source scan.

{"version":3,"file":"Sqrt.js","sourceRoot":"","sources":["../../src/kernels/Sqrt.ts"],"names":[],"mappings":"AAAA;;;;;;;;;;;;;GAeG;AAEH,OAAO,EAAe,IAAI,EAAC,MAAM,uBAAuB,CAAC;AAEzD,OAAO,EAAC,uBAAuB,EAAC,MAAM,gBAAgB,CAAC;AACvD,MAAM,CAAC,MAAM,UAAU,GAAiB,uBAAuB,CAAC,IAAI,CAAC,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 copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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';\nexport const sqrtConfig: KernelConfig = createUnaryKernelConfig(Sqrt);\n"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-

wasm/dist/kernels/Sqrt.js.map
No license file was found, but licenses were detected in source scan.

{"version":3,"file":"Identity.js","sourceRoot":"","sources":["../../src/kernels/Identity.ts"],"names":[],"mappings":"AAAA;;;;;;;;;;;;;;;GAeG;AAEH,OAAO,EAAC,QAAQ,EAA2C,MAAM,uBAAuB,CAAC;AAKzF,MAAM,UAAU,QAAQ,CAAC,IAAoD,EAAE,OAAO,EAAE,GAAG,IAAI,CAAC;IAC9F,MAAM,EAAC,MAAM,EAAE,EAAC,CAAC,EAAC,EAAE,OAAO,EAAC,GAAG,IAAI,CAAC;IACpC,MAAM,GAAG,GAAG,OAAO,CAAC,YAAY,CAAC,CAAC,CAAC,KAAK,EAAE,CAAC,CAAC,KAAK,CAAC,CAAC;IACnD,MAAM,KAAK,GAAG,OAAO,CAAC,sBAAsB,CAAC,CAAC,CAAC,CAAC;IAChD,MAAM,OAAO,GAAG,OAAO,CAAC,sBAAsB,CAAC,GAAG,CAAC,CAAC;IACpD,OAAO,CAAC,GAAG,CAAC,KAAK,CAAC,CAAC;IACnB,OAAO,GAAG,CAAC;AACb,CAAC;AAED,MAAM,CAAC,MAAM,cAAc,GAAiB;IAC1C,UAAU,EAAE,QAAQ;IACpB,WAAW,EAAE,OAAO;IACpB,UAAU,EAAE,QAAQ,IAAI,EAAE;CAC3B,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 copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {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"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Identity.js.map
No license file was found, but licenses were detected in source scan.

{"version":3,"file":"shared.js","sourceRoot":"","sources":["../../src/kernel_utils/shared.ts"],"names":[],"mappings":"AAAA;;;;;;;;;;;;;;;GAeG;AAEH,uEAAuE;AACvE,gBAAgB;AAChB,iDAAiD;AACjD,OAAO,EAAC,QAAQ,EAAC,MAAM,uBAAuB,CAAC;AAC/C,aAAa;AACb,0CAA0C;AAC1C,qFAAqF;AACrF,iDAAiD;AACjD,OAAO,EAAC,MAAM,EAAE,IAAI,EAAE,KAAK,EAAC,MAAM,eAAe,CAAC;AAClD,OAAO,EAAC,QAAQ,EAAC,MAAM,iBAAiB,CAAC;AACzC

'@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):
* /opt/cola/permits/1234600203_1638277742.68/0/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.

{"version":3,"file":"DepthwiseConv2dNative.js","sourceRoot":"","sources":["../../src/kernels/DepthwiseConv2dNative.ts"],"names":[],"mappings":"AAAA;;;;;;;;;;;;;;GAeG;AAEH,OAAO,EAAC,YAAY,EAAE,qBAAqB,EAA8F,MAAM,uBAAuB,CAAC;AAIvK,IAAI,mBAAmB,CAAC;AAE3B,SAAS,KAAK,CAAC,OAAoB;IACjC,mBAAmB;QACf,OAAO,CAAC,IAAI,CAAC,CAAC,KAAK,CAAC,qBAAqB,EAAE,IAAI,CAAC,CAAC,IAAI,EAAE;YACzD,QAAQ;YACR,QAAQ;YACR,QAAQ;YACR

==========\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"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/DepthwiseConv2dNative.js.map
No license file was found, but licenses were detected in source scan.

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 * ==\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):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Floor.js.map
No license file was found, but licenses were detected in source scan.

{"version":3,"file":"Cast.js","sourceRoot":"","sources":["../../src/kernels/Cast.ts"],"names":[],"mappings":"AAAA;;;;;;;;;;;;GAeG;AAEH,OAAO,EAAC,IAAI,EAAkD,MAAM,uBAAuB,CAAC;AAK5F,MAAM,UAAU,IAAI,CAChB,IAAkE;IAEpE,MAAM,EAAC,MAAM,EAAE,MAAM,EAAE,CAAC,EAAC,MAAM,EAAE,CAAC,EAAC,MAAM,EAAE,KAAK,EAAE,EAAC,MAAM,EAAE,CAAC,EAAC,MAAM,EAAE,KAAK,EAAE,EAAC,MAAM,EAAE,OAAO,EAAE,EAAC,MAAM,EAAE,GAAG,EAAE,IAAI,EAAE,CAAC;IACpD,MAAM,EAAC,MAAM,EAAE,GAAG,EAAE,GAAG,EAAE,OAAO,EAAE,CAAC,EAAC,MAAM,EAAE,IAAI,EAAE,CAAC,EAAC,MAAM,EAAE,KAAK,EAAE,EAAC,MAAM,EAAE,CAAC,EAAC,MAAM,EAAE,KAAK,EAAE,EAAC,MAAM,EAAE,OAAO,EAAE,EAAC,MAAM,EAAE,GAAG,EAAE,IAAI,EAAE,CAAC;IAC7C,MAAM,EAAC,MAAM,EAAE,OAAO,EAAE,EAAC,MAAM,EAAE,GAAG,EAAE,IAAI,EAAE,CAAC;IAC7B

;SACrB,CAAC,CAAC;IACL,CAAC;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,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;QAC/C,MAAM,GAAG,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;QAE/C,MAAM,GAAG,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;QAC

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\n return {kernelName, backendName: 'wasm', setupFunc, kernelFunc};\n}\n"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/binary_kernel.js.map
No license file was found, but licenses were detected in source scan.

{"version":3,"file":"Any.js","sourceRoot":"","sources":["../../src/kernels/Any.ts"],"names":[],"mappings":"AAAA;;;;;;;;;;;;;GAeG;AAEH,OAAO,EAAC,GAAG,EAAuB,YAAY,EAAwC,IAAI,EAAC,MAAM,uBAAuB,CAAC;AAIzH,OAAO,EAAC,uBAAuB,EAAC,MAAM,gBAAgB,CAAC;AAEvD,IAAI,OAAiE,CAAC;AAEtE,SAAS,KAAK,CAAC,OAAoB;IACjC,OAAO,GAAG,OAAO,CAAC,MAAM,CAAC,CAAC,CAAC,EAAE,CAAC,CAAC,KAAK,SAAS,CAAC,CAAC;IAC/C

'@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"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Any.js.map
No license file was found, but licenses were detected in source scan.

{"version":3,"file":"Round.js","sourceRoot":"","sources":["../../src/kernels/Round.ts"],"names":[],"mappings":"AAAA;;;;;;;;;;;;;;;GAeG;AACH,OAAO,EAAe,KAAK,EAAC,MAAM,uBAAuB,CAAC;AAE1D,OAAO,EAAC,MAAM,uBAAuB,EAAC,MAAM,gBAAgB,CAAC;AAEvD,MAAM,CAAC,MAAM,WAAW,GAAG,IAAI,KAAK,CAAC,MAAM,EAAE,WAAW,CAAC,CAAC","sourcesContent":["/**\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, Round} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\n\nexport const roundConfig: KernelConfig = createUnaryKernelConfig(Round);\n"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Round.js.map
No license file was found, but licenses were detected in source scan.

{"version":3,"file":"Relu.js","sourceRoot":"","sources":["../../src/kernels/Relu.ts"],"names":[],"mappings":"AAAA;;;;;;;;;;;;;;;GAeG;AACH,OAAO,EAAe,KAAK,EAAC,MAAM,uBAAuB,CAAC;AAE1D,OAAO,EAAC,MAAM,uBAAuB,EAAC,MAAM,gBAAgB,CAAC;AAEvD,MAAM,CAAC,MAAM,UAAU,GAAG,IAAI,KAAK,CAAC,MAAM,EAAE,WAAW,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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF 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, Relu} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const reluConfig: KernelConfig = createUnaryKernelConfig(Relu);\n"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Relu.js.map
No license file was found, but licenses were detected in source scan.

{"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,EAAC,MAAM,gBAAgB,CAAC;AAEvD,MAAM,CAAC,MAAM,SAAS,GAAG,uBAAuB,CAAC,GAAG,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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF 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"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Exp.js.map
No license file was found, but licenses were detected in source scan.

{"version":3,"file":"Greater.js","sourceRoot":"","sources":["../../src/kernels/Greater.ts"],"names":[],"mappings":"AAAA;;;;;;;;;;;;;;;;GAgBG;AACH,OAAO,EAAC,OAAO,EAAE,MAAM,uBAAuB,CAAC;AAE/C,OAAO,EAAC,wBAAwB,EAAC,MAAM,gBAAgB,CAAC;AAExD,MAAM,CAAC,MAAM,WAAW,GAAG,wBAAwB,CAAC,OAAO,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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF 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';\n\nimport {createBinaryKernelConfig} from

'./binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const greaterConfig: KernelConfig =\n createBinaryKernelConfig(Greater, supportsFullBroadcast, 'bool');\n"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Greater.js.map
No license file was found, but licenses were detected in source scan.

{"version":3,"file":"Reverse.js","sourceRoot":"","sources":["../../src/kernels/Reverse.ts"],"names":[],"mappings":"AAAA;;;;;;;;;;;;;;GAeG;AAEH,OAAO,EAA2B,OAAO,EAA2C,IAAI,EAAC,MAAM,uBAAuB,CAAC;AAIvH,OAAO,EAAC,QAAQ,EAAC,MAAM,YAAY,CAAC;AACpC,OAAO,EAAC,OAAO,EAAC,MAAM,WAAW,CAAC;AAElC,OAAO,EAAC,IAAI,EAAE,8BAA8B,CAAC;AAC7C,OAAO,EAAC,WAAW,EAAC,MAAM,eAAe,CAAC;AAE1C,OAAO,EAAC,OAAO,EAAC,MAAM,WAAW,CAAC;AAClC,OAAO,EAAC,OAAO,EAAC,MAAM,WAAW,CAAC;AAElC

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"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Reverse.js.map
No license file was found, but licenses were detected in source scan.

{"version":3,"file":"NonMaxSuppressionV5.js","sourceRoot":"","sources":["../../src/kernels/NonMaxSuppressionV5.ts"],"names":[],"mappings":"AAAA;;;;;;;;;;;;;;;GAeG;AAEH,OAAO,EAA2B,mBAAmB,EAAkE,MAAM,uBAAuB,CAAC;AAIrJ,OAAO,EAAC,iBAAiB,EAAC,MAAM,0BAA0B,CAAC;AAE3D,IAAI,QAAQ,CAAC;AAEf,SAAS,KAAK,CAAC,OAAoB;IACjC,QAAQ,GAAG,OAAO,CAAC,QAAQ,CAAC,IAAI,CAAC,OAAO,CAAC,CAAC;IAC1C,IAAI,CAAC,QAAQ,CAAC,IAAI,CAAC,KAAK,CAAC,CAAC;IAC1B

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"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/NonMaxSuppressionV5.js.map
No license file was found, but licenses were detected in source scan.

{"version":3,"file":"Relu6.js","sourceRoot":"","sources":["../../src/kernels/Relu6.ts"],"names":[],"mappings":"AAAA;;;;;;;;;;;;;;GAeG;AACH,OAAO,EAAe,KAAK,EAAC,MAAM,uBAAuB,,CAAC;AAE1D,OAAO,EAAC,uBAAuB,,EAAC,MAAM,gBAAgB,,CAAC;AACvD,MAAM,CAAC,MAAM,WAAW,GAAiB,CAAC,KAAK,CAAC,CAAC,CAAC

gB,EAAE,YAAY,EAAE,eAAe,EAAE,aAAa,EAAC,CAAC;AAC1E,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 *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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`.\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"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/NonMaxSuppression_util.js.map
No license file was found, but licenses were detected in source scan.

{"version":3,"file":"MirrorPad.js","sourceRoot":"","sources":["../../src/kernels/MirrorPad.ts"],"names":[],"mappings":"AAAA;;;;;;;;;;;;;;;GAeG;AAEH,OAAO,EAA2B,SAAS,EAAkC,MAAM,uBAAuB,CAAC;AAI3G,OAAO,EAAC,QAAQ,EAAC,MAAM,SAAS,CAAC;AAEjC,kCAAkC;AAClC,IAAK,iBAGJ;AAHD,WAAK,iBAAiB;IACpB,+DAAM,CAAA;IACN,mEAAQ,CAAA;AACV,CAAC,EAHI,iBAAiB,KAAjB,iBAAiB,QAGrB;AAED,MAAM,CAAC,OAAO,UAAU,SAAS,CAAC,EAAC,MAAM,EAAE,KAAK,EAAE,UAAU,EAAE,WAAW,EAAE,WAAW,EAAC;;IACrF,MAAM,CAAC,GAAG,MAAM,CAAC,KAAK,CAAC,MAAM,CAAC,CAAC;IAC/B,MAAM,CAAC,GAAG,KAAK,CAAC,MAAM,CAAC,CAAC;IACxB,MAAM,CAAC,GAAG,UAAU,CAAC,MAAM,CAAC,CAAC;IAC7B,MAAM,CAAC,GAAG,WAAW,CAAC,MAAM,CAAC,CAAC;IAC9B,MAAM,CAAC,GAAG,WAAW,CAAC,MAAM,CAAC,CAAC;IAE9B,IAAI,MAAM,KAAK,iBAAiB,CAAC,OAAO,EAAE;QACxC,KAAK,IAAI,CAAC,GAAG,CAAC,EAAE,CAAC,GAAG,CAAC,EAAE,CAAC,EAAE,EAAE;YAC1B,KAAK,IAAI,CAAC,GAAG,CAAC,EAAE,CAAC,GAAG,CAAC,EAAE,CAAC,EAAE,EAAE;gBAC1B,KAAK,IAAI,CAAC,GAAG,CAAC,EAAE,CAAC,GAAG,CAAC,EAAE,CAAC,EAAE,EAAE;oBAC1B,MAAM,IAAI,GAAG,CAAC,GAAG,CAAC,GAAG,CAAC,GAAG,CAAC,CAAC;oBAC3

AAC","sourcesContent":["/**\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, 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\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):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/MirrorPad.js.map
No license file was found, but licenses were detected in source scan.

{"version":3,"file":"Abs.js","sourceRoot":"","sources":["../../src/kernels/Abs.ts"],"names":[],"mappings":"AAAA;;;;;;;;;;;;GAeG;AACH,OAAO,EAAC,gBAAgB,EAAE,MAAM,EAAC,MAAM,uBAAuB,CAAC;AAExD,OAAO,EAAC,gBAAgB,EAAE,MAAM,gBAAgB,CAAC;AAEvD,MAAM,CAAC,MAAM,SAAS,GAAG,gBAAgB,CAAC,GAAG,EAAE,SAAS,CAAC,CAAC;AAE1D,MAAM,CAAC,MAAM,SAAS,GAAG,EAAC,UAAU,EAAE,GAAG,EAAE,UAAU,EAAE,SAAS,EAAC,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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Abs.js.map
No license file was found, but licenses were detected in source scan.

{"version":3,"file":"index.js","sourceRoot":"","sources":["../src/index.ts"],"names":[],"mappings":"AAAA;;;;;;;;;;;;;;;;GAeG;AAEH,OAAO,wBAAwB,CAAC;AAChC,cAAc,QAAQ,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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 './register_all_kernels';\nexport * from './base';\n"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/index.js.map
No license file was found, but licenses were detected in source scan.

{"version":3,"file":"FusedDepthwiseConv2D.js","sourceRoot":"","sources":["../../src/kernels/FusedDepthwiseConv2D.ts"],"names":[],"mappings":"AAAA;;;;;;;;;;;;;;;GAeG;AAEH,OAAO,EAAC,YAAY,EAAE,oBAAoB,EAA4F,MAAM,uBAAuB,CAAC;AAIpK,OAAO,EAAC,iBAAiB,EAAE,MAAM,EAAC,MAAM,SAAS,CAAC;AAAE,OAAO,EAAC,KAAK

GAAG,QAAQ,CAAC,OAAO,CAAC,IAAI,CAAC;IACtC,MAAM,cAAc,GAAG,QAAQ,CAAC,cAAc,CAAC;IAC/C,MAAM,aAAa,GAAG,QAAQ,CAAC,aAAa,CAAC;IAC7C,MAAM,YAAY,GAAG,QAAQ,CAAC,YAAY,CAAC;IAC3C,MAAM,WAAW,GAAG,QAAQ,CAAC,WAAW,CAAC;IACzC,MAAM,aAAa,GAAG,QAAQ,CAAC,UAAU,CAAC;IAC1C,MAAM,SAAS,GAAG,QAAQ,CAAC,OAAO,CAAC,IAAI,CAAC,MAAM,CAAC,CAAC,CAAC,CAAC,CAAC,CAAC,CAAC,CAAC,CAAC,CAAC,CAAC,CAAC,CAAC,CAAC;IAC3D

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"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/FusedDepthwiseConv2D.js.map
No license file was found, but licenses were detected in source scan.

{"version":3,"file":"FloorDiv.js","sourceRoot":"","sources":["../../src/kernels/FloorDiv.ts"],"names":[],"mappings":"AAAA;;;;;;;;;;;;;;;GAeG;AAEH,OAAO,EAAC,QAAQ,EAAEe,MAAM,uBAAuB,CAAC;AAE7D,OAAO,EAAC,wBAAwB,EAAC,MAAM,iBAAiB,CAAC;AAEzD,MAAM,qBAAqB,GAAG,KAAK,CAAC;AACpC,MAAM,cAAc,GAAG,KAAK,CAAC;AAE7B,MAAM,UAAU,QAAQ,CAAC,OAAiB;IACxC,wBAAwB,CAAC,QAAQ,EAAE,OAAO,EAAE,qBAAqB,EAAE,cAAc,CAAC,CAAC;AACrF,CAAC;AAED,MAAM,CAAC,MAAM,QAAQ,GAAe,EAAC,UAAU,EAAE,QAAQ,EAAE,WAAW,EAAE,MAAM,EAAE,SAAS,EAAE,QAAQ,EAAC,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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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';\n\nimport {createBinaryKernelConfig} from './binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const floorDivConfig: KernelConfig =\n createBinaryKernelConfig(FloorDiv, supportsFullBroadcast);\n"]}

Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/FloorDiv.js.map
No license file was found, but licenses were detected in source scan.

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* limitations under the License.
* ===
*/

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Any.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/SpaceToBatchND.js
*
 /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/BatchToSpaceND.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/All.ts
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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/SpaceToBatchND.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Round.d.ts
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 /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/SpaceToBatchND.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Ceil.ts
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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/MirrorPad.ts
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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Elu.d.ts
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No license file was found, but licenses were detected in source scan.

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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"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
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No license file was found, but licenses were detected in source scan.

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MAAM,EAAC,MAAM,EAAE,KAAK,EAAE,OAAO,EAAC,GAAG,IAAI,CAAC;IACtC,MAAM,EAAC,KAAK,E
AAC,GAAG,MAAM,CAAC;IACvB,MAAM,EAAC,GAAG,EAAC,GAAG,EAAC,GAAG,KAAK,CAAC;IAEpB,MAAM,SAAS,
GAAG,KAAK,CAAC,KAAK,CAAC,MAAM,CAAC;IACrC,MAAM,QAAQ,GAAG,KAAK,CAAC,KAAK,CAAC,KAAK,CAA
C,KAAK,EAAE,CAAC;IACrC,IAAI,IAAI,GAAG,GAAG,CAAC;IACf,MAAM,CAAC,IACf,GAAG,IAAI,GAAG,CAAC,MAAM,CACP,CAAC,CAAC,EAAE,CAAC,EAAE,CAAC,KAAK,CAAC,KAAK,CAAC,CAAC,CAAC

No license file was found, but licenses were detected in source scan.

{"version":3,"file":"test_node.js","sourceRoot":"","sources":["../src/test_node.ts"],"names":[],"mappings":"AAAA;;;;;;;;;;;;;GAeG;AAEH,6BAA6B;AAC7B,OAAO,SAAS,CAAC;AAEjB,iDAAiD;AACjD,OAAO,EAAC,WAAW,EAAC,MAAM,yCAAyC,CAAC;AACpE,OAAO,OAAO,MAAM,SAAS,CAAC;AAE9B,KAAK,CAAC,eAAe,CAAC,QAAQ,CAAC,oBAAoB,EAAE,CAAC,oBAAoB,EAAE,CAAC,CAAC;IAC5E,MAAM,CAAC,EAAE,CAAC,CAAC;AACb,CAAC,CAAC,CAAC;AAEH

No license file was found, but licenses were detected in source scan.

{"version":3,"file":"Neg.js","sourceRoot":"","sources":["../../src/kernels/Neg.ts"],"names":[],"mappings":"AAAA;;;;;;;;;;;;GAeG;AACH,OAAO,EAAe,GAAG,EAAC,MAAM,uBAAuB,CAAC;AAExD,OAAO,EAAC,uBAAuB,EAAC,MAAM,gBAAgB,CAAC;AACvD,MAAM,CAAC,MAAM,SAAS,GAAG,uBAAuB,CAAC,GAAG,CAAC,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 copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF 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"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Neg.js.map
No license file was found, but licenses were detected in source scan.

{"version":3,"file":"NonMaxSuppressionV3.js","sourceRoot":"","sources":["../../src/kernels/NonMaxSuppressionV3.ts"],"names":[],"mappings":"AAAA;;;;;;;;;;;;;;;GAeG;AAEH,OAAO,EAAe,GAAG,EAAC,MAAM,uBAAuB,CAAC;AAExD,OAAO,EAAC,uBAAuB,EAAC,MAAM,gBAAgB,CAAC;AACvD,MAAM,CAAC,MAAM,SAAS,GAAG,uBAAuB,CAAC,GAAG,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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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\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: NonMaxSuppressionV3,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: kernelFunc as {} as KernelFunc,\n};\n"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/NonMaxSuppressionV3.js.map
No license file was found, but licenses were detected in source scan.

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AI,UAAU,IAAI,IAAI,EAAE;QACtB,OAAO,CAAC,WAAW,CAAC,UAAU,CAAC,MAAM,CAAC,CAAC;KACxC;IAED,OAAO,GAAG,CAAC;AACb,CAAC;AAED,MAAM,CAAC,MAAM,mBAAmB,GAAiB;IAC/C,UAAU,EAAE,aAAa;IACzB,WAAW,EAAE,MAAM;IACnB,SAAS,EAAE,KAAK;IAChB,UAAU,EAAE,aAAiC;CAC9C,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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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}\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):
* /opt/cola/permits/1234600203_1638277742.68/0/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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 * ===\n
*/\nimport {KernelConfig, Square} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const squareConfig: KernelConfig = createUnaryKernelConfig(Square);\n"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Square.js.map
No license file was found, but licenses were detected in source scan.

{"version":3,"file":"DepthToSpace.js","sourceRoot":"","sources":["../../src/kernels/DepthToSpace.ts"],"names":[],"mappings":"AAAA;;;;;;;;;;;;;;;GAeG;AAEH,OAAO,EAAC,YAAY,EAA+E,IAAI,EAAC,MAAM,uBAAuB,CAAC;AAItI,IAAI,gBAAgB,CAAC;AAE5C,SAAS,KAAK,CAAC,OAAoB;IAC/C,gBAAgB,GAAG,OAAO,CAAC,IAAI,CAAC,KAAK,CAAC,YAAY,EAAE,QAAQ,CAAC,QAAQ,CAAC,QAAQ,CAAC

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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 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):
* /opt/cola/permits/1234600203_1638277742.68/0/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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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
  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"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/StridedSlice.js.map
No license file was found, but licenses were detected in source scan.

{"version":3,"file":"tf-backend-wasm.es2017.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/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/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","../node_modules/@tensorflow/tfjs-backend-cpu/dist/kernels/Concat_impl.js","../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/NotEqu

al.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","../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/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.js","../src/backend_wasm.ts","../wasm-out/tfjs-backend-wasm-threaded-simd.worker.js","../src/base.ts","../src/version.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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 * @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, 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 ${biasData.shape.length}.`);\n }\n biasId = biasData.id;\n }\n const preluActivationWeightsId = preluActivationWeights == null ?\n 0 :\n backend.dataIdMap.get(preluActivationWeights.dataId).id;\n const fusedActivation =\n FusableActivation[activation as {} as keyof typeof FusableActivation];\n if (fusedActivation == null) {\n throw new Error(\n `${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] :\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 * @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 *\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\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 {DataType, KernelConfig, TensorInfo, UnaryInputs, util} from '@tensorflow/tfjs-core';\n\nimport\n{BackendWasm} from '../backend_wasm';\n\nimport {CppDType} 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\n wasmFunc = backend.wasm.cwrap(kernelName, null /* void */, [\n 'number', // x_id\n 'number', // dtype\n\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 * @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\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*/\nimport {Abs, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from\n'./unary_kernel';\n\nexport const absConfig: KernelConfig = createUnaryKernelConfig(Abs);\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

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 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\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 License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {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 * @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 {AddN, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {CppDType} 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, 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 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {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 * @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';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {identity} from './Identity';\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\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 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","/**\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 {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 = 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. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance 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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==\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

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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';\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
*/\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
`${convInfo.dataFormat}'. Please use 'channelsLast'.`);\n  }\n\n  if (convInfo.dilationWidth !== 1 ||
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convInfo.dilationHeight !== 1) {\n throw new Error(\n `was backend only supports average pooling with dilation = [1, 1],\n ` +\n `got [${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 * @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\n distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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, 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\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 * @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 {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\nfunction 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 =

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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
 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,
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
Int32Array(b3d.shape).buffer);\n\n  wasmBatchMatMul(\n      a3dId, aShapeBytes, a3d.shape.length, b3dId,
bShapeBytes,\n      b3d.shape.length, transposeA, transposeB, outId);\n\n  backend.disposeData(a3d.dataId);\n
backend.disposeData(b3d.dataId);\n\n  out.shape
 = outShape;\n  return out;\n}\n\nexport const batchMatMulConfig: KernelConfig = {\n  kernelName:
BatchMatMul,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: batchMatMul as {} as
KernelFunc\n};\n","/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
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License.\n *
==========================================================================\n
*/\nimport { backend_util, buffer, Slice, slice_util, util } from '@tensorflow/tfjs-core';\nimport
 { assertNotComplex } from '../cpu_util';\nexport function sliceImpl(vals, begin, size, shape, dtype) {\n    const
isContinous = slice_util.isSliceContinous(shape, begin, size);\n    const length = util.sizeFromShape(size);\n    const
xStrides = util.computeStrides(shape);\n    if (isContinous) {\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) :\n        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}\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}\nexport const sliceConfig = {\n   kernelName: Slice,\n   backendName: 'cpu',\n   kernelFunc: slice\n};\n//# sourceMappingURL=data:application/json; base64,eyJ2ZXJzaW9uIjozLCJmaWxlIjoiU2xpY2UuanMiLCJzb3VyY2VSb290IjoiIiwic291cmNlcyI6WyIuLi8uLi8uLi8uLi8uLi8uLi90ZmpzLWJhY2tlbmQtY3B1L3NyYy9rZXJuZWxzL1NsaWNlLnRzIl0sIm5hbWVzIjpbXSwibWFwcGluZ3MiOiJBQUFBOzs7Ozs7Ozs7Ozs7R0FlRztBQUU8sRUFBQWlCLE1BQUEsRUFBQUMsTUFBQSxFQUFBQyxNQUFBLEVBQUFD

nNlIGF0XG4gKlxuICogaHR0cDovL3d3dy5hcGFjaGUub3JnL2xpY2Vuc2VzL0xJQ0VOU0UtMi4wXG4gKlxuICogVW5sZXNzIHJlcXVpcmVkIGJ5IGFwcGxpY2FibGUgbGF3IG9yIGFncmVlZCB0byBpbiB3cml0aW5nLCBzb2Z0d2FyZVxuICogZGlzdHJpYnV0ZWQgdW5kZXIgdGhlIExpY2Vuc2UgaXMgZGlzdHJpYnV0ZWQgb24gYW4gXCJBUyBJUyIgQVNJUyBUwiIEJBU0lTTLFxuICogV0lUSE9VVCBXQVJSQU5USUVTIE9SIENPTkRJVElPTlMgT0YgQU5ZIEtJTkQsIGVpdGhlciBleHByZXNzIG9yIGltcGxpZWQuXG4gKiBiBTZWUgdGhlIExpY2Vuc2UgZm9yIHRoZSBzcGVjaWZpYyBsYW5kWFnZSBnc3dvbnMgYW5kXG4gKiBsaW1pdGF0aW9ucyBsYW5kZXIgdGhlIExpY2Vuc2UgZm9yIHRoZSBsaW1pdGF0aW9ucyBsYW4gXCJhbmQgbGljZW5zZWQgdW5kZXIgdGhlIExpY2Vuc2UgaXMgZGlzdHJpYnV0ZWQgb24gYW4gXCJBUyBJUyIgQVNJUyBUwiIEJhY2tlbmRWYWx1ZXMsIGJ1ZmZlciwgRGF0YVR5cGUsIEtlcm5lbENvbmZpZywgS2VybmVsRnVuYywgU2xpY2UsIHNsaWNlX3V0aWws

License for the specific language governing permissions and\n * limitations under the License.\n * ==========\n */\n\nimport {backend_util, KernelConfig, KernelFunc, Slice, slice_util, SliceAttrs, SliceInputs, TypedArray, util} from '@tensorflow/tfjs-core';\n\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\n const [begin_, size_] = slice_util.parseSliceParams(x, begin, size);\n\n const isContinous = slice_util.isSliceContinous(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 (isContinous) {\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.typedArrayFromHeap(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.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\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\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 * @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
*/\n\nimport {backend_util, BatchToSpaceND, BatchToSpaceNDAttrs, BatchToSpaceNDInputs, KernelConfig,
KernelFunc} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport
{reshape} from './Reshape';\nimport {slice} from './Slice';\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:
{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\nexport const batchToSpaceNDConfig:
KernelConfig = {\n  kernelName: BatchToSpaceND,\n  backendName: 'wasm',\n  kernelFunc: batchToSpaceND as
{} as KernelFunc\n};\n","/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed
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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\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
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=============================================================================\n
*/\nimport {KernelConfig, Ceil} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const ceilConfig: KernelConfig = createUnaryKernelConfig(Ceil);\n","/**\n *
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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*/\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\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 License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF
ANY 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, 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 = $inputs.map(t => {\n const innerSize = util.sizeFromShape(t.shape.slice(axis));\n const shape = [-1, innerSize];\n return reshape({inputs: {x: t}, backend, attrs: {shape}});\n });\n\n const inputsValShapes = inputs2D.map(t => {\n return {vals: backend.readSync(t.dataId), shape: t.shape};\n });\n\n // Concats 2d tensors along axis=1.\n outShape =\n backend_util.computeOutShape(inputs2D.map(t => t.shape), 1 /* axis */);\n const simplyConcat = inputs2D[0].shape[0] === 1;\n const outVals = concatImplCPU(\n inputsValShapes, outShape, inputs[0].dtype,\n simplyConcat) as string[];\n\n const finalOutShape =\n backend_util.computeOutShape($inputs.map(t => t.shape), axis);\n\n out.shape = finalOutShape;\n const outData = backend.dataIdMap.get(out.dataId);\n outData.stringBytes =\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

= 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\nexport const concatConfig: KernelConfig = {\n kernelName: Concat,\n
backendName: 'wasm',\n kernelFunc: concat as {} as KernelFunc,\n};\n","/**\n * @license\n * Copyright 2020
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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 { backend_util, util } from '@tensorflow/tfjs-core';\nexport function concatImpl(inputs, outShape, dtype,
simplyConcat) {\n   const outVals = util.getArrayFromDType(dtype, util.sizeFromShape(outShape));\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.set(input.vals,
 offset);\n   offset += size;\n   });\n   }\n   else {\n   let colOffset = 0;\n   inputs.forEach(input => {\n
        const decodedData = dtype === 'string' ?\n   backend_util.fromUint8ToStringArray(input.vals) :\n
      input.vals;\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   }\n   colOffset += input.shape[1];\n
});\n   }\n   return outVals;\n}\n//#
sourceMappingURL=data:application/json; base64,eyJ2ZXJzaW9uIjozLCJmaWxlIjoiQ29uY2F0X2ltcGwuanMiLC
Jzb3VyY2VSb290IjoiIiwic291cmNlcyI6WyIuLi8uLi8uLi8uLi8uLi8uLi90ZmpzLWJhY2tlbmQtY3B1L3NyYy9rZ
XJuZWxzL0NvbmNhdF9pbXBsLnRzIl0sIm5hbWVzIjpbXSwibWFwcGluZ3MiOiJBQUFBOzs7Ozs7Ozs7Ozs7Oz
s7R0FlRztBQUVILE9BQU8sRUFBQyxZQUFZLEVBQUUsZUFBZSxFQUFDLE1BQU0sc0JBQXNCLENBQUM7QU
FDO0FBRTlCSxVQUFVLENBQUMsQ0FBQyxDQUFDLENBQUMsQ0FBQyxDQUFDLENBQUMsQ0FBQyxDQUFDLENBQUMsQ
xFQUFFLFlFlBQXFCO0lBQ3hDLE1BQU0sT0FBTyxHQUFHLFlBQVksQ0FBQyxpQkFBaUIsQ0FBQyxDQUFDLENBQUMsQ
EVBQUUsUFBSSxDQUFDLGFBQWEsQ0FBQyxRQUFRLENBQUMsQ0FBQyxDQUFDLENBQUMsQ0FBQyxDQUFDO0lBRTVFLE
sWUFBWSxJQUFJLEtBQUssS0FBSyxCQUU7UUFDdEMsMsa0RBQWtEO1FBQ2xELE1BQU0sTSxHQUFHLENBQUNmLE1BQU0sQ0FBQyxPQUFPLENBQUMsQ0FBQyxDQUFDLENBQUMsQ0FBQyxDQUFDLENBQUMsQ
TSxHQUFHLENBQUMsQ0FBQztRQUNmLE1BQU0sQ0FBQyxPQUFPLENBQUMsQ0FBQyxDQUFDLENBQUMsQ0FBQyxDQUFDLENBQUMsQ
U7WUFDckIsTUFBTSxJLEdBQUcsQ0FBQyxDQUFDLENBQUMsQ0FBQyxDQUFDLENBQUMsQ0FBQyxDQUFDLENBQUMsQ
xDQUFDLENBQUM7WUFFNUMsMsT0FBTyxDQUFDLENBQUMsQ0FBQyxDQUFDLENBQUMsQ0FBQyxDQUFDLENBQUMsQ
BQUUsTUFBTSxDQUFDLENBQUMsQ0FBQ

QUU7b0JBQzdDLE9BQU8sQ0FBQyxNQUFNLEdBQUcsR0FBRyxDQUFDLEdBQUcsV0FBVyxDQUFDLElBQUksRUFBRSBSxDQUFDLENBQUM7aUJBQzdDO2FBQ0Y7UFFRCxxTQUFTLElBQUksS0FBSyxDQUFDLENBQUMsQ0FBQyxDQUFDLENBQUMsQ0FBQyxDQUFDLENBQUMsQ0FBQyxCQUFDLENBQUMsQ0FBQyxDQUFDLENBQUMsQ0FBQyxDQUFDLENBQUMsQ0FBQyxDQUFDLENBQUMsQ0FBQyxDQUFDLENBQUMsQ0FBQyxDQUFDLENBQUMsQ0FBQyxDQUFDLENBQUMsQ0FBQyxDQUFDLENBQUMsQ0FBQyxDQUFDLENBQUMsQ0FBQyxDQUFDLENBQUMsQ0FBQyxDQUFDLENBQUMsQ0FBQyxCQUFDLENBQUMsQ0FBQyxDQUFDLENBQUMsQ0FBQyxDQUFDLENBQUMsQ0FBQyxDQUFDLENBQUMsQ0FBQyxDQUFDLENBQUMsQ0FBQyxDQUFDLENBQUMsQ0FBQyxDQUFDLENBQUMsQ0FBQyxDQUFDLENBQUMsQ0FBQyxDQUFDLENBQUMsQ0FBQyxDQUFDLENBQUMsQ0FBQyxDQUFDLENBQUMsQ0FBQyxDQUFDLENBQUMsQ0FBQyxC

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 */\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\nexport const conv2DBackpropInputConfig: KernelConfig = {\n kernelName: Conv2DBackpropInput,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: conv2DBackpropInput 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 {Cos, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\n\nexport const cosConfig: KernelConfig = createUnaryKernelConfig(Cos);\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 {Cosh, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\n\nexport const coshConfig: KernelConfig =

createUnaryKernelConfig(Cosh);\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 {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","/**\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, 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\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\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 * @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\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","/**\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 {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 Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES

OR CONDITIONS OF 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 =\n createBinaryKernelConfig(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 *
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*/\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 copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 * @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} 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 * @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 {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:\n 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\n 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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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';\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==========\n */\n\nimport {FloorDiv, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from './binary_kernel';\n\nconst supportsFullBroadcast = false;\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 use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 * @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, 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\nexport 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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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

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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\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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\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 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 * @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, 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 {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 },\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 * @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 {Greater, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from './binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const greaterConfig: KernelConfig =\n createBinaryKernelConfig(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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 =\n createBinaryKernelConfig(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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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';\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\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

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{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\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\n const {transposed, axes, originalAxes, inputWasTransposed} =\n   permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed)\n {\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, 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 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 *\n ===\n */\nimport {KernelConfig, Maximum} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const maximumConfig:\n KernelConfig =\n   createBinaryKernelConfig(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 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';\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

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]);\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 * @license\n
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==========================================================================\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\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 * 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
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*/\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';\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\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\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 * @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
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==\n
*/\nimport {KernelConfig, Minimum} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = false;\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

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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*/\n\nimport {BackendWasm} from '../backend_wasm';\n\n// Analogous to `struct Result` in `non_max_suppression_impl.h`.\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 * @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, 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\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 =\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 Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES 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, 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\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
{} as KernelFunc,\n};\n","/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed
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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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==========\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 Google LLC. All
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==========\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 * @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';\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 * @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, 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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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, 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,\n 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 * @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, Pow} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = false;\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 * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 = 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 License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {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\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\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   '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\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 *
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*/\n\nimport {KernelConfig, KernelFunc, Range, RangeAttrs, TensorInfo} from '@tensorflow/tfjs-core';\n\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\n const out = backend.makeOutput([values.length], dtype);\n   const outVals = backend.typedArrayFromHeap(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 *
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*/\nimport { util } from '@tensorflow/tfjs-core';\nexport function rangeImpl(start, stop, step, dtype) {\n   const sameStartStop = start === stop;\n   const increasingRangeNegativeStep = start < stop && step < 0;\n   const decreasingRangePositiveStep = stop < start && step > 1;\n   if (sameStartStop
  || increasingRangeNegativeStep ||\n   decreasingRangePositiveStep) {\n   return util.makeZerosTypedArray(0, dtype);\n   }\n   const numElements = Math.abs(Math.ceil((stop - start) / step));\n   const values = util.makeZerosTypedArray(numElements, dtype);\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   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//#

sourceMappingURL=data:application/json; base64,eyJ2ZXJzaW9uIjozLCJmaWxlIjoiUmFuZ2VfaW1wbC5qcyIsInNvdXJjZVJvb3QiOiIiLCJzb3VyY2VzIjpbIi4uLy4uLy4uLy4uLy4uLy4uL3RmanMtYmFja2VuZC1jcHUvc3JjL2tlcm5lbHMvUmFuZ2VfaW1wbC50cyJdLCJuYW1lcyI6W10sIm1hcHBpbmdzIjoiQUFBQTs7Ozs7Ozs7Ozs7O0dBZUc7QUFFSCxPQUFPLEVBQWMsSUFBSSxFQUFFLFVBQVUsRUFBRSxNQUFNLEVBQUUsTUFBTSxFQUFFLE1BQU0sRUFBRSxNQUFNLEVBQUUsTUFBTSxFQUFFLE1BQU0sRUFBRSxNQUFNLEVBQUUsTUFBTSxFBTSxVQUFVLEVBQUUsTUFBTSxFQUFFLE1BQU0sRUFBRSxNQUFNLEVBQUUsTUFBTSxFQUFFLE1BQU0sEBMkIsR0FBRyxFQUFFLE1BQU0sRUFBRSxNQUFNLEVBQUUsTUFBTSxFQUFFLE1BQU0sEBMkIsR0FBRyxFQUFFLE1BQU0sRUFBRSxNQUFNLEVBQUUsTUFBTSxFQUFFLE1BQU0sEhhLEVBQUUsTUFBTSxFQUFFLE1BQU0sRUFBRSxNQUFNLEVBQUUsTUFBTSxFQUFFLE1BQU0sEBQXdCO0FBQ0QsT0FBTyxFQUFFLFlBQVksRUFBRSxNQUFNLEVBQUUsTUFBTSxFQUFFLE1BQU0sEBQXdCO0FBQ0QsT0FBTyxFQUFFLFlBQVksRUFBRSxNQUFNLEVBQUUsTUFBTSxFQUFFLE1BQU0sEBQXdCO0FBQ0QsT0FBTyxFQUFFLFlBQVksRUFBRSxNQUFNLEVBQUUsTUFBTSxFQUFFLE1BQU0sEBQXdCO0FBQ0QsT0FBTyxFQUFFLFlBQVksRUFBRSxNQUFNLEVBQUUsTUFBTSxFQUFFLE1BQU0sEBQXdCO0FBQ0QsT0FBTyxFQUFFLFlBQVksRUFBRSxNQUFNLEVBQUUsTUFBTSxFQUFFLE1BQU0sEBQXdCO0FBQ0QsT0FBTyxFQUFFLFlBQVksRUFBRSxNQUFNLEVBQUUsTUFBTSxFQUFFLE1BQU0sEBQXdCO0FBQ0QsT0FBTyxFQUFFLFlBQVksRUFBRSxNQUFNLEVBQUUsTUFBTSxFQUFFLE1BQU0sEBQXdCO0FBQ0QsT0FBTyxFQUFFLFlBQVksRUFBRSxNQUFNLEVBQUUsTUFBTSxFQUFFLE1BQU0sEBQXdCO0FBQ0QsT0FBTyxFQUFFLFlBQVksRUFBRSxNQUFNLEVBQUUsTUFBTSxFQUFFLE1BQU0sEBQXdCO0FBQ0QsT0FBTyxFQUFFLFlBQVksRUFBRSxNQUFNLEVBQUUsTUFBTSxFQUFFLE1BQU0sEBQXdCO0FBQ0QsT0FBTyxFQUFFLFlBQVksRUFBRSxNQUFNLEVBQUUsTUFBTSxFQUFFLE1BQU0sEBQXdCO0FBQ0QsT0FBTyxFQUFFLFlBQVksRUFBRSxNQUFNLEVBQUUsTUFBTSxFQUFFLE1BQU0sEBQXdCO0FBQ0QsT0FBTyxFQUFFLFlBQVksRUFBRSxNQUFNLEVBQUUsTUFBTSxFQUFFLE1BQU0sEBQXdCO0FBQ0QsT0FBTyxFQUFFLFlBQVksRUFBRSxNQUFNLEVBQUUsTUFBTSxFQUFFLE1BQU0sEBQXdCO0FBQ0QsT0FBTyxFQUFFLFlBQVksRUFBRSxNQUFNLEVBQUUsTUFBTSxFQUFFLE1BQU0sEBQXdCO0FBQ0QsT0FBTyxFQUFFLFlBQVksRUFBRSxNQUFNLEVBQUUsTUFBTSxFQUFFLE1BQU0sEBQXdCO0FBQ0QsT0FBTyxFQUFFLFlBQVksRUFBRSxNQUFNLEVBQUUsTUFBTSxFQUFFLE1BQU0sEBQXdCO0FBQ0QsT0FBTyxFQUFFLFlBQVksRUFBRSxNQUFNLEVBQUE="
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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\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\nexport const resizeBilinearConfig: KernelConfig = {\n kernelName: ResizeBilinear,\n 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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 '@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 * ==\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
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*/\nimport {KernelConfig, Round} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const roundConfig: KernelConfig = createUnaryKernelConfig(Round);\n","/**\n *
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*/\nimport {KernelConfig, Rsqrt} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\nexport const rsqrtConfig: KernelConfig = createUnaryKernelConfig(Rsqrt);\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, scatter_util, ScatterNd, ScatterNdAttrs, ScatterNdInputs, TensorInfo, util}
from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {CppDType} 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\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\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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\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 * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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\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 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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*/\nimport {KernelConfig, Sin} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\nexport const sinConfig: KernelConfig = createUnaryKernelConfig(Sin);\n","/**\n * @license\n *
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language governing permissions and\n * limitations under the License.\n *
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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) =>\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\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 * @license\n * Copyright 2021 Google
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*/\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';\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\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 < 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
  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
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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\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 *
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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 * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the

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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, Square} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from './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 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n
* WITHOUT WARRANTIES OR CONDITIONS OF 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 * @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, 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\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 Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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, slice_util, StridedSlice, StridedSliceAttrs, StridedSliceInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\n\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\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 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 * @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, Sub} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = true;\nexport const subConfig: KernelConfig =\n createBinaryKernelConfig(Sub, 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\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\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, 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 * @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 governing permissions and\n * limitations under the License.\n *
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*/\nimport {KernelConfig, Tan} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const tanConfig: KernelConfig = createUnaryKernelConfig(Tan);\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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*/\nimport {KernelConfig, Tanh} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const tanhConfig: KernelConfig = createUnaryKernelConfig(Tanh);\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

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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\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 Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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, 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: 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 '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\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 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\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}, 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 */\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 */\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 './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 * @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\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/IHkBZlHETpA/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","\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 (\nfunction(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&&!ENVIRONMENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var ENVIRONMENT_IS_PTHREAD=Module[\"ENVIRONMENT_IS_PTHREAD\"]||false;if(ENVIRONMENT_IS_PTHREAD){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=nodePath[\"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[\"argv\"].slice(2);process[\"on\"](\"uncaughtException\",function(ex){if(!(ex instanceof ExitStatus)){throw ex}});process[\"on\"](\"unhandledRejection\",abort);quit_=function(status){process[\"exit\"](status)};Module[\"inspect\"]=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){scriptDirectory=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.substr(0,scriptDirectory.lastIndexOf(\"/\")+1)}else{scriptDirectory=\"\"}if(ENVIRONMENT_IS_NODE){read_=function shell_read(filename,binary){if(!nodeFS)nodeFS=require(\"fs\");if(!nodePath)nodePath=require(\"path\");filename=nodePath[\"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]}}moduleOverrides=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;err(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[idx++]&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){wasmMemory=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;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){addOnPreRun(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\"].length){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\"](runDependencies)}}function removeRunDependency(id){runDependencies--;if(Module[\"monitorRunDependencies\"]){Module[\"monitorRunDependencies\"](runDependencies)}if(runDependencies==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.error(\"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\"][\"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(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
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,ENOCSI: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: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,ENOTSOCK: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,EOVERFLOW:61,ECANCELED:11,ENOTRECOVERABLE:56,EOWNERDEAD:62,ESTRPIPE:135};function _emscripten_futex_wake(addr,count){if(addr<=0||addr>GROWABLE_HEAP_I8().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.pthreads[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.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);__emscripten_thread_init(tb,!ENVIRONMENT_IS_WORKER,1);_emscripten_register_main_browser_thread_id(tb)},initWorker:function(){},pthreads:{},threadExitHandlers:[],setThreadStatus:function(){},runExitHandlers:function(){while(PThread.threadExitHandlers.length>0){PThread.threadExitHandlers.pop()()}if(ENVIRONMENT_IS_PTHREAD&&_pthread_self())___pthread_tsd_run_dtors()},runExitHandlersAndDeinitThread:function(tb,exitCode){Atomics.store(GROWABLE_HEAP_U32(),tb+56>>2,1);Atomics.store(GROWABLE_HEAP_U32(),tb+60>>2,0);PThread.runExitHandlers();Atomics.store(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(functio
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.post
Message({\"cmd\":\"load\",\"urlOrBlob\":Module[\"mainScriptUrlOrBlob\"]||_scriptDir,\"wasmMemory\":wasmMe
mory,\"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.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
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_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);return 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_callArgs.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]}var
 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=[]},registerRemoveEventListeners:function(){if(!JSEvents.removeEventListenersRegistered){__ATEXIT__.push(JSEvents.removeAllEventListeners);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,argsList)){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.deferredCalls.splice(i,1);--i}}},canPerformEventHandlerRequests:function(){return JSEvents.inEventHandler&&JSEvents.currentEventHandler.allowsDeferredCalls},runDeferredCalls:function(){if(!JSEvents.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,eventTypeString){for(var i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==target&&(!eventTypeString||eventTypeString==JSEvents.eventHandlers[i].eventTypeString)){JSEvents._removeHandler(i--
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)}}},_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
_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_on_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)return
_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){ext[\"vertexAttribDivisorANGLE\"](index,divisor)};ctx[\"drawArraysInstanced\"]=function(mode,first,count,primcount){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[\"drawBuffersWEBGL\"](n,bufs)};return 1}}function
__webgl_enable_WEBGL_multi_draw(ctx){return!!(ctx.multiDrawWebgl=ctx.getExtension(\"WEBGL_multi_draw\"))}var
GL={counter:1,buffers:[],programs:[],framebuffers:[],renderbuffers:[],textures:[],uniforms:[],shaders:[],vaos:[],contexts:{},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.enableExtensionsByDefault){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(contextHandle){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
_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
()[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=_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 \"+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()[status>>2]=threadExitCode;Atomics.store(GROWABLE_HEAP_U32(),thread+64>>2,1);if(!ENVIRONMENT_IS_PTHREAD)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_thread_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_write,_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_logical_cores,\"u\":_emscripten_receive_on_main_thread_js,\"q\":_emscripten_resize_heap,\"v\":_emscripten_set_canvas_element_size,\"i\":_emscripten_set_current_thread_status,\"s\":_emscripten_set_thread_name,\"w\":_emscripten_webgl_create_context,\"l\":_fd_close,\"n\":_fd_seek,\"g\":_fd_write,\"o\":initPthreadsJS,\"a\":wasmMemory||Module[\"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
)};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
_DepthwiseConv2dNative=Module[\"_DepthwiseConv2dNative\"]=function(){return(_DepthwiseConv2dNative=M
odule[\"_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,ar
guments)};var
_Exp=Module[\"_Exp\"]=function(){return(_Exp=Module[\"_Exp\"]=Module[\"asm\"][\"ba\"]).apply(null,argument
s)};var
_FlipLeftRight=Module[\"_FlipLeftRight\"]=function(){return(_FlipLeftRight=Module[\"_FlipLeftRight\"]=Modul
e[\"asm\"][\"ca\"]).apply(null,arguments)};var
_Floor=Module[\"_Floor\"]=function(){return(_Floor=Module[\"_Floor\"]=Module[\"asm\"][\"da\"]).apply(null,arg
uments)};var
_FloorDiv=Module[\"_FloorDiv\"]=function(){return(_FloorDiv=Module[\"_FloorDiv\"]=Module[\"asm\"][\"ea\"]).
apply(null,arguments)};var
_FusedBatchNorm=Module[\"_FusedBatchNorm\"]=function(){return(_FusedBatchNorm=Module[\"_FusedBatchN
orm\"]=Module[\"asm\"][\"fa\"]).apply(null,arguments)};var
_FusedConv2D=Module[\"_FusedConv2D\"]=function(){return(_FusedConv2D=Module[\"_FusedConv2D\"]=Mod
ule[\"asm\"][\"ga\"]).apply(null,arguments)};var
_FusedDepthwiseConv2D=Module[\"_FusedDepthwiseConv2D\"]=function(){return(_FusedDepthwiseConv2D=M
odule[\"_FusedDepthwiseConv2D\"]=Module[\"asm\"][\"ha\"]).apply(null,arguments)};var
_Gather=Module[\"_Gather\"]=function(){return(_Gather=Module[\"_Gather\"]=Module[\"asm\"][\"ia\"]).apply(nul
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\"][\"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
_Sigmoid=Module[\"_Sigmoid\"]=function(){return(_Sigmoid=Module[\"_Sigmoid\"]=Module[\"asm\"][\"Ta\"]).ap

ply(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\"]).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

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_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[\"_emscripten_tls_init\"]=Module[\"asm\"][\"wb\"]).apply(null,arguments)};var
__emscripten_thread_init=Module[\"__emscripten_thread_init\"]=function(){return(__emscripten_thread_init=Module[\"__emscripten_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
_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\"]=10512;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){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()}if(Module[\"setStatus\"]){Module[\"setStatus\"](\"Running...\");setTimeout(function(){setTimeout(function(){Mo
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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_PTHREAD){postMessage({\"cmd\":\"exitProcess\",\"returnCode\":status});throw new ExitStatus(status)}else{}}if(noExitRuntime){}else{PThread.terminateAllThreads();EXITSTATUS=status;exitRuntime();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&&!ENVIRONMENT_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=nodePath[\"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[\"argv\"].slice(2);process[\"on\"](\"uncaughtException\",function(ex){if(!(ex instanceof ExitStatus)){throw ex}});process[\"on\"](\"unhandledRejection\",abort);quit_=function(status){process[\"exit\"](status)};Module[\"inspect\"]=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){scriptDirectory=self.location.href}else if(typeof document!==\"undefined\"&&document.currentScript){scriptDirectory=document.currentScript.src}if(_scriptDir){scriptDirectory=_scriptDir}if(scriptDirectory.indexOf(\"blob:\")!==0){scriptDirectory=scriptDirectory.substr(0,scriptDirectory.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]}}moduleOverrides=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[idx++]&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
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+=\"\";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\"];updateGlobalBufferAndViews(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(wasmBinaryFile)&&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,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\":_fd_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=Module[\"_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\"]=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\"]).a

pply(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
_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
_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

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_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
_TopK=Module[\"_TopK\"]=function(){return(_TopK=Module[\"_TopK\"]=Module[\"asm\"][\"Pa\"]).apply(null,arguments)};var
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_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 return WasmBackendModule.ready\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 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,

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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
${dtype}`);\n    }\n  }\n}\n\nfunction createInstantiateWasmFunc(path: string) {\n  // this will be replace by rollup
plugin patchWechatWebAssembly in\n  // minprogram's output.\n  // tslint:disable-next-line:no-any\n
  return (imports: any, callback: any) => {\n    util.fetch(path, {credentials: 'same-origin'}).then((response) => {\n
if (!response['ok']) {\n        imports.env.a(`failed to load wasm binary file at '${path}'`);\n      }\n
response.arrayBuffer().then(binary => {\n        WebAssembly.instantiate(binary, imports).then(output => {\n
callback(output.instance, output.module);\n        });\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 * 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          [`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\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
;\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,
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\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 intialized.\n */\nexport function getThreadsCount(): number {\n if (actualThreadsCount === -1) {\n throw new Error(`WASM
 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 * ==========\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';\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":["CppDType","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","xBatch

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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
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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\nsetTestEnvs([{name: 'test-wasm', backendName: 'wasm', isDataSync: true}]);\n\n/**\n * Tests that have these substrings in their name will be included unless one\n * of the strings in excludes appears in the name.\n */\nconst TEST_FILTERS: TestFilter[] = [\n {\n startsWith: 'tensor ',\n excludes: [\n 'complex', // Complex numbers not supported yet\n 'derivative', // Gradients not yet supported.\n // Downcasting broken, see: https://github.com/tensorflow/tfjs/issues/2590\n 'Tensor2D float32 -> bool', 'Tensor2D int32 -> bool'\n]\n },\n {include: 'softmax'},\n {\n include: 'pow',\n excludes: [\n 'gradient', // zerosLike not defined yet.\n 'broadcasting same rank Tensors different shape', // Broadcasting along\n // inner dims not\n // supported yet.\n]\n },\n {\n include: 'add ',\n excludes: [\n 'gradient', // Gradient is missing.\n 'upcasts when dtypes dont match', // Uses the 'complex' dtype.\n 'complex', // Complex numbers not supported yet\n]\n },\n {include: 'depthToSpace'},\n {\n include: 'avgPool',\n excludes: [\n 'gradient', // Not yet implemented.\n 'avgPool3d', // Not yet implemented.\n]\n },\n {\n include: 'relu',\n excludes: [\n 'derivative', // Not yet implemented.\n 'gradient', // Not yet implemented.\n 'valueAndGradients', // Not yet implemented.\n 'broadcasted bias', // Not yet implemented.\n 'fused A x B with 2d bias' // Fused matMul with 2D bias not yet\n // supported.\n]\n },\n {\n include: 'maxPool',\n excludes: [\n 'maxPoolBackprop', // Not yet implemented.\n 'maxPool3d', // Not yet implemented.\n 'maxPool3dBackprop', // Not yet implemented.\n 'ignores NaNs', // Actual != expected.\n 'maxPoolWithArgmax' // Not yet implemented.\n\n]\n },\n {include: 'cropAndResize'},\n {\n include: 'resizeBilinear',\n excludes: [\n 'gradients', // Not yet implemented.\n]\n },\n {\n include: 'matmul ',\n excludes: [\n 'valueAndGradients',\n // Gradients not defined yet\n 'gradient', // Gradients not defined yet\n 'zero in its shape', // Zero in shapes aren't supported yet\n 'matmul followed by mul', // mul not supported yet\n 'upcasts', // Upcasting not supported yet.\n 'fused A x B with 2d bias', // Fused matMul with 2D bias not yet\n // supported.\n]\n },\n {\n include: 'depthwiseConv2D ',\n excludes: [\n 'broadcasted bias', // Broadcasted bias not yet supported.\n 'gradient', // Gradients not defined yet.\n 'NCHW', // xnn pack does not support channels first.\n]\n },\n {\n include: 'conv2d ',\n excludes: [\n 'broadcasted bias', // Broadcasted bias not yet supported.\n 'gradient', // Gradients not defined yet.\n 'backProp input x=[2,3,3,1] f=[2,2,1,1] s=1 p=0', // Gradients not\n // defined.\n 'NCHW', // xnn pack does not support channels first.\n // Issue: https://github.com/tensorflow/tfjs/issues/3104.\n // Actual != expected.\n 'relu bias stride 2 x=[1,8,8,16] f=[3,3,16,1] s=[2,2] d=8 p=same',\n 'prelu bias stride 2 x=[1,8,8,16] f=[3,3,16,1] s=[2,2] d=8 p=same',\n]\n },\n {include: 'conv2dTranspose ', excludes: ['gradient']},\n {\n include: 'prelu ',\n excludes: [\n 'gradient', // Gradient is missing.\n 'derivative' // Missing gradient.\n]\n },\n {\n include: ' cast ',\n excludes: [\n 'complex', // Complex numbers not yet implemented.\n 'shallow slice an input that was cast' // Slice is not implemented.\n]\n },\n {\n include: 'gather',\n excludes: [\n 'gradient' // Not yet implemented.\n]\n },\n {\n include: 'sigmoid ',\n excludes: [\n 'sigmoidCrossEntropy', // Not yet implemented.\n 'gradient' // Not\n yet implemented.\n]\n },\n {include: 'scatterND '},\n {\n include: 'abs ',\n excludes: [\n 'gradient', // Not yet implemented.\n 'complex' // Complex numbers not supported yet.\n]\n },\n {\n include: 'sub ',\n excludes: [\n 'complex', // Complex numbers not yet implemented.\n 'gradient', // Not yet implemented.\n 'upcasts', // Upcasting not supported yet.\n]\n },\n {\n include: 'mul ',\n excludes: [\n 'complex', // Complex numbers not yet supported.\n 'gradient', // Gradient not defined yet.\n]\n },\n {\n include: 'div ',\n excludes: [\n 'gradient', // Gradient not defined yet.\n 'upcasts', // Cast not supported yet.\n 'divNoNan' // divNoNan not yet implemented.\n]\n },\n {\n include: 'batchNorm',\n excludes: [\n 'gradient' // Gradient is missing.\n]\n },\n {include: 'slice '},\n {include: 'stridedSlice '},\n {include: 'rotate '},\n {include:

'rotateWithOffset'},\n
{include: 'flipLeftRight '},\n {include: 'square '},\n {include: 'squaredDifference'},\n {\n startsWith: 'min ',\n excludes: [\n '2D, axis=0', // Permuted axes requires transpose, which is not yet\n // implemented.\n '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', // Complex numbers not supported yet\n 'gradient' // Split is not yet implemented\n]\n },\n {include: 'transpose'},\n {include: 'oneHot'},\n {include: 'split'},\n {include: 'pad ', excludes: ['complex', 'zerosLike']},\n {\n 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 {include: 'addN'},\n {include: 'nonMaxSuppression'},\n {include: 'argmax', excludes: ['gradient']},\n {include: 'exp '},\n {\n include: 'elu',\n excludes: [\n 'derivative', // Not yet implemented.\n 'gradient', // Not yet implemented.\n 'selu' // Not yet implemented.\n]\n },\n {include: 'unstack'},\n {\n include: 'minimum',\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: '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: [\n 'broadcasting Tensor2D shapes', // Broadcasting along outer dims not\n // supported yet.\n 'broadcasting Tensor3D shapes', // Same as above.\n 'broadcasting Tensor4D shapes', // Same as above.\n 'string'\n]\n },\n {\n include: 'greater ',\n excludes: [\n 'broadcasting Tensor2D shapes', // Broadcasting along outer dims not\n // supported yet.\n 'broadcasting Tensor3D shapes', // Same as above.\n 'broadcasting Tensor4D shapes', // Same as above.\n 'string'\n]\n },\n {\n include: 'greaterEqual',\n excludes: [\n 'gradient', // Not yet implemented.\n 'broadcasting Tensor2D shapes', // Broadcasting along outer dims not\n // supported yet.\n 'broadcasting Tensor3D shapes', // Same as above.\n 'broadcasting Tensor4D shapes', // Same as above.\n 'string'\n]\n },\n {\n include: 'less ',\n excludes: [\n 'broadcasting Tensor2D shapes', // Broadcasting along outer dims not\n // supported yet.\n 'broadcasting Tensor3D shapes', // Same as above.\n 'broadcasting Tensor3D float32', // Same as above.\n 'broadcasting Tensor4D shapes', // Same as above.\n 'string'\n]\n },\n {\n include: 'lessEqual',\n excludes: [\n 'gradient', // Not yet implemented.\n 'broadcasting Tensor2D shapes', // Broadcasting along outer dims not\n // supported yet.\n 'broadcasting Tensor3D shapes', // Same as above.\n 'broadcasting Tensor3D float32', // Same as above.\n 'broadcasting Tensor4D shapes', // Same as above.\n 'string'\n]\n },\n {\n include: 'notEqual',\n excludes: [\n 'broadcasting Tensor2D shapes', // Broadcasting along outer dims not\n // supported yet.\n 'broadcasting Tensor3D shapes', // Same as above.\n 'broadcasting Tensor4D shapes', // Same as above.\n 'string'\n]\n },\n {\n include: 'mean ',\n excludes: [\n 'axis=0', // Reduction not supported along inner dimensions.\n]\n },\n {startsWith: 'reverse'},\n {startsWith: 'sum '},\n {startsWith: 'cumsum'},\n {\n startsWith: 'logicalAnd ',\n excludes: [\n 'broadcasting Tensor2D shapes', // Broadcasting along outer dimensions\n // not yet supported.\n 'broadcasting Tensor3D shapes', // Same as above.\n 'broadcasting Tensor4D shapes', // Same as above.\n]\n },\n {\n startsWith: 'tile ',\n excludes: [\n 'gradient', // Gradient not yet implemented.\n 'string tensor' // String tensors not yet implemented.\n]\n },\n {startsWith: 'sin '},\n {\n startsWith: 'cos ',\n excludes: [\n 'gradient', // Gradient not yet implemented.\n]\n },\n {\n startsWith: 'cosh',\n excludes: [\n 'gradient' // Gradient not yet implemented.\n]\n },\n {\n startsWith: 'tan',\n excludes: ['gradient'] // Gradient not yet implemented.\n\n },\n {\n startsWith: 'tanh ',\n excludes: ['gradient'] // Gradient not yet implemented.\n },\n {\n startsWith: 'rsqrt ',\n 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 },\n {\n   startsWith: 'onesLike',\n   // Complex numbers not supported yet.\n   excludes: ['complex'],\n },\n {include: 'prod'},\n {include: 'floor'},\n {include: 'topk'},\n {include: 'expandDims'},\n {include: 'stack'},\n {\n include: 'round',\n   // Pool is not supported yet.\n   excludes: ['pool'],\n },\n {include: 'step kernel'},\n {include: 'ceil'},\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 {include: 'image.transform'},\n {include: 'batchToSpaceND'},\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\n // Include all of the wasm specific tests.\n if (testName.startsWith('wasm')) {\n   return true;\n }\n\n return false;\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):
* /opt/cola/permits/1234600203_1638277742.68/0/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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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):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/SplitV.js.map
No license file was found, but licenses were detected in source scan.

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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
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'./kernels/Cumsum';\nimport {depthToSpaceConfig} from './kernels/DepthToSpace';\nimport
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'./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 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"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/register_all_kernels.js.map
No license file was found, but licenses were detected in source scan.

{"version":3,"file":"AvgPool.js","sourceRoot":"","sources":["../../src/kernels/AvgPool.ts"],"names":[],"mappings":"AAAA;;;;;;;;;;;;;;GAeG;AAEH,OAAO,EAAC,OAAO,EAAE,OAAO,EAAE,OAAO,EAA+B,YAAY,EAAE,qBAAqB,EAAC,MAAM,uBAAuB,EAAC,MAAM,qBAAqB,EAAC,MAAM,iBAAi

AY,EAAE,WAAW,EAClE,MAAM,EAAE,QAAQ,EAAE,SAAS,EAAE,OAAO,EAAE,YAAY,EAAE,WAAW,EAAE,QAAQ,EACzE,KAAK,CAAC,CAAC;IACX,OAAO,GAAG,CAAC;AACb,CAAC;AAED,MAAM,CAAC,MAAM,aAAa,GAAiB;IACzC,UAAU,EAAE,OAAO;IACnB,WAAW,EAAE,MAAM;IACnB,WAAW,EAAE,SAAS,EAAE,KAAK;IAC7B,UAAU,EAAE,OAAO,EAAE,KAAK,CAAC,CAAC;IAC5B,CAAC,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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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}\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"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/AvgPool.js.map
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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):
* /opt/cola/permits/1234600203_1638277742.68/0/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":"tf-backend-wasm.node.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","../sr

c/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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT
 WARRANTIES OR CONDITIONS OF ANY 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 * @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 {_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, 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 ${biasData.shape.length}.`);\n   }\n   biasId = biasData.id;\n }\n const preluActivationWeightsId = preluActivationWeights == null ?\n   0 :\n   backend.dataIdMap.get(preluActivationWeights.dataId).id;\n const fusedActivation =\n   FusableActivation[activation as {} as keyof typeof FusableActivation];\n if (fusedActivation == null) {\n   throw new Error(\n   `${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 * @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
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==\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 * @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
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==\n */\nimport {Abs, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\n\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 \"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, 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 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\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 License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required
by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {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 * @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 {AddN, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport

{BackendWasm} from '../backend_wasm';\n\nimport {CppDType} 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, 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 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed
to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {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 * @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';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {identity} from './Identity';\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\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 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","/**\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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==\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 = 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. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {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,\n 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\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 */\n\nimport {ArgMax, ArgMaxAttrs, ArgMaxInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {permuteAxesAndTranspose} from './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\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 LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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}\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 * @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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 ==========================================================================\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 * @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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 ==========================================================================\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\nfunction 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
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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 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, 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 Int32Array(b3d.shape).buffer);\n\n  wasmBatchMatMul(\n      a3dId, aShapeBytes, a3d.shape.length, b3dId, bShapeBytes,\n      b3d.shape.length, transposeA, transposeB, outId);\n\n  backend.disposeData(a3d.dataId);\n  backend.disposeData(b3d.dataId);\n\n  out.shape =
 outShape;\n  return out;\n}\n\nexport const batchMatMulConfig: KernelConfig = {\n  kernelName: BatchMatMul,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: batchMatMul 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, util } from '@tensorflow/tfjs-core';\nexport function
 concatImpl(inputs, outShape, dtype, simplyConcat) {\n    const outVals = util.getArrayFromDType(dtype, util.sizeFromShape(outShape));\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.set(input.vals, offset);\n            offset += size;\n        });\n    }\n    else {\n        let colOffset = 0;\n        inputs.forEach(input => {\n            const decodedData = dtype === 'string' ?\n                backend_util.fromUint8ToStringArray(input.vals) :\n                input.vals;\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
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}\n colOffset += input.shape[1];\n });\n }\n return outVals;\n}\n//# sourceMappingURL=data:application/json; base64,eyJ2ZXJzaW9uIjozLCJmaWxlIjoiQ29uY2F0X2ltcGwuanMiLCJzb3VyY2VSb290IjoiIiwic291cmNlcyI6WyIuLi8uLi8uLi8uLi8uLi8uLi90ZmpzLWJhY2tlbmQtY3B1L3NyYy9rZXJuZWxzL0NvbmNhdF9pbXBsLnRzIl0sIm5hbWVzIjpbXSwibWFwcGluZ3MiOiJBQUFBOzs7Ozs7Ozs7Ozs7R0FlRztBQUVILE9BQU8sRUFBQyxNQUFNLEVBQUMsTUFBTSxpQkFBaUIsQ0FBQztBQUV2QyxPQ0FBQyxFQUFDLGNBQWMsRUFBQyxNQUFNLGlCQUFpQixDQUFDO0FBRXpDLE9BQU8sRUFBQyxjQUFjLEVBQUMsTUFBTSxpQkFBaUIsQ0FBQztBQUUvQyxPQUFPLEVBQUMsZUFBZSxFQUFDLE1BQU0sa0JBQWtCLENBQUM7QUFFakQsT0FBTyxFQUFDLGVBQWUsRUFBQyxNQUFNLGtCQUFrQixDQUFDO0FBRWpELE9BQU8sRUFBQyxlQUFlLEVBQUMsTUFBTSxrQkFBa0IsQ0FBQztBQUVqRC

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==\n
*/\nimport { util } from '@tensorflow/tfjs-core';\nexport function rangeImpl(start, stop, step, dtype) {\n   const sameStartStop = start === stop;\n   const increasingRangeNegativeStep = start < stop && step < 0;\n   const decreasingRangePositiveStep = stop < start && step > 1;\n   if (sameStartStop || increasingRangeNegativeStep ||\n   decreasingRangePositiveStep) {\n   return util.makeZerosTypedArray(0, dtype);\n   }\n   const numElements = Math.abs(Math.ceil((stop - start) / step));\n   const values = util.makeZerosTypedArray(numElements, dtype);\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   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//#
sourceMappingURL=data:application/json; base64,eyJ2ZXJzaW9uIjozLCJmaWxlIjoiUmFuZ2VfaW1wbC5qcyIsInNvdXJjZVJvb3QiOiIiLCJzb3VyY2VzIjpbIi4uLy4uLy4uLy4uLy4uLy4uL3RmanMtYmFja2VuZC1jcHUvc3JjL2tlcm5lbHMvUmFuZ2VfaW1wbC50cyJdLCJuYW1lcyI6W10sImhcHBpbmdzIjoiQUFBQTs7Ozs7Ozs7Ozs7O0dBZUc7QUFFSCxPQUFPLEVBQUUsSUFBSSxFQUFFLE1BQU0sNkJBQTZCLENBQUM7QUFFbkQsTUFBTSxVQUFVLFNBQVMsQ0FBQyxLQUFhLEVBQUUsSUFBWSxFQUFFLElBQVksRUFBRSxLQUFlO0lBQ3BFLE1BQU0sYUFBYSxHQUFHLEtBQUssS0FBSyxJQUFJLENBQUM7SUFDckMsTUFBTSwyQkFBMkIsR0FBRyxLQUFLLEdBQUcsSUFBSSxJQUFJLEdBQUcsQ0FBQyxDQUFDO0lBQ3pELE1BQU0sMkJBQTJCLEdBQUcsSUFBSSxHQUFHLEtBQUssSUFBSSxJQUFJLEdBQUcsQ0FBQyxDQUFDO0lBQzdELElBQUksQ0FBQyxhQUFhLElBQUksMkJBQTJCLElBQUk7UUFDakQsMkJBQTJCLENBQUMsRUFBRTtRQUM1QixPQUFPLElBQUksQ0FBQyxtQkFBbUIsQ0FBQyxDQUFDLEVBQUUsS0FBSyxDQUFDLENBQUM7SUFDNUMsQ0FBQztJQUNELE1BQU0sV0FBVyxHQUFHLElBQUksQ0FBQyxHQUFHLENBQUMsSUFBSSxDQUFDLElBQUksQ0FBQyxDQUFDLElBQUksR0FBRyxLQUFLLENBQUMsR0FBRyxJQUFJLENBQUMsQ0FBQyxDQUFDO0lBQzlELE1BQU0sTUFBTSxHQUFHLElBQUksQ0FBQyxtQkFBbUIsQ0FBQyxXQUFXLEVBQUUsS0FBSyxDQUFDLENBQUM7SUFDNUQsSUFBSSxJQUFJLEdBQUcsS0FBSyxJQUFJLElBQUksS0FBSyxDQUFDLEVBQUU7UUFDOUIsY0FBYztRQUNkLDBDQUEwQztRQUMxQyxJQUFJLEdBQUcsQ0FBQyxDQUFDLENBQUM7SUFDWixDQUFDO0lBQ0QsTUFBTSxDQUFDLENBQUMsQ0FBQyxHQUFHLEtBQUssQ0FBQztJQUNsQixLQUFLLElBQUksQ0FBQyxHQUFHLENBQUMsRUFBRSxDQUFDLEdBQUcsTUFBTSxDQUFDLE1BQU0sRUFBRSxDQUFDLEVBQUUsRUFBRTtRQUN0QyxNQUFNLENBQUMsQ0FBQyxDQUFDLEdBQUcsTUFBTSxDQUFDLENBQUMsR0FBRyxDQUFDLENBQUMsR0FBRyxJQUFJLENBQUM7SUFDbkMsQ0FBQztJQUNELE9BQU8sTUFBTSxDQUFDO0FBQ2xCLENBQUM7QUFDRCxPQUFPLEVBQUUsU0FBUyxJQUFJLFNBQVMsRUFBRSxDQUFDO0FBQ2xDLE9BQU8sRUFBRSxTQUFTLEVBQUUsQ0FBQyxDQUFDLENBQUMsU0FBUyxDQUFDLFNBQVM

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backend.makeTensorInfo($size, x.dtype, outVals);\n}\nexport const sliceConfig = {\n kernelName: Slice,\n backendName: 'cpu',\n kernelFunc: slice\n};\n//#
sourceMappingURL=data:application/json; base64,eyJ2ZXJzaW9uIjozLCJmaWxlIjoiU2xpY2UuanMiLCJzb3VyY2VSb290IjoiIiwic291cmNlcyI6WyIuLi8uLi8uLi8uLi8uLi8uLi90ZmpzLWJhY2tlbmQtY3B1L3NyYy9rZXJuZWxzL1NsaWNlLnRzIl0sIm5hbWVzIjpbXSwibWFwcGluZ3MiOiJBQUFBOzs7Ozs7Ozs7Ozs7R0FlRztBQU8sRUFBQyxXQUFVLElBQUksRUFBRSxPQUFPO0lBQ3BCLE9BQU8sQ0FBQyxPQUFPLE1BQU0sS0FBSyxRQUFRLElBQUksT0FBTyxNQUFNLEtBQUssV0FBVyxHQUFHLE9BQU8sQ0FBQyxPQUFPLENBQUMsR0FBRyxPQUFPLE1BQU0sS0FBSyxVQUFVLElBQUksTUFBTSxDQUFDLEdBQUcsRUFBRSxPQUFPLENBQUMsR0FBRyxPQUFPLE9BQU8sS0FBSyxXQUFXLElBQUksT0FBTyxDQUFDLEdBQUcsRUFBRSxPQUFPLENBQUMsR0FBRyxPQUFPLElBQUksS0FBSyxXQUFXLEdBQUcsSUFBSSxHQUFHLFVBQVUsRUFBRSxPQUFPO1FBQ3JSLGFBQWEsQ0FBQztRQUNkLE1BQU0sQ0FBQyxjQUFjLENBQUMsT0FBTyxFQUFFLFlBQVksRUFBRSxFQUFFLEtBQUssRUFBRSxJQUFJLEVBQUUsQ0FBQyxDQUFDO1FBQ2hF

ogVW5sZXNzIHJlcXVpcmVkIGJ5IGFwcGxpY2FibGUgbGF3IG9yIGFncmVlZCB0byBpbiB3cml0aW5nLCBzb2Z0d2FyZVxuICogZGlzdHJpYnV0ZWQgdW5kZXIgdGhlIExpY2Vuc2UgaXMgZGlzdHJpYnV0ZWQgb24gYW4gXCJBUyBJUyBBU1wiIEJBU0lTLFxuICogV0lUSE9VVCBXQVJSQU5USUVTIE9SIENPTkRJVElPTlMgT0YgQU5ZIEtJTkQsIGVpdGhlciBleHBsaWNpdCBvciBpbXBsaWVkLiBTZWUgdGhlIExpY2Vuc2UgZm9yIHRoZSBzcGVjaWZpYyBsYW5ndWFnZSBnb3Zlcm5pbmcgcGVybWlzc2lvbnMgYW5kIGxpbWl0YXRpb25zIHVuZGVyIHRoZSBMaWNlbnNlLiBqID09PT09PT09PT

==========\n*/\n\nimport {backend_util, KernelConfig, KernelFunc, Slice, slice_util, SliceAttrs, SliceInputs, TypedArray, util} from '@tensorflow/tfjs-core';\n\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\n const [begin_, size_] = slice_util.parseSliceParams(x, begin, size);\n\n const isContinous = slice_util.isSliceContinous(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 (isContinous) {\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.typedArrayFromHeap(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.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\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\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 * @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 {backend_util, BatchToSpaceND, BatchToSpaceNDAttrs, BatchToSpaceNDInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {reshape} from './Reshape';\nimport {slice} from './Slice';\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: {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\nexport const batchToSpaceNDConfig: KernelConfig = {\n kernelName: BatchToSpaceND,\n backendName: 'wasm',\n kernelFunc: batchToSpaceND 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 {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\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*/\nimport {KernelConfig, Ceil} from '@tensorflow/tfjs-core';\n\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\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\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 License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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';\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 = $inputs.map(t => {\n   const innerSize = util.sizeFromShape(t.shape.slice(axis));\n   const shape = [-1, innerSize];\n   return reshape({inputs: {x: t}, backend, attrs: {shape}});\n   });\n\n   const inputsValShapes = inputs2D.map(t => {\n   return {vals: backend.readSync(t.dataId), shape: t.shape};\n   });\n\n   // Concats 2d tensors along axis=1.\n   outShape =\n   backend_util.computeOutShape(inputs2D.map(t => t.shape), 1 /* axis */);\n   const simplyConcat = inputs2D[0].shape[0] === 1;\n   const outVals = concatImplCPU(\n   inputsValShapes, outShape, inputs[0].dtype,\n   simplyConcat) as string[];\n\n   const finalOutShape =\n   backend_util.computeOutShape($inputs.map(t => t.shape), axis);\n\n   out.shape = finalOutShape;\n   const outData = backend.dataIdMap.get(out.dataId);\n   outData.stringBytes =\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 = 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\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
 distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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, 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 */\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\nexport const conv2DBackpropInputConfig: KernelConfig = {\n kernelName: Conv2DBackpropInput,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: conv2DBackpropInput 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 {Cos, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\n\nexport const cosConfig: KernelConfig = createUnaryKernelConfig(Cos);\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 {Cosh, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\n\nexport const coshConfig: KernelConfig = createUnaryKernelConfig(Cosh);\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 {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","/**\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, 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\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\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 * @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\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","/**\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 {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',\n // 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 Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF 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 =\n createBinaryKernelConfig(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 copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 * @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} 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 * @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 {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 compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF 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","/**\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 {FloorDiv, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from './binary_kernel';\n\nconst supportsFullBroadcast = false;\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 use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 * @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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=============================================================================\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,
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dilationHeight,\n      dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels,\n      fusedActivation, preluActivationWeightsId, leakyreluAlpha ||
 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 * @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, 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}\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\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 (${outputChannels})`);\n    }\n
  biasId = biasData.id;\n  }\n\n  const filterHeight = convInfo.filterHeight;\n  const filterWidth =
convInfo.filterWidth;\n  const padTop = convInfo.padInfo.top;\n  const padRight = convInfo.padInfo.right;\n  const padBottom = convInfo.padInfo.bottom;\n  const padLeft = convInfo.padInfo.left;\n  const dilationHeight =
convInfo.dilationHeight;\n  const dilationWidth = convInfo.dilationWidth;\n  const strideHeight =
convInfo.strideHeight;\n  const strideWidth = convInfo.strideWidth;\n  const inputChannels =
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convInfo.inChannels;\n const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n const batchSize = convInfo.batchSize;\n const inHeight = convInfo.inHeight;\n const inWidth = convInfo.inWidth;\n\n if (dataFormat !== 'NHWC') {\n   throw new Error(\n   `wasm backend FusedDepthwiseConv2D does not support dataFormat:'` +\n   `${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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {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 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 * @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, 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 {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 },\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 * @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 {Greater, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from './binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const greaterConfig: KernelConfig =\n createBinaryKernelConfig(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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n
 * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS 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 {GreaterEqual, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from './binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const greaterEqualConfig: KernelConfig =\n createBinaryKernelConfig(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 *\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 WARRANTIES OR CONDITIONS OF ANY 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}\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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;\nexport const lessConfig: KernelConfig =\n createBinaryKernelConfig(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 *\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 OR CONDITIONS OF ANY 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';\n\nconst supportsFullBroadcast = false;\nexport const lessEqualConfig: KernelConfig =\n createBinaryKernelConfig(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 *\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*/\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 *\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 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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, 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\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\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, 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 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

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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';\nconst supportsFullBroadcast = false;\nexport const maximumConfig: KernelConfig =\n
createBinaryKernelConfig(Maximum, supportsFullBroadcast);\n","/**\n * @license\n * Copyright 2019 Google
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and\n * limitations under the License.\n *
==========\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
'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 //\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 * @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 */\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\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 * 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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==========\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';\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\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\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 * @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
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 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\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 copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF 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`.\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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\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:
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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to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT
WARRANTIES OR CONDITIONS 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\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 {}
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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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 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 Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS 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, 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 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS 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, 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 * @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, 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 * @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';\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n

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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 = 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 License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {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\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\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 'prod', reductionAxes, input.shape.length);\n const [outShape, reduceShape]\n =\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\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\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 *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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';\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\n
const
out = backend.makeOutput([values.length], dtype);\n const outVals = backend.typedArrayFromHeap(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
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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, RealDiv} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'./binary_kernel';\n\nconst supportsFullBroadcast = true;\nexport const realDivConfig: KernelConfig =\n
createBinaryKernelConfig(RealDiv, supportsFullBroadcast);\n","/**\n * @license\n * Copyright 2019 Google LLC.
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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 *
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*/\nimport {KernelConfig, Relu} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\nexport const reluConfig: KernelConfig = createUnaryKernelConfig(Relu);\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 {KernelConfig, Relu6} from '@tensorflow/tfjs-core';\n\nimport
{createUnaryKernelConfig} from './unary_kernel';\nexport const relu6Config: KernelConfig =
createUnaryKernelConfig(Relu6);\n","/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n *
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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\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\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\nexport const resizeBilinearConfig: KernelConfig = {\n kernelName: ResizeBilinear,\n 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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 '@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

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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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS
OF 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 {createUnaryKernelConfig} from './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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF 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';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable

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==========\n */\n\nimport {KernelConfig, KernelFunc, scatter_util, ScatterNd, ScatterNdAttrs, ScatterNdInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {CppDType} 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\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\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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\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 * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed

on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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\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 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
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==========\n */\nimport {KernelConfig, Sin} from '@tensorflow/tfjs-core';\n\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 \"License\");\n * 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\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\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 * @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 *
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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, 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';\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\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 < 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
  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
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==========\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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';\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 License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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';\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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} from './binary_kernel';\nconst supportsFullBroadcast = true;\nexport const squaredDifferenceConfig: KernelConfig =\n createBinaryKernelConfig(SquaredDifference, 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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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} 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\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 Apache License, Version 2.0 (the \"License\");\n * you may not use this

file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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, slice_util, StridedSlice, StridedSliceAttrs, StridedSliceInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\n\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\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 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 * @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

*/\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 * @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, 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\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 =\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 * @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\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, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const tanConfig: KernelConfig = createUnaryKernelConfig(Tan);\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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==========\n */\nimport {KernelConfig, Tanh} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const tanhConfig: KernelConfig = createUnaryKernelConfig(Tanh);\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, 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\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 Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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, 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: 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 '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\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 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\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}, 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*/\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 */\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
'./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 * @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\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/IHkBZlHETpA/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","\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 (\nfunction(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&&!ENVIRONMENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var ENVIRONMENT_IS_PTHREAD=Module[\"ENVIRONMENT_IS_PTHREAD\"]||false;if(ENVIRONMENT_IS_PTHREAD){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=nodePath[\"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[\"argv\"].slice(2);process[\"on\"](\"uncaughtException\",function(ex){if(!(ex instanceof ExitStatus)){throw ex}});process[\"on\"](\"unhandledRejection\",abort);quit_=function(status){process[\"exit\"](status)};Module[\"inspect\"]=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){scriptDirectory=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.substr(0,scriptDirectory.lastIndexOf(\"/\")+1)}else{scriptDirectory=\"\"}if(ENVIRONMENT_IS_NODE){read_=function

shell_read(filename,binary){if(!nodeFS)nodeFS=require(\"fs\");if(!nodePath)nodePath=require(\"path\");filename=nodePath[\"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]}}moduleOverrides=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;err(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[idx++]&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){wasmMemory=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;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){addOnPreRun(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\"].length){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\"](runDependencies)}}function removeRunDependency(id){runDependencies--;if(Module[\"monitorRunDependencies\"]){Module[\"monitorRunDependencies\"](runDependencies)}if(runDependencies==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.error(\"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\"][\"I\"];wasmModule=module;if(!ENVIRONMENT_IS_PTHREAD){var numWorkersToLoad=PThread.unusedWorkers.length;PThread.unusedWorkers.forEach(function(w){PThread.loadWasmModuleToWorker(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(wasmBinaryFile)&&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(){__emscripten_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,EBADF: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,ECHRNG:106,EL2NSYNC:156,EL3HLT:107,EL3RST:108,ELNRNG:109,EUNATCH:110,ENOCSI:111,EL2HLT:112,EDEADLK:16,ENOLCK:46,EBADE: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,ENOTSOCK: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,EOVERFLOW:61,ECANCELED:11,ENOTRECOVERABLE:56,EOWNERDEAD:62,ESTRPIPE:135};function _emscripten_futex_wake(addr,count){if(addr<=0||addr>GROWABLE_HEAP_I8().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.pthreads[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.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

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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(){},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(functio
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
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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 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.pthreads[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-

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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
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
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call=JSEvents.deferredCalls[i];if(call.targetFunction==targetFunction&&arraysHaveEqualContent(call.argsList,argsList)){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.deferredCalls.splice(i,1);--i}}},canPerformEventHandlerRequests:function(){return JSEvents.inEventHandler&&JSEvents.currentEventHandler.allowsDeferredCalls},runDeferredCalls:function(){if(!JSEvents.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,eventTypeString){for(var i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==target&&(!eventTypeString||eventTypeString==JSEvents.eventHandlers[i].eventTypeString)){JSEvents._removeHandler(i--)}}},_removeHandler:function(i){var h=JSEvents.eventHandlers[i];h.target.removeEventListener(h.eventTypeString,h.eventListenerFunc,h.useCapture);JSEvents.eventHandlers.splice(i,1)},registerOrRemoveHandler:function(eventHandler){var jsEventHandler=function jsEventHandler(event){++JSEvents.inEventHandler;JSEvents.currentEventHandler=eventHandler;JSEvents.runDeferredCalls();eventHandler.handlerFunc(event);JSEvents.runDeferredCalls();--JSEvents.inEventHandler};if(eventHandler.callbackfunc){eventHandler.eventListenerFunc=jsEventHandler;eventHandler.target.addEventListener(eventHandler.eventTypeString,jsEventHandler,eventHandler.useCapture);JSEvents.eventHandlers.push(eventHandler);JSEvents.registerRemoveEventListeners()}else{for(var i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==eventHandler.target&&JSEvents.eventHandlers[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,targetThread,637534208,eventHandlerFunc,eventData,varargs);stackRestore(stackTop)},getTargetThreadForEventCallback:function(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()[varargs+8>>2]=height;__emscripten_call_on_thread(0,targetThread,657457152,0,targetCanvasPtr,varargs);stackRestore(stackTop)}function _emscripten_set_offscreencanvas_size_on_target_thread(targetThread,targetCanvas,width,height){targetCanvas=targetCanvas?UTF8ToString(targetCanvas):\"\";_emscripten_set_offscreencanvas_size_on_target_thread_js(targetThread,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_HEAP_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&&prevViewport[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_on_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)return
_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){ext[\"vertexAttribDivisorANGLE\"](index,divisor)};ctx[\"drawArraysInstanced\"]=function(mode,first,count,primcount){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[\"drawBuffersWEBGL\"](n,bufs)};return 1}}function
__webgl_enable_WEBGL_multi_draw(ctx){return!!(ctx.multiDrawWebgl=ctx.getExtension(\"WEBGL_multi_draw\"))}var
GL={counter:1,buffers:[],programs:[],framebuffers:[],renderbuffers:[],textures:[],uniforms:[],shaders:[],vaos:[],contexts:{},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
_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()[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)})}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 __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()[status>>2]=threadExitCode;Atomics.store(GROWABLE_HEAP_U32(),thread+64>>2,1);if(!ENVIRONMENT_IS_PTHREAD)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_thread_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_write,_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_logical_cores,\"u\":_emscripten_receive_on_main_thread_js,\"q\":_emscripten_resize_heap,\"v\":_emscripten_set_canvas_element_size,\"i\":_emscripten_set_current_thread_status,\"s\":_emscripten_set_thread_name,\"w\":_emscripten_webgl_create_context,\"l\":_fd_close,\"n\":_fd_seek,\"g\":_fd_write,\"o\":initPthreadsJS,\"a\":wasmMemory||Module[\"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

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_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
_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
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_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
_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
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_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
_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[\"_emscripten_tls_init\"]=Module[\"asm\"][\"wb\"]).apply(null,arguments)};var
__emscripten_thread_init=Module[\"__emscripten_thread_init\"]=function(){return(__emscripten_thread_init=Module[\"__emscripten_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
_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\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
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()}}}';","\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){scriptDirectory=self.location.href}else if(typeof document!==\"undefined\"&&document.currentScript){scriptDirectory=document.currentScript.src}if(_scriptDir){scriptDirectory=_scriptDir}if(scriptDirectory.indexOf(\"blob:\")!==0){scriptDirectory=scriptDirectory.substr(0,scriptDirectory.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]}}moduleOverrides=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[idx++]&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){addOnPreRun(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\"].length){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[\"monitorRunDependencies\"](runDependencies)}}function removeRunDependency(id){runDependencies--;if(Module[\"monitorRunDependencies\"]){Module[\"monitorRunDependencies\"](runDependencies)}if(runDependencies==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;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.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\"];updateGlobalBufferAndViews(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(wasmBinaryFile)&&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,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\":_fd_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=Module[\"_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\"]=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,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
_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\"][\"
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\"][\"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\"]).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
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\"][\"R
a\"]).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(nu
ll,arguments)};var
_free=Module[\"_free\"]=function(){return(_free=Module[\"_free\"]=Module[\"asm\"][\"Ua\"]).apply(null,argument
s)};var
___errno_location=Module[\"___errno_location\"]=function(){return(___errno_location=Module[\"___errno_locati
on\"]=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(){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})();\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 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 ${dtype}`);\n    }\n  }\n}\n\nfunction
createInstantiateWasmFunc(path: string) {\n  // this will be replace by rollup plugin patchWechatWebAssembly in\n
// minprogram's output.\n  // tslint:disable-next-line:no-any\n  return (imports: any, callback: any) => {\n
util.fetch(path, {credentials: 'same-origin'}).then((response) => {\n      if (!response['ok']) {\n
imports.env.a(`failed to load wasm binary file at '${path}'`);\n      }\n      response.arrayBuffer().then(binary => {\n
   WebAssembly.instantiate(binary, imports).then(output => {\n          callback(output.instance, output.module);\n
 });\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 * 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          [`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\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 ;\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, 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\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 intialized.\n */\nexport function getThreadsCount(): number {\n if (actualThreadsCount === -1) {\n   throw new Error(`WASM backend not initialized.`);\n }\n return actualThreadsCount;\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 * @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 './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';\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","sliceImplCPU","Slice","BatchToSpaceND","Cast","Ceil","ClipByValue","concatImplCPU","Concat","Conv2D","Conv2DBackpropInput","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","Rsqrt","ScatterNd","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","tslib_1.__extends","DataStorage","engine","KernelBackend","wasmFactoryThreadedSimd","wasmFactory","deprecationWarn","registerBackend"],"mappings":";;;;

AG,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,CAAC,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;IAC/C,IAAM,GAAAG,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,CAAC,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;IAE/C,IAAI,MAAM,GAAG,CAAC,CAAC;IACf,IAAI,IAAI,IAAI,IAAI,EAAE;QAChB,IAAM,GAAAG,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,IAAI,CAAC,MAAM,CAAC,CAAC,CAAC;QACpD,IAAI,QAAQ,CAAC,KAAK,CAAC,EAAE;YAC/B,IAAM,GAAAG,GAAG,KAAK,CAAC,MAAM,CAAC,KAAK,CAAC,EAAE;YAC/B,IAAM,GAAAG,GAAG,KAAK,CAAC,EAAE;YAC/B,IAAM,GAAAG,GAAG,MAAM,GAAG,CAAA,AAAC,GAAG,CAAA,AAAC,GAAG,CAAA,AAAC

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* @deprecated Use `setWasmPaths` instead.
* Sets the path to the `.wasm` file which will be fetched when the wasm
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* https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers
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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Max.js.map
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{"version":3,"file":"tf-backend-wasm.fesm.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/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/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","../node_modules/@tensorflow/tfjs-backend-cpu/dist/kernels/Concat_impl.js","../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","../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/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/ZerosLike.ts","../src/register_all_kernels.ts","../src/kernels/Unpack.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/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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 * @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, 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 ${biasData.shape.length}.`);\n    }\n    biasId = biasData.id;\n  }\n  const preluActivationWeightsId = preluActivationWeights == null ?\n      0 :\n      backend.dataIdMap.get(preluActivationWeights.dataId).id;\n  const fusedActivation =\n      FusableActivation[activation as {} as keyof typeof FusableActivation];\n  if (fusedActivation == null) {\n    throw new Error(\n        `${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] :\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 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 * @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 * @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 * @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, 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:\n 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 ===\n 'float32') {\n kernelFunc();\n return out;\n }\n\n const aBroadcastDims =\n backend_util.getBroadcastDims(a.shape, newShape);\n const bBroadcastDims =\n 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\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 License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless
 required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {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 * @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 {AddN, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {CppDType} 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, 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 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law
 or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {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 * @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, KernelFunc, TensorInfo, Transpose, TransposeAttrs, TransposeInputs} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {identity} from './Identity';\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\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 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","/**\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\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 = 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. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n
*\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS 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 {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 */\n\nimport {ArgMax, ArgMaxAttrs, ArgMaxInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {permuteAxesAndTranspose} from './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\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

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  kernelFunc: argmax 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 {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 * @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, 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      () =>
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`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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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\nfunction 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, 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 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, 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 Int32Array(b3d.shape).buffer);\n\n wasmBatchMatMul(\n   a3dId, aShapeBytes, a3d.shape.length, b3dId, bShapeBytes,\n   b3d.shape.length, transposeA, transposeB, outId);\n\n backend.disposeData(a3d.dataId);\n backend.disposeData(b3d.dataId);\n\n out.shape
 = outShape;\n return out;\n}\n\nexport const batchMatMulConfig: KernelConfig = {\n kernelName: BatchMatMul,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: batchMatMul 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, buffer, Slice, slice_util, util } from '@tensorflow/tfjs-core';\nimport
 { assertNotComplex } from '../cpu_util';\nexport function sliceImpl(vals, begin, size, shape, dtype) {\n   const isContinous = slice_util.isSliceContinous(shape, begin, size);\n   const length = util.sizeFromShape(size);\n   const xStrides = util.computeStrides(shape);\n   if (isContinous) {\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) :\n   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}\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}\nexport const sliceConfig = {\n   kernelName: Slice,\n backendName: 'cpu',\n   kernelFunc: slice\n};\n//#
sourceMappingURL=data:application/json; base64,eyJ2ZXJzaW9uIjozLCJmaWxlIjoiU2xpY2UuanMiLCJzb3VyY2VSb290IjoiIiwic291cmNlcyI6WyIuLi8uLi8uLi8uLi8uLi8uLi90ZmpzLWJhY2tlbmQtY3B1L3NyYy9rZXJuZWxzL1NsaWNlLnRzIl0sIm5hbWVzIjpbXSwibWFwcGluZ3MiOiJBQUFBOzs7Ozs7Ozs7Ozs7R0FlRzs7Ozs7Ozs7Oz

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hdE9mZnNldCwgZmxhdE9mZnNldCArIGxlbmd0aCk7XG4gICAgfVxuXG4gICAgcmV0dXJuICh2YWxzIGFzIF
R5cGVkQXJyYXkpLnN1YmFycmF5KGZsYXRPZmZzZXQsIGZsYXRPZmZzZXQgKyBsZW5ndGgpO1xuICB9
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mV3Mb2MoaSk7XG4gICAgY29uc3QgaW5Mb2MgPSBvdXRMb2MubWFwKChpZHg6IG51bWJlciwgaikgPT4gaX
WR4ICsgYmVnaW5bal0pO1xuICAgICAgICAgICAg

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\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 * @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 {backend_util, BatchToSpaceND, BatchToSpaceNDAttrs, BatchToSpaceNDInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {reshape} from './Reshape';\nimport {slice} from './Slice';\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: {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,\n 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\nexport const batchToSpaceNDConfig: KernelConfig = {\n kernelName: BatchToSpaceND,\n backendName: 'wasm',\n kernelFunc: batchToSpaceND 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 {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\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
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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 */\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\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 License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OF

ANY 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';\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 = $inputs.map(t => {\n const innerSize = util.sizeFromShape(t.shape.slice(axis));\n const shape = [-1, innerSize];\n return reshape({inputs: {x: t}, backend, attrs: {shape}});\n });\n\n const inputsValShapes = inputs2D.map(t => {\n return {vals: backend.readSync(t.dataId), shape: t.shape};\n });\n\n // Concats 2d tensors along axis=1.\n outShape =\n backend_util.computeOutShape(inputs2D.map(t => t.shape), 1 /* axis */);\n const simplyConcat = inputs2D[0].shape[0] === 1;\n const outVals = concatImplCPU(\n inputsValShapes, outShape, inputs[0].dtype,\n simplyConcat) as string[];\n\n const finalOutShape =\n backend_util.computeOutShape($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\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 Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF 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, util } from '@tensorflow/tfjs-core';\nexport function concatImpl(inputs, outShape, dtype, simplyConcat) {\n const outVals = util.getArrayFromDType(dtype, util.sizeFromShape(outShape));\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.set(input.vals,
offset);\n offset += size;\n });\n }\n else {\n let colOffset = 0;\n inputs.forEach(input => {\n
const decodedData = dtype === 'string' ?\n backend_util.fromUint8ToStringArray(input.vals) :\n
input.vals;\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 }\n colOffset += input.shape[1];\n
});\n }\n return outVals;\n}\n//#
sourceMappingURL=data:application/json; base64,eyJ2ZXJzaW9uIjozLCJmaWxlIjoiQ29uY2F0X2ltcGwuanMiLC
Jzb3VyY2VSb290IjoiIiwic291cmNlcyI6WyIuLi8uLi8uLi8uLi8uLi8uLi90ZmpzLWJhY2tlbmQtY3B1L3NyYy9rZ
XJuZWxzL0NvbmNhdF9pbXBsLnRzIl0sIm5hbWVzIjpbXSwibWFwcGluZ3MiOiJBQUFBOzs7Ozs7Ozs7Oz
s7R0FlRztBQUVILE9BQU8sRUFBQyxxZQUFZLEVBQXVDLElBQUksRUFBQyxxNQUFNLHVCQUF1QixDQU
FDO0FBRTlGLE1BQU0sVUFBVSxVQUFVLENBQ3RCLE1BQXFELEVBQUUsUUFBa0IsS0FBZS
xFQUFFLFlBQXFCO0lBQ3hDLE1BQU0sT0FBTyxxHQUFHLElBQUksQ0FBQyxpQkFBaUIsQ0FBQyxxLQUFLLL
EVBQUUsSUFBSSxDQUFDLGFBQWEsQ0FBQyxxRQUFRLENBQUMsQ0FBQyxqDQUFDO0lBRTVFLElBQUk
sWUFBWSxJQUFJLEtBQUssS0FBSyxEMsa0RBQWtEO1FBQ2xELElBQUksTUFB
TSxHQUFHLENBQUMsQ0FBQztRQUNmLE1BQU0sQ0FBQyxxPQUFPLENBQUMsS0FBSyxDQUFDLEVBQU
U7WUFDckIsTUFBTSxJQUFJLEdBQUcsSUFBSSxDQUFDLGFBQWEsQ0FBQyxLQUFLLENBQUMsS0FBSy
xDQUFDLENBQUM7WUFFNUMsQ0FBQyxxHQUFHLENBQUMsS0FBSyxDQUFDLEVBQUUsQ0FBQyxxCLEVB
QUUsTUFBTSxDQUFDLENBQUM7WUFDdkMsQUFBSyxDQUFDLENBQUMsQ0FBQztRQUNqQixDQUFDLENBQUMsQ0FBQztRQUNILE9BQU8sTUFBTSxDQUFDO0lBQ2xCLENBQUM7QUFFRCxNQUFNLENBQUMsTUFBTSxPQUFPLEdBQWlCLEVBQUMsVUFBVSxFQUFFLFVBQVUsRUFBQyxDQUFDO0FBRTlELE
wZSwgc2ltcGx5Q29uY2F0OiBib29sZWFuKTogVHlwZWRBcnJheXzdHJpbmdbXSB7XG4gIGNvbnN0IG91dF
WVzLCBzaGFwZTogbnVtYmVyW119Piwgb3V0U2hhcGU6IG51bWJlcltdLFxuICAgIGR0eXBlOiBEYXRhVHl
wZSwgc2ltcGx5Q29uY2F0OiBib29sZWFuKTogVHlwZWRBcnJheSB7XG4gIGNvbnN0IG91dF

ZhbHMgPSB1dGlsLmdldEFycmF5RnJvbURUeXBlKGR0eXBlLCB1dGlsLnNpemVGcm9tU2hhcGUob3V0U2hhcGUpKTtcblxuICBpZiAoc2ltcGx5Q29uY2F0ICYmIGR0eXBlICE9PSAnc3RyaW5nJykge1xuICAgIC8vIFVzZSBidWlsdC1pbiBUeXBlZEFycmF5LnNldCgpIG1ldGhvZCBmb3Igc3BlZWQuXG4gICAgb3V0IG9mZnNldCA9IDA7XG4gICAgaW5wdXRzLmZvckVhY2goaW5wdXQgPT4gb3V0LnNldChpbnB1dCwgb2Zmc2V0KSk7XG4gICAgb2Zmc2V0ICs9IGlucHV0Lmxlbmd0aDtcbiAgfSBlbHNlIHtcbiAgICBmb3IgKGxldCBpID0gMDsgaSA8IGlucHV0cy5sZW5ndGg7IGkrKykge1xuICAgICAgb3V0LnNldChpbnB1dHNbaV0sIGkgKiBpbnB1dHNbMF0ubGVuZ3RoKTtcbiAgICB9XG4gIH1cblxuICByZXR1cm4gb3V0O1xufVxuXG5mdW5jdGlvbiBjb25jYXRWMihhcmdzKSB7XG4gIGNvbnN0IHtpbnB1dHMsIGF4aXMsIGJhY2tlbmR9ID0gYXJnczsgLy8gVGhlIGNvbmNhdCBvcCBzdXBwb3J0cyBhIHNjYWxhciBhbmQgYSBub24tc2NhbGFyXG4gIC8vIHRlbnNvciBpbnB1dCBhbmQgY29uY2F0ZW5hdGVzIGFsbCBpbnB1dHMgYWxvbmcgdGhlXG4gIC8vIHNwZWNpZmllZCBheGlzLlxuICBpZiAoYXhpcyAhPT0gMSAmJiBheGlzICE9PSAtMSAmJlxuICAgICAgaW5wdXRzLmV2ZXJ5KGlucHV0ID0+IGlucHV0LnNoYXBlLmxlbmd0aCA9PT0gMikpIHtcbiAgICAvLyBUT0RPKGNhcnRlcmtvKTogUmVtb3ZlIHRoaXMgaGFjayBvbmNlIHRoZSBmaXhlZC1pbmRleFxuICAgIC8vIGVkaXRpbmcgY2FwYWJpbGl0eSBvZiB0aGUgYmFja2VuZCBpcyBnb25lLlxuICAgIHJldHVybiBjb25jYXRWMihbXG4gICAgICBhcmdzLmlucHV0cy5tYXAoXG4gICAgICAgICAgKHQsIGkpID0+ICh7aW5wdXRzOiB7eDogdH0sIGJhY2tlbmQsIGF0dHJzOiB7YXhpczogMX19KSksXG4gICAgICBhcmdzLmF0dHJzXG4gICAgXSwgYmFja2VuZCk7XG4gIH1cblxuICBjb25zdCBvdXRTaGFwZSA9IGNvbmNhdF91dGlsLmNvbXB1dGVPdXRTaGFwZShcbiAgICAgIGlucHV0cy5tYXAoaW5wdXQgPT4gaW5wdXQuc2hhcGUpLCBheGlzKTtcbiAgY29uc3Qgb3V0ID0gYmFja2VuZC5tYWtlT3V0cHV0KG91dFNoYXBlLCBpbnB1dHNbMF0uZHR5cGUpO1xuXG4gIGlmIChvdXRTaGFwZS5zb21lKHMgPT4gcyA9PT0gMCkpIHtcbiAgICByZXR1cm4gb3V0O1xuICB9XG5cbiAgLy8gVE9ETyhjYXJ0ZXJrbyk6IFJlbW92ZSB0aGlzIGhhY2sgb25jZSB0aGUgZml4ZWQtaW5kZXhcbiAgLy8gZWRpdGluZyBjYXBhYmlsaXR5IG9mIHRoZSBiYWNrZW5kIGlzIGdvbmUuXG4gIGlmIChpbnB1dHMuZXZlcnkoaW5wdXQgPT4gaW5wdXQuc2hhcGUubGVuZ3RoID09PSAyKSkge1xuICAgIGNvbnN0IHBpZWNlcyA9IFtdO1xuICAgIGZvciAobGV0IGkgPSAwOyBpIDwgaW5wdXRzWzBdLnNoYXBlWzBdOyBpKyspIHtcbiAgICAgIGZvciAobGV0IGogPSAwOyBqIDwgaW5wdXRzLmxlbmd0aDsgaisrKSB7XG4gICAgICAgIGNvbnN0IHNpemUgPSBpbnB1dHNbal0uc2hhcGVbMV07XG4gICAgICAgIGNvbnN0IHNsaWNlID0gaW5wdXRzW2pdLmRhdGEuc3ViYXJyYXkoaSAqIHNpemUsIGkgKiBzaXplICsgc2l6ZSk7XG4gICAgICAgIHBpZWNlcy5wdXNoKHNsaWNlKTtcbiAgICAgIH1cbiAgICB9XG4gICAgY29uc3QgY29uY2F0ZW5hdGVkID0gcGllY2VzLmNvbmNhdCgpO1xuICAgIHJldHVybiBiYWNrZW5kLm1ha2VPdXRwdXQob3V0U2hhcGUsIGlucHV0c1swXS5kdHlwZSwgY29uY2F0ZW5hdGVkKTtcbiAgfVxuXG4gIGNvbnN0IG91dFZhbHMgPSBvdXQudmFscygpO1xuICBjb25zdCBvdXRTdHJpZGVzID0gdXRpbC5jb21wdXRlU3RyaWRlcyhvdXRTaGFwZSk7XG4gIGZvciAobGV0IGogPSAwOyBqIDwgaW5wdXRzLmxlbmd0aDsgaisrKSB7XG4gICAgY29uc3QgaW5wdXQgPSBpbnB1dHNbal07XG4gICAgY29uc3QgaW5wdXRTaGFwZSA9IGlucHV0LnNoYXBlO1xuICAgIGNvbnN0IGlucHV0U3RyaWRlcyA9IHV0aWwuY29tcHV0ZVN0cmlkZXMoaW5wdXRTaGFwZSk7XG4gICAgbGV0IG91dE9mZnNldCA9IGF4aXMgPT09IDAgPyAwIDogb3V0U3RyaWRlc1theGlzIC0gMV07XG4gICAgbGV0IGluT2Zmc2V0ID0gMDtcbiAgICBmb3IgKGxldCBpID0gMDsgaSA8IGlucHV0U2hhcGVbYXhpc107IGkrKykge1xuICAgICAgLy8gVXNlIGJ1aWx0LWluIFR5cGVkQXJyYXkuc2V0KCkgbWV0aG9kIGZvciBzcGVlZC5cbiAgICAgIG91dFZhbHMuc2V0KFxuICAgICAgICAgIGlucHV0LmRhdGEuc3ViYXJyYXkoaW5PZmZzZXQsIGluT2Zmc2V0ICsgaW5wdXRTdHJpZGVzW2F4aXNdKSxcbiAgICAgICAgICBvdXRPZmZzZXQpO1xuICAgICAgb3V0T2Zmc2V0ICs9IG91dFN0cmlkZXNbYXhpc107XG4gICAgICBpbk9mZnNldCArPSBpbnB1dFN0cmlkZXNbYXhpc107XG4gICAgfVxuICB9XG5cbiAgcmV0dXJuIG91dDtcbn1cblxuZXhwb3J0IHtjb25jYXRWMiBhcyBjb25jYXRWMkNvbmZpZ30gPSB7XG4gIGtlcm5lbE5hbWU6IGNvbmNhdFYyLFxuICBiYWNrZW5kTmFtZTogJ3dhc20nLFxuICBzZXR1cEZ1bmM6IHNldHVwQ29uY2F0VjIsXG4gIGt2aW5nRnVuYzoga2VybmVsRnVuY1xufTtcbiAgICAgIGlucHV0LmRhdGEuc3ViYXJyYXkoaW5PZmZzZXQsIGluT2Zmc2V0ICsgaW5wdXRTdHJpZGVzW2F4aXNdKSxcbiAgICAgICAgICBvdXRPZmZzZXQpO
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 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 *
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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   '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,\n   filterHeight, filterWidth, inHeight, inWidth,\n   inChannels, outHeight, outWidth, outChannels, strideHeight,\n   strideWidth,\n   topPad, leftPad, fltS0, fltS1, fltS2, xBatchStride, xRowStride,\n   xColStride, xChannelStride,\n   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 * @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 {Cos, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\n\nexport const cosConfig: KernelConfig = createUnaryKernelConfig(Cos);\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 {Cosh, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\n\nexport const coshConfig: KernelConfig = createUnaryKernelConfig(Cosh);\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 {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","/**\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, 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\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\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 * @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\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","/**\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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:\n 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 Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 * 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 {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 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 {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 copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 * @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} 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 * @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 {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,
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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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF 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","/**\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 {FloorDiv, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from './binary_kernel';\n\nconst supportsFullBroadcast = false;\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 use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 * @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, 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

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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\nexport 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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY 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}\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\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 ==\n 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 *\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 {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 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 * @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 {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 {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    },\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 * @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 {Greater, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from './binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const greaterConfig: KernelConfig =\n createBinaryKernelConfig(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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on 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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governing permissions and\n * limitations under the License.\n *
==========\n
*/\nimport {GreaterEqual, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig}
from './binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const greaterEqualConfig: KernelConfig =\n
createBinaryKernelConfig(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 *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY 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';\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\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 *
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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
*/\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
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY 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';\nconst supportsFullBroadcast = false;\nexport const lessEqualConfig: KernelConfig =\n
createBinaryKernelConfig(LessEqual, supportsFullBroadcast, 'bool');\n","/**\n * @license\n * Copyright 2019
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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, 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 *
==========\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 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {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\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\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, 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 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 * ==========\n */\nimport {KernelConfig, Maximum} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const maximumConfig: KernelConfig =\n createBinaryKernelConfig(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 governing permissions and\n * limitations under the License.\n * ==========\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 '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 //\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 * @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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= 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,
  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 * @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';\nconst supportsFullBroadcast = false;\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\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\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*/\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 copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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';\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*/\n\nimport {BackendWasm} from '../backend_wasm';\n\n// Analogous to `struct Result` in `non_max_suppression_impl.h`.\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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\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:
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
 */\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\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 {} 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, 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 {} 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, 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 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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, 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 * @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, 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 * @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';\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

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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   '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 * @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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*/\nimport {KernelConfig, Pow} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = false;\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 * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS 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 {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 = 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 License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS 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, Prod, ProdAttrs, ProdInputs, 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 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\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   '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\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

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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 {KernelConfig, KernelFunc, Range, RangeAttrs, TensorInfo} from '@tensorflow/tfjs-core';\n\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\n const out = backend.makeOutput([values.length], dtype);\n const outVals = backend.typedArrayFromHeap(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
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 { util } from '@tensorflow/tfjs-core';\nexport function rangeImpl(start, stop, step, dtype) {\n const sameStartStop = start === stop;\n const increasingRangeNegativeStep = start < stop && step < 0;\n const decreasingRangePositiveStep = stop < start && step > 1;\n if (sameStartStop
|| increasingRangeNegativeStep ||\n decreasingRangePositiveStep) {\n return util.makeZerosTypedArray(0, dtype);\n }\n const numElements = Math.abs(Math.ceil((stop - start) / step));\n const values = util.makeZerosTypedArray(numElements, dtype);\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 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//#
sourceMappingURL=data:application/json; base64,eyJ2ZXJzaW9uIjozLCJmaWxlIjoiUmFuZ2VfaW1wbC5qcyIsInNvdXJjZVJvb3QiOiIiLCJzb3VyY2VzIjpbIi4uLy4uLy4uLy4uLy4uLy4uL3RmanMtYmFja2VuZC1jcHUvc3JjL3tlcm5lbHMvUmFuZ2VfaW1wbC50cyJdLCJuYW1lcyI6W10sIm1hcHBpbmdzIjoiQUFBQTs7Ozs7Ozs7Ozs7O0dBZUc7QUFFSCxPQUFPLEVBQUMsWUFBWSxFQUFFLFVBQVUsRUFBRSxLQUFLLEVBQUUsVUFBVSxFQUFFLFVBQVUsRUFBQyxNQUFNLHVCQUF1QixDQUFDO0FBRTlGLE9BQU8sRUFBQyxhQUFhLEVBQUMsTUFBTSxnQkFBZ0IsQ0FBQztBQUM3QyxPQUFPLEVBQUMsWUFBWSxFQUFDLE1BQU0sNkJBQTZCLENBQUM7QUFFekQsTUFBTSxDQUFDLE1BQU0sS0FBSztJQUNkLENBQUMsSUFBMkMsRUFBYyxFQUFFO1FBQzFELE1BQU0sRUFBQyxPQUFPLEVBQUUsS0FBSyxFQUFDLEdBQUcsSUFBSSxDQUFDO1FBQzlCLE1BQU0sRUFBQyxLQUFLLEVBQUUsSUFBSSxFQUFFLElBQUksRUFBRSxLQUFLLEVBQUMsR0FBRyxLQUFLLENBQUM7UUFDekMsTUFBTSxNQUFNLEdBQUcsWUFBWSxDQUFDLEtBQUssRUFBRSxJQUFJLEVBQUUsSUFBSSxFQUFFLEtBQUssQ0FBQyxDQUFDO1FBRXRELE1BQU0sR0FBRyxHQUFHLE9BQU8sQ0FBQyxVQUFVLENBQUMsQ0FBQyxNQUFNLENBQUMsTUFBTSxDQUFDLEVBQUUsS0FBSyxDQUFDLENBQUM7UUFDdkQsTUFBTSxPQUFPLEdBQUcsT0FBTyxDQUFDLHFCQUFxQixDQUFDLEdBQUcsQ0FBQyxDQUFDO1FBQ25EO1lBQ0UsT0FBTyxDQUFDLEdBQUcsQ0FBQyxNQUFNLENBQUMsQ0FBQztZQUNwQixPQUFPLEdBQUcsQ0FBQztTQUNaO0lBQ0gsQ0FBQztDQUNGLENBQUM7QUFFRixNQUFNLENBQUMsTUFBTSxXQUFXLEdBQWlCO0lBQ3ZDLFVBQVUsRUFBRSxLQUFLO0lBQ2pCLFdBQVcsRUFBRSxNQUFNO0lBQ25CLFVBQVUsRUFBRSxLQUFrQjtDQUMvQixDQUFDIiwic291cmNlc0NvbnRlbnQiOlsiLyoqXG4gKiBAbGljZW5zZVxuICogQ29weXJpZ2h0IDIwMjAgR29vZ2xlIExMQy4gQWxsIFJpZ2h0cyBSZXNlcnZlZC5cbiAqIExpY2Vuc2VkIHVuZGVyIHRoZSBBcGFjaGUgTGljZW5zZSwgVmVyc2lvbiAyLjAgKHRoZSBcIkxpY2Vuc2VcIik7XG4gKiB5b3UgbWF5IG5vdCB1c2UgdGhpcyBmaWxlIGV4Y2VwdCBpbiBjb21wbGlhbmNlIHdpdGggdGhlIExpY2Vuc2UuXG4gKiBZb3UgbWF5IG9idGFpbiBhIGNvcHkgb2YgdGhlIExpY2Vuc2UgYXRcbiAqXG4gKiBodHRwOi8vd3d3LmFwYWNoZS5vcmcvbGljZW5zZXMvTElDRU5TRS0yLjBcbiAqXG4gKiBVbmxlc3MgcmVxdWlyZWQgYnkgYXBwbGljYWJsZSBsYXcgb3IgYWdyZWVkIHRvIGluIHdyaXRpbmcsIHNvZnR3YXJlXG4gKiBkaXN0cmlidXRlZCB1bmRlciB0aGUgTGljZW5zZSBpcyBkaXN0cmlidXRlZCBvbiBhbiBcIkFTIElTXCIgQkFTSVMsXG4gKiBXSVRIT1VUIFdBUlJBTlRJRVMgT1IgQ09ORElUSU9OUyBPRiBBTlkgS0lORCwgZWl0aGVyIGV4cHJlc3Mgb3IgaW1wbGllZC5cbiAqIFNlZSB0aGUgTGljZW5zZSBmb3IgdGhlIHNwZWNpZmljIGxhbmd1YWdlIGdvdmVybmluZyBwZXJtaXNzaW9ucyBhbmRcbiAqIGxpbWl0YXRpb25zIHVuZGVyIHRoZSBMaWNlbnNlLlxuICogPT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PVxuICovXG5cbmltcG9ydCB7S2VybmVsQ29uZmlnLCBLZXJuZWxGdW5jLCBSYW5nZSwgUmFuZ2VBdHRycywgVGVuc29ySW5mb30gZnJvbSAnQHRlbnNvcmZsb3cvdGZqcy1jb3JlJztcblxuaW1wb3J0IHtCYWNrZW5kV2FzbX0gZnJvbSAnLi4vYmFja2VuZF93YXNtJztcbmltcG9ydCB7cmFuZ2VJbXBsQ1BVfSBmcm9tICcuLi9rZXJuZWxfdXRpbHMvc2hhcmVkJztcblxuZXhwb3J0IGNvbnN0IHJhbmdlID1cbiAgICAoYXJnczoge2JhY2tlbmQ6IEJhY2tlbmRXYXNtLCBhdHRyczogUmFuZ2VBdHRyc30pOiBUZW5zb3JJbmZvID0+IHtcbiAgICAgIGNvbnN0IHtiYWNrZW5kLCBhdHRyc30gPSBhcmdzO1xuICAgICAgY29uc3Qge3N0YXJ0LCBzdG9wLCBzdGVwLCBkdHlwZX0gPSBhdHRyczsgICAgICBjb25zdCB2YWx1ZXMgPSByYW5nZUltcGxDUFUoc3RhcnQsIHN0b3AsIHN0ZXAsIGR0eXBlKTtcblxuICAgICAgY29uc3Qgb3V0ID0gYmFja2VuZC5tYWtlT3V0cHV0KFt2YWx1ZXMubGVuZ3RoXSwgZHR5cGUpO1xuICAgICAgY29uc3Qgb3V0VmFscyA9IGJhY2tlbmQudHlwZWRBcnJheUZyb21IZWFwKG91dCk7XG4gICAgICBvdXRWYWxzLnNldCh2YWx1ZXMpO1xuICAgICAgcmV0dXJuIG91dDtcbiAgICB9O1xuXG5leHBvcnQgY29uc3QgcmFuZ2VDb25maWc6IEtlcm5lbENvbmZpZyA9IHtcbiAga2VybmVsTmFtZTogUmFuZ2UsXG4gIGJhY2tlbmROYW1lOiAnd2FzbScsXG4gIGtlcm5lbEZ1bmM6IHJhbmdlIGFzIHt9IGFzIEtlcm5lbEZ1bmNcbn07XG4iLCIvKipcbiAqIEBsaWNlbnNlXG4gKiBDb3B5cmlnaHQgMjAyMCBHb29nbGUgTExDLiBBbGwgUmlnaHRzIFJlc2VydmVkLlxuICogTGljZW5zZWQgdW5kZXIgdGhlIEFwYWNoZSBMaWNlbnNlLCBWZXJzaW9uIDIuMCAodGhlIFwiTGljZW5zZVwiKTtcbiAqIHlvdSBtYXkgbm90IHVzZSB0aGlzIGZpbGUgZXhjZXB0IGluIGNvbXBsaWFuY2Ugd2l0aCB0aGUgTGljZW5zZS5cbiAqIFlvdSBtYXkgb2J0YWluIGEgY29weSBvZiB0aGUgTGljZW5zZSBhdFxuICpcbiAqIGh0dHA6Ly93d3cuYXBhY2hlLm9yZy9saWNlbnNlcy9MSUNFTlNFLTIuMFxuICpcbiAqIFVubGVzcyByZXF1aXJlZCBieSBhcHBsaWNhYmxlIGxhdyBvciBhZ3JlZWQgdG8gaW4gd3JpdGluZywgc29mdHdhcmVcbiAqIGRpc3RyaWJ1dGVkIHVuZGVyIHRoZSBMaWNlbnNlIGlzIGRpc3RyaWJ1dGVkIG9uIGFuIFwiQVMgSVNcIiBCQVNJUyxcbiAqIFdJVEhPVVQgV0FSUkFOVElFUyBPUiBDT05ESVRJT05TIE9GIEFOWSBLSU5ELCBlaXRoZXIgZXhwcmVzcyBvciBpbXBsaWVkLlxuICogU2VlIHRoZSBMaWNlbnNlIGZvciB0aGUgc3BlY2lmaWMgbGFuZ3VhZ2UgZ292ZXJuaW5nIHBlcm1pc3Npb25zIGFuZFxuICogbGltaXRhdGlvbnMgdW5kZXIgdGhlIExpY2Vuc2UuXG4gKiA9PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PVxuICovXG5cbmltcG9ydCB7IHV0aWwgfSBmcm9tICdAdGVuc29yZmxvdy90ZmpzLWNvcmUnO1xuZXhwb3J0IGZ1bmN0aW9uIHJhbmdlSW1wbChzdGFydCwgc3RvcCwgc3RlcCwgZHR5cGUpIHtcbiAgY29uc3Qgc2FtZVN0YXJ0U3RvcCA9IHN0YXJ0ID09PSBzdG9wO1xuICBjb25zdCBpbmNyZWFzaW5nUmFuZ2VOZWdhdGl2ZVN0ZXAgPSBzdGFydCA8IHN0b3AgJiYgc3RlcCA8IDA7XG4gIGNvbnN0IGRlY3JlYXNpbmdSYW5nZVBvc2l0aXZlU3RlcCA9IHN0b3AgPCBzdGFydCAmJiBzdGVwID4gMTtcbiAgaWYgKHNhbWVTdGFydFN0b3BcbiAgfHwgaW5jcmVhc2luZ1JhbmdlTmVnYXRpdmVTdGVwIHx8XG4gICAgICBkZWNyZWFzaW5nUmFuZ2VQb3NpdGl2ZVN0ZXApIHtcbiAgICByZXR1cm4gdXRpbC5tYWtlWmVyb3NUeXBlZEFycmF5KDAsIGR0eXBlKTtcbiAgfVxuICBjb25zdCBudW1FbGVtZW50cyA9IE1hdGguYWJzKE1hdGguY2VpbCgoc3RvcCAtIHN0YXJ0KSAvIHN0ZXApKTtcbiAgY29uc3QgdmFsdWVzID0gdXRpbC5tYWtlWmVyb3NUeXBlZEFycmF5KG51bUVsZW1lbnRzLCBkdHlwZSk7XG4gIGlmIChzdG9wIDwgc3RhcnQgJiYgc3RlcCA9PT0gMSkge1xuICAgIC8vIEF1dG8gYWRqdXN0IHRoZSBzdGVwJ3Mgc2lnbiBpZiBpdCBoYXNuJ3QgYmVlbiBzZXRcbiAgICAvLyAob3Igd2FzIHNldCB0byAxKVxuICAgIHN0ZXAgPSAtMTtcbiAgfVxuICB2YWx1ZXNbMF0gPSBzdGFydDtcbiAgZm9yIChsZXQgaSA9IDE7IGkgPCB2YWx1ZXMubGVuZ3RoOyBpKyspIHtcbiAgICB2YWx1ZXNbaV0gPSB2YWx1ZXNbaSAtIDFdICsgc3RlcDtcbiAgfVxuICByZXR1cm4gdmFsdWVzO1xufVxuLy8jXG5zb3VyY2VNYXBwaW5nVVJMPWRhdGE6YXBwbGljYXRpb24vanNvbjtiYXNlNjQsZXlKMlpYSnphVzl1SWpvekxDSm1hV3hsSWpvaVVtRnVaMlZmYVcxd0M1cWN5SXNJbk52ZFhKalpWSnZiM1FpT2lJc0lpd2liM1Z5WTJWeklqcGJJaTR1THk0dUx5NHVMeTR1THk0dUwzSnRhbXBNdFltWmphMlZ1WkMxcVlIVnZjM0pqTDNSc2IyTnJMMjF5YldsdVpXMXpMMUpoYlhCc1pTOVNZVzF3YkdVdlVtRnVaMlZmYVcxd0xuUjNjeUlzSW5OdmRYSmpaWE1pT2xzaWRtRnNkV1Z6SWwwNlhTd2libUZ0WlhNaU9sdGRMQ0p0WVcxbGN5STZXMTBzSW0xaGNIQnBibWR6SWpvaVFVRkJRVHM3T3pzN096czdPenM3TzBGQlFVRTdPMEZCUTBFN1FVRkJRU3hKUVVGQlFTeFBRVUZQTEVWQlFVTXNTVUZCUVN4RlFVRkZMRVZCUVVVc1JVRkJSU3hKUVVGSkxFVkJRVVVzUlVGQlJTeFBRVUZQTEVWQlFVVXNSVUZCUlN4SlFVRkpMRVZCUVVVc1JVRkJSU3hQUVVGUExFVkJRVVVzUlVGQlJTeEpRVUZKTEVWQlFVVXNSVUZCUlN4UFFVRlB

2UsIFZlcnNpb24gMi4wICh0aGUgXCJMaWNlbnNlXCIpO1xuICogeW91IG1heSBub3QgdXNlIHRoaXMgZmlsZSBleGNlcHQgaW4gY29tcGxpYW5jZSB3aXRoIHRoZSBMaWNlbnNlLlxuICogWW91IG1heSBvYnRhaW4gYSBjb3B5IG9mIHRoZSBMaWNlbnNlIGF0XG4gKlxuICogaHR0cDovL3d3dy5hcGFjaGUub3JnL2xpY2Vuc2VzL0xJQ0VOU0UtMi4wXG4gKlxuICogVW5sZXNzIHJlcXVpcmVkIGJ5IGFwcGxpY2FibGUgbGF3IG9yIGFncmVlZCB0byBpbiB3cml0aW5nLCBzb2Z0d2FyZSBkaXN0cmlidXRlZCB1bmRlciB0aGUgTGljZW5zZSBpcyBkaXN0cmlidXRlZCBvbiBhbiBcIkFTIElTXCIgQkFTSVMsXG4gKiBXSVRIT1VUIFdBUlJBTlRJRVMgT1IgQ09ORElUSU9OUyBPRiBBTlkgS0lORCwgZWl0aGVyIGV4cHJlc3Mgb3IgaW1wbGllZC5cbiAqIFNlZSB0aGUgTGljZW5zZSBmb3IgdGhlIHNwZWNpZmljIGxhbmd1YWdlIGdvdmVybmluZyBwZXJtaXNzaW9uc1xuICogYW5kIGxpbWl0YXRpb25zIHVuZGVyIHRoZSBMaWNlbnNlLlxuICogPT09PT09PT09P

agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF 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';\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\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\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\nexport const resizeBilinearConfig: KernelConfig = {\n kernelName: ResizeBilinear,\n 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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 '@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 *\n ==\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 './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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF 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';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS 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, scatter_util, ScatterNd, ScatterNdAttrs, ScatterNdInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {CppDType} 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\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\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS 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, 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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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\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 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';\n\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 \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n
 * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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, 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\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 * @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 {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';\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\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 < 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
  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';\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,\n 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';\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 License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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';\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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} from './binary_kernel';\nconst supportsFullBroadcast = true;\nexport const squaredDifferenceConfig: KernelConfig =\n createBinaryKernelConfig(SquaredDifference, 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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on

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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 {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\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 Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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, slice_util, StridedSlice, StridedSliceAttrs, StridedSliceInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\n\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\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    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($end).buffer);\n    const
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stridesBytes = new Uint8Array(new Int32Array($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 =\nbackend.dataIdMap.get(out.dataId).id;\n\n wasmStridedSlice(\n xId, xStridesBytes, x.shape.length,\nbeginBytes, 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 * @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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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, Sub} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = true;\nexport const subConfig: KernelConfig =\n createBinaryKernelConfig(Sub, 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 * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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, 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\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 =\nbackend.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,\n 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 * @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 governing permissions and\n * limitations under the License.\n *
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*/\nimport {KernelConfig, Tan} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const tanConfig: KernelConfig = createUnaryKernelConfig(Tan);\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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*/\nimport {KernelConfig, Tanh} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const tanhConfig: KernelConfig = createUnaryKernelConfig(Tanh);\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
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/\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\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.
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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

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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, 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: 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    '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
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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 * @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, 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//\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 './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 * @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\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;\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\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/IHkBZlHETpA/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","\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 (\nfunction(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&&!ENVIRONMENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var ENVIRONMENT_IS_PTHREAD=Module[\"ENVIRONMENT_IS_PTHREAD\"]||false;if(ENVIRONMENT_IS_PTHREAD){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=nodePath[\"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[\"argv\"].slice(2);process[\"on\"](\"uncaughtException\",function(ex){if(!(ex instanceof ExitStatus)){throw ex}});process[\"on\"](\"unhandledRejection\",abort);quit_=function(status){process[\"exit\"](status)};Module[\"inspect\"]=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[idx++]&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){wasmMemory=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;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){addOnPreRun(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\"].length){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\"](runDependencies)}}function removeRunDependency(id){runDependencies--;if(Module[\"monitorRunDependencies\"]){Module[\"monitorRunDependencies\"](runDependencies)}if(runDependencies==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.error(\"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\"][\"I\"];wasmModule=module;if(!ENVIRONMENT_IS_PTHREAD){var numWorkersToLoad=PThread.unusedWorkers.length;PThread.unusedWorkers.forEach(function(w){PThread.loadWasmModuleToWorker(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(wasmBinaryFile)&&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(){__emscripten_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,EBADF: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,ECHRNG:106,EL2NSYNC:156,EL3HLT:107,EL3RST:108,ELNRNG:109,EUNATCH:110,ENOCSI:111,EL2HLT:112,EDEADLK:16,ENOLCK:46,EBADE: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,ENOTSOCK: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,EOVERFLOW:61,ECANCELED:11,ENOTRECOVERABLE:56,EOWNERDEAD:62,ESTRPIPE:135};function _emscripten_futex_wake(addr,count){if(addr<=0||addr>GROWABLE_HEAP_I8().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.pthreads[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.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);__emscripten_thread_init(tb,!ENVIRONMENT_IS_WORKER,1);_emscripten_register_main_browser_thread_id(tb)},initWorker:function(){},pthreads:{},threadExitHandlers:[],setThreadStatus:function(){},runExitHandlers:function(){while(PThread.threadExitHandlers.length>0){PThread.threadExitHandlers.pop()()}if(ENVIRONMENT_IS_PTHREAD&&_pthread_self())___pthread_tsd_run_dtors()},runExitHandlersAndDeinitThread:function(tb,exitCode){Atomics.store(GROWABLE_HEAP_U32(),tb+56>>2,1);Atomics.store(GROWABLE_HEAP_U32(),tb+60>>2,0);PThread.runExitHandlers();Atomics.store(GROWABLE_HEAP_U32(),tb+4>>2,exitCode);Atomics.store(GROWABLE_HEAP_U32(),tb+0>>2,1);_emscripten_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_PTHREAD){postMessage({\"cmd\":\"exit\"})}}},threadCancel:function(){PThread.runExitHandlersAndDeinitThread(_pthread_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)}}PThread.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=[]},freeThreadData:function(pthread){if(!pthread)return;if(pthread.threadInfoStruct){var 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.pthreads[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.pthreads[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 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.pthreads[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 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);return 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_callArgs.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]}var
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

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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
target&&target.nodeName?target.nodeName:\"\"},fullscreenEnabled:function(){return
document.fullscreenEnabled||document.webkitFullscreenEnabled}};function stringToNewUTF8(jsString){var
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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()[varargs+8>>2]=height;__emscripten_call_on_thread(0,targetThread,657457152,0,targetCanvasPtr,varargs);stackRestore(stackTop)}function _emscripten_set_offscreencanvas_size_on_target_thread(targetThread,targetCanvas,width,height){targetCanvas=targetCanvas?UTF8ToString(targetCanvas):\"\";_emscripten_set_offscreencanvas_size_on_target_thread_js(targetThread,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_HEAP_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&&prevViewport[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_on_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)return _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){ext[\"vertexAttribDivisorANGLE\"](index,divisor)};ctx[\"drawArraysInstanced\"]=function(mode,first,count,primcount){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[\"drawBuffersWEBGL\"](n,bufs)};return 1}}function __webgl_enable_WEBGL_multi_draw(ctx){return!!(ctx.multiDrawWebgl=ctx.getExtension(\"WEBGL_multi_draw\"))}var GL={counter:1,buffers:[],programs:[],framebuffers:[],renderbuffers:[],textures:[],uniforms:[],shaders:[],vaos:[],contexts:{},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.enableExtensionsByDefault){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(contextHandle){return GL.contexts[contextHandle]},deleteContext:function(contextHandle){if(GL.currentContext===GL.contexts[contextHandle])GL.currentContext=null;if(typeof JSEvents===\"object\")JSEvents.removeAllHandlersOnTarget(GL.contexts[contextHandle].GLctx.canvas);if(GL.contexts[contextHandle]&&GL.contexts[contextHandle].GLctx.canvas)GL.contexts[contextHandle].GLctx.canvas.GLctxObject=undefined;_free(GL.contexts[contextHandle].handle);GL.contexts[contextHandle]=null},initExtensions:function(context){if(!context)context=GL.currentContext;if(context.initExtensionsDone)return;context.initExtensionsDone=true;var GLctx=context.GLctx;__webgl_enable_ANGLE_instanced_arrays(GLctx);__webgl_enable_OES_vertex_array_object(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.indexOf(\"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)],\"premultipliedAlpha\":!!GROWABLE_HEAP_I32()[a+(16>>2)],\"preserveDrawingBuffer\":!!GROWABLE_HEAP_I32()[a+(20>>2)],\"powerPreference\":__emscripten_webgl_power_preferences[powerPreference],\"failIfMajorPerformanceCaveat\":!!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()[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)})}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\":thre

adParams.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 __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()[status>>2]=threadExitCode;Atomics.store(GROWABLE_HEAP_U32(),thread+64>>2,1);if(!ENVIRONMENT_IS_PTHREAD)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_thread_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
_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
)};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
_DepthwiseConv2dNative=Module[\"_DepthwiseConv2dNative\"]=function(){return(_DepthwiseConv2dNative=M
odule[\"_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,ar
guments)};var
_Exp=Module[\"_Exp\"]=function(){return(_Exp=Module[\"_Exp\"]=Module[\"asm\"][\"ba\"]).apply(null,argument
s)};var
_FlipLeftRight=Module[\"_FlipLeftRight\"]=function(){return(_FlipLeftRight=Module[\"_FlipLeftRight\"]=Modul
e[\"asm\"][\"ca\"]).apply(null,arguments)};var
_Floor=Module[\"_Floor\"]=function(){return(_Floor=Module[\"_Floor\"]=Module[\"asm\"][\"da\"]).apply(null,arg
uments)};var
_FloorDiv=Module[\"_FloorDiv\"]=function(){return(_FloorDiv=Module[\"_FloorDiv\"]=Module[\"asm\"][\"ea\"]).
apply(null,arguments)};var
_FusedBatchNorm=Module[\"_FusedBatchNorm\"]=function(){return(_FusedBatchNorm=Module[\"_FusedBatchN
orm\"]=Module[\"asm\"][\"fa\"]).apply(null,arguments)};var
_FusedConv2D=Module[\"_FusedConv2D\"]=function(){return(_FusedConv2D=Module[\"_FusedConv2D\"]=Mod
ule[\"asm\"][\"ga\"]).apply(null,arguments)};var
_FusedDepthwiseConv2D=Module[\"_FusedDepthwiseConv2D\"]=function(){return(_FusedDepthwiseConv2D=M
odule[\"_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
_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

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_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
_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
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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

en_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\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&&!ENVIRONMENT_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=nodePath[\"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[\"argv\"].slice(2);process[\"on\"](\"uncaughtException\",function(ex){if(!(ex instanceof ExitStatus)){throw ex}});process[\"on\"](\"unhandledRejection\",abort);quit_=function(status){process[\"exit\"](status)};Module[\"inspect\"]=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){scriptDirectory=self.location.href}else if(typeof document!==\"undefined\"&&document.currentScript){scriptDirectory=document.currentScript.src}if(_scriptDir){scriptDirectory=_scriptDir}if(scriptDirectory.indexOf(\"blob:\")!==0){scriptDirectory=scriptDirectory.substr(0,scriptDirectory.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]}}moduleOverrides=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[idx++]&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){addOnPreRun(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\"].length){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[\"monitorRunDependencies\"](runDependencies)}}function removeRunDependency(id){runDependencies--;if(Module[\"monitorRunDependencies\"]){Module[\"monitorRunDependencies\"](runDependencies)}if(runDependencies==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;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.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\"];updateGlobalBufferAndViews(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(wasmBinaryFile)&&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,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\":_fd_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=Module[\"_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\"]=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
_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
_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
_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
___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(){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})();\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 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 ${dtype}`);\n    }\n  }\n}\n\nfunction createInstantiateWasmFunc(path: string) {\n  // this will be replace by rollup plugin patchWechatWebAssembly in\n  // minprogram's output.\n  // tslint:disable-next-line:no-any\n
  return (imports: any, callback: any) => {\n    util.fetch(path, {credentials: 'same-origin'}).then((response) => {\n      if (!response['ok']) {\n        imports.env.a(`failed to load wasm binary file at '${path}'`);\n      }\n      response.arrayBuffer().then(binary => {\n        WebAssembly.instantiate(binary, imports).then(output => {\n          callback(output.instance, output.module);\n        });\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 * 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 [`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\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;\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,
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\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 intialized.\n */\nexport function getThreadsCount(): number {\n if (actualThreadsCount === -1) {\n throw new Error(`WASM
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);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)}}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 * @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 './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';\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":["CppDType","FusableActivation","wasmFusedMatMul","fusedMatMulConfig"
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eluAlpha","aId","dataIdMap","get","dataId","id","bId","biasId","biasData","shape","length","preluActivationWeight
sId","fusedActivation","leftDim","rightDim","batchDim","out","makeOutput","outId","aShapeBytes","Uint8Array",
"Int32Array","buffer","bShapeBytes","createUnaryKernelConfig","outType","wasmFunc","x","xId","util","sizeFro
mShape","absConfig","Abs","createBinaryKernelConfig","supportsFullBroadcast","outputType","newShape","back
end_util","assertAndGetBroadcastShape","aBroadcastDims","getBroadcastDims","bBroadcastDims","loopsOverAll
OfA","every","v","i","loopsOverAllOfB","addConfig","Add","addNConfig","AddN","inputIds","map","inputIdsByt
es","identity","inVals","typedArrayFromHeap","set","identityConfig","Identity","wasmTranspose","transpose","red
ucedShape","perm","newPerm","push","minValIdx","j","removeOneSizeDims","permIsNoOp","outShape","inShap
e","Array","computeOutShape","cloned","permBytes","xShapeBytes","transposeConfig","Transpose","permuteAxe

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,CAChB,MAAMe,EAAWxB,EAAQkB,UAAUC,IAAIV,EAAEW,QAC5C,GAA8B,IAA1BI,EAASC,MAAMC,O
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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"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/GatherV2.js.map
No license file was found, but licenses were detected in source scan.

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Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Maximum.js.map
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* ===\n*/\nimport {KernelConfig, Rsqrt} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const rsqrtConfig: KernelConfig = createUnaryKernelConfig(Rsqrt);\n"]}

Found in path(s):
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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"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/TopK.js.map
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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/PadV2_test.cc
No license file was found, but licenses were detected in source scan.

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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 //\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"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/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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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"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Mean.js.map
No license file was found, but licenses were detected in source scan.

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it('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\n it('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\n it('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\n it('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\n it('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\n xit('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\n it('backend init succeeds with default path', async () => {\n expect(await
tf.setBackend('wasm-test')).toBe(true);\n });\n\n it('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 sure/);\n });\n});\n"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/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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AAO,GAAG,CAAC;AACb,CAAC;AAED,MAAM,CAAC,MAAM,SAAS,GAAiB;IACrC,iBAAiB,UAAU,EAAE,EAAE,GAAG,CAAC;IACnC,WAAW,EAAE,EAAE,GAAG,CAAC;IACnB,SAAS,EAAE,EAAE,GAAG,CAAC;IACjB,UAAU,EAAE,EAAE,GAAG,CAAC;CACnB,","sourceRoot":"","names":[],"mappings":"AAAA,EAAE,CAAC,CAAC,CAAC

s/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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT
WARRANTIES OR CONDITIONS OF ANY 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 * @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 {_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, 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 ${biasData.shape.length}.`);\n }\n biasId = biasData.id;\n }\n const preluActivationWeightsId = preluActivationWeights == null ?\n 0 :\n backend.dataIdMap.get(preluActivationWeights.dataId).id;\n const fusedActivation =\n FusableActivation[activation as {} as keyof typeof FusableActivation];\n if (fusedActivation == null) {\n throw new Error(\n `${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 * @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 * @license\n * Copyright 2019 Google

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and\n * limitations under the License.\n *
==========\n */\nimport {Abs, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\n\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 \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 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\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 License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless
required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {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 * @license\n * Copyright 2019 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
*/\n\nimport {AddN, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from '../backend_wasm';\n\nimport {CppDType} 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, 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
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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 {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 * @license\n * Copyright 2019 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
*/\n\nimport {KernelConfig, KernelFunc, TensorInfo, Transpose, TransposeAttrs, TransposeInputs} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {identity} from
'./Identity';\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\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
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","/**\n * @license\n * Copyright 2020 Google Inc. 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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==========================================================================\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 =
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. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance 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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==========\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 =\n util.sizeFromShape(reduceShape);\n\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 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 =\n backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n   out.shape = newShape;\n }\n\n return\n out;\n}\n\nexport const anyConfig: KernelConfig = {\n kernelName: Any,\n backendName: 'wasm',\n setupFunc:\n setup,\n kernelFunc: any 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 *\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 {ArgMax, ArgMaxAttrs, ArgMaxInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-\ncore';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {permuteAxesAndTranspose} from\n './kernel_utils';\nimport {CppDType} from './types';\n\nlet wasmFunc: (\n   xId: number, dtype: number, outerSize:\n 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:\n {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 =\n backend.dataIdMap.get(x.dataId).id;\n let\n inputId = xId;\n let input = x;\n\n const {transposed, axes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\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 }\n\n const outShape = input.shape.slice(0, -1);\n const out = backend.makeOutput(outShape, 'int32');\n const\n outId = backend.dataIdMap.get(out.dataId).id;\n const outerSize = util.sizeFromShape(out.shape);\n const\n innerSize = input.shape[axes[0]];\n wasmFunc(inputId, CppDType[input.dtype], outerSize, innerSize, outId);\n\n if\n (inputWasTransposed) {\n   // dispose of the transposed tensor.\n   backend.disposeData(transposed.dataId);\n\n }\n\n return out;\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 * @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\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 {AvgPool, AvgPoolAttrs, AvgPoolInputs, backend_util, KernelConfig, KernelFunc, Tensor4D} from\n '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmAvgPool: (\n   xId:\n number, batchSize: number, inputHeight: number, inputWidth: number,\n   filterHeight: number, filterWidth:\n number, padTop: number, padRight: number,\n   padBottom: number, padLeft: number, strideHeight: number,\n stride Width: 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 * @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, 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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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\nfunction 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, 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 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, 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 Int32Array(b3d.shape).buffer);\n\n wasmBatchMatMul(\n a3dId, aShapeBytes, a3d.shape.length, b3dId, bShapeBytes,\n b3d.shape.length, transposeA, transposeB, outId);\n\n backend.disposeData(a3d.dataId);\n backend.disposeData(b3d.dataId);\n\n out.shape
= outShape;\n return out;\n}\n\nexport const batchMatMulConfig: KernelConfig = {\n kernelName: BatchMatMul,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: batchMatMul 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, util } from '@tensorflow/tfjs-core';\nexport
function concatImpl(inputs, outShape, dtype, simplyConcat) {\n const outVals = util.getArrayFromDType(dtype,
util.sizeFromShape(outShape));\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.set(input.vals, offset);\n offset += size;\n });\n }\n
else {\n let colOffset = 0;\n inputs.forEach(input => {\n const decodedData = dtype === 'string' ?\n
backend_util.fromUint8ToStringArray(input.vals) :\n input.vals;\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
}\n colOffset += input.shape[1];\n });\n }\n return outVals;\n}\n//#
sourceMappingURL=data:application/json; base64,eyJ2ZXJzaW9uIjozLCJmaWxlIjoiQ29uY2F0X2ltcGwuanMiLC
Jzb3VyY2VSb290IjoiIiwic291cmNlcyI6WyIuLi8uLi8uLi8uLi8uLi8uLi90ZmpzLWJhY2tlbmQtY3B1L3NyYy9rZ
XJuZWxzL0NvbmNhdF9pbXBsLnRzIl0sIm5hbWVzIjpbXSwibWFwcGluZ3MiOiJBQUFBOzs7Ozs7Ozs7Ozs
s7R0FlRztBQUVILE9BQU8sRUFBQyxXVDLElBQUksRUFBQyxNQUFNLHVCQUAsIsS0FBZS
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EVBQUUsUSFBSSxDQUFDLGFBQWEsQ0FBQyxRQUFFRLENBQUMsQ0FBQyxxDQUFDO0lBRTVFLElBQUk
sWUFBWSxJQUFJLEtBQUssS0FBSyxRQUFFRLEVBQUU7UUFDdEMsEO1FBQ2xELELElBQUksTUFB
TSxHQUFHLENBQUMsQ0FBQztsRQUNmLE1BQU0sQ0FBQyxPQUFFPLENBQUMsQ0FBQyxDQUFDLEVBQU
U7WUFDckIsTUFBTSxJQUFJLEdBQUcsSUFBSSxSUFBSSxxDQUFDLGFBQWEsQ0FBQyxLQUFLLLENBQWtCLQUNKO1A07UUFDM
xDQUFDLENBQUM7WUFFNUMsT1NBQU07UUFDTCxJQUFJLFNBQVMsR0FBRyxxDQUFDLENBQUM7YUFDbkIsTUFBTSxJQUFJLGFBQWEsQ0FBQyxLQUFLLENBQUMsQ0FBQyxDQUFDLEVBQUUsSTtBQUFBLFNBQVMsR0FBRyxxL
BQUksRUFBRSxxDQUFDLENBQUMsQ0FBQyxDQUFDLENBQUMsQ0FBQyxDQUFDLENBQUMsQ0FBQy

09PT09PT09PT

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FBRyxLQUFLLENBQUMsR0FBRyxJQUFJLENBQUMsQ0FBQyxDQUFDO0lBQy9ELE1BQU0sTUFBTSxHQ
UFHLElBQUksQ0FBQyxtQkFBbUIsQ0FBQyxXQUFXLEVBQUUsS0FBSyxDQUFDLENBQUM7NUQsS
UFBSSxJQUFJLEdBQUcsS0FBSyxJQUFJLElBQUksS0FBSyxDQUFDLEVBQUU7UUFDOUIsb0RBQW9EO
BQ3BELG9CQUFvQixRQUNwQixxJQUFJLEdBQUcsQ0FBQyxDQUFDLENBQUMsQ0FBQyxDQUFDLENBQUM7S0FDWDtLQUV0
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UUFDdEMsQ0FBQyxDQUFDLENBQUMsQ0FBQyxDQUFDLENBQUMsQ0FBQyxDQUFDLENBQUMsQ0FBQyxDQUFDLENBQUMsQ
xDQUFDLEdBQUcsSUFBSSxDQUFDO0tBQ1osQ0FBQyxDQUFDLENBQUMsQ0FBQyxDQUFDLENBQUMsQ0FBQyxDQUFDLENBQUMsQ
sInNvdXJjZXNDb250ZW50IjpbIi8qKlxuICogQGxpY2Vuc2VcbiAqIENvcHlyaWdodCAyMDIwIEdvb2dsZSBMT
EMuIEFsbCBSaWdodHMgUmVzZXJ2ZWQuXG4gKiBMaWNlbnNlZCB1bmRlciB0aGUgQXBhY2hlIExpY2Vuc
2UsIFZlcnNpb24gMi4wIChoaXMgZmlsZSBleGNlcHQgaW4gY29tcGxpYW5jZSB3aXRoIHRoZSBMaWNlbnNlLlxuICog
jb3B5IG9mIHRoZSBMaWNlbnNlIGF0XG4gKlxuICogaHR0cDovL3d3dy5hcGFjaGUub3JnL2xpY2Vuc2VzL0xJ
Q0VOU0UtMi4wXG4gKlxuICogVW5sZXNzIHJlcXVpcmVkIGJ5IGFwcGxpY2FibGUgbGF3IG9yIGFncmVlZC
B0byBpbiB3cml0aW5nLCBzb2Z0d2FyZVxuICogZGlzdHJpYnV0ZWQgdW5kZXIgdGhlIExpY2Vuc2UgaXMgZ
GlzdHJpYnV0ZWQgb24gYW4gXCJBUyBJU1wiIEJBU0lsTLFxuICogV0lUSE9VVCBXQVJSQU5USUVTIE9SIE
NPTkRJVElPTlMgT0YgQU5ZIEtJTkQsIGVpdGhlciBleHByZXNzIG9yIGltcGxpZWQuXG4gKiBiTZWUgdGhlIE
xpY2Vuc2UgZm9yIHRoZSBzcGVjaWZpYyBsYW5ndWFnZSBnb3Zlcm5pbmcgcGVybWlzc2lvbnMgYW5kXG4
gKiBsaW1pdGF0aW9ucyB1bmRlciB0aGUgTGljZW5zZS5cbiAqID09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09P
T09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09XG4gKi9cblxuaW1wb3J
0IHtEYXRhVHlwZU1hcCwgdXRpbH0gZnJvbSAnQHRlbnNvcmZsb3cvdGZqcy1jb3JlJztcblxuZXhwb3J0IGZ1bm
N0aW9uIHJhbmdlSW1wbChcbiAgICBzdGFydDogbnVtYmVyLCBzdG9wOiBudW1iZXIsIHN0ZXA6IG51bWJlci
xcbiAgICBkdHlwZTogJ2Zsb2F0MzInfCdpbnQzMicpOiBEYXRhVHlwZU1hcFsnZmxvYXQzMicgfCAnaW50Mz
InXSB7XG4gIGNvbnN0IHNhbWVTdGFydFN0b3AgPSBzdGFydCA9PT0gc3RvcDtcbiAgY29uc3QgaW5jcmVhc
2luZ1JhbmdlTmVnYXRpdmVTdGVwID0gc3RhcnQgPCBzdG9wICYmIHN0ZXAgPCAwO1xuICBjb25zdCBkZ
WNyZWFzaW5nUmFuZ2VQb3NpdGl2ZVN0ZXAgPSBzdG9wIDwgc3RhcnQgJiYgc3RlcCA+IDA7XG4gIGlmIChzYW
WYgKHNhbWVTdGFydFN0b3AgfHwgaW5jcmVhc2luZ1JhbmdlTmVnYXRpdmVTdGVwIHx8XG4gICAgICAgICAg

const xStrides = util.computeStrides(shape);\n if (isContinous) {\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) :\n 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}\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}\nexport const sliceConfig = {\n kernelName: Slice,\n backendName: 'cpu',\n kernelFunc: slice\n};\n//# sourceMappingURL=data:application/json; base64,eyJ2ZXJzaW9uIjozLCJmaWxlIjoiU2xpY2UuanMiLCJzb3VyY2VSb290IjoiIiwic291cmNlcyI6WyIuLi8uLi8uLi8uLi8uLi8uLi90ZmpzLWJhY2tlbmQtY3B1L3NyYy9rZXJuZWxzL1NsaWNlLnRzIl0sIm5hbWVzIjpbXSwibWFwcGluZ3MiOiJBQUFBOzs7Ozs7Ozs7Ozs7R0FlRztBQU8sRUFBQWlCLE1BQUssQ0FBQyxFQUFBQyxPQUFNLEVBQUFDLFNBQVEsRUFBQUMsT0FBTSxFQUFDLEdBQUdDLEtBQUksQ0FBQztFQUNqRCxNQUFNLEVBQUNDLE1BQUssRUFBQyxHQUFHSixPQUFNLENBQUM7RUFDdkIsTUFBTSxFQUFDSyxPQUFNLEVBQUVDLEtBQUksRUFBQyxHQUFHRixNQUFLLENBQUM7RUFDN0JHLGdCQUFnQixDQUFDRixNQUFLLEVBQUUsT0FBTyxDQUFDLENBQUM7RUFDakMsTUFBTSxDQUFDRyxNQUFNLEVBQUVDLEtBQUssQ0FBQyxHQUFHQyxVQUFVLENBQUNDLGlCQUFpQixDQUFDTixNQUFLLEVBQUVDLE1BQUssRUFBRUMsS0FBSSxDQUFDLENBQUM7RUFDekVHLFVBQVUsQ0FBQ0UsMkJBQTJCLENBQUNQLE1BQUssRUFBRUcsTUFBTSxFQUFFQyxLQUFLLENBQUMsQ0FBQztFQUM3RCxNQUFNSSxJQUFHLEdBQUdDLE9BQU0sQ0FBQ0MsR0FBRyxDQUFDVixNQUFLLENBQUNXLFVBQVUsQ0FBQyxDQUFDQyxNQUFNLENBQUM7RUFDaEQsTUFBTUMsT0FBTSxHQUFHQyxVQUFTLENBQUNOLElBQUcsRUFBRUgsTUFBTSxFQUFFTCxNQUFLLEVBQUVHLE1BQUssQ0FBQ1ksS0FBSyxFQUFFZixNQUFLLENBQUNnQixLQUFLLENBQUM7RUFDbkUsT0FBT1IsT0FBTSxDQUFDUyxjQUFjLENBQUNKLE9BQU0sRUFBRWIsTUFBSyxDQUFDZ0IsS0FBSyxFQUFFSCxPQUFNLENBQUM7QUFDM0QsQ0FBQztBQUVELE9BQU8sTUFBTUssV0FBVSxHQUFHO0VBQ3hCQyxVQUFVLEVBQUUsT0FBTztFQUNuQkMsV0FBVyxFQUFFLEtBQUs7RUFDbEJDLFVBQVUsRUFBRXZCLEtBQUs7QUFDbkIsQ0FBQyJ9

9DLE1BQU0sSUFBSSxHQUFHLE9BQU8sQ0FBQyxJQUFJLENBQUMsR0FBRyxDQUFDLENBQUMsQ0FBQ
yxNQUFNLENBQUMsQ0FBQyxNQUFNLENBQUM7SUFDL0MsUFBTSxPQUFPLEdBQUcsU0FBUyxDQUF
DLElBQUksRUFBRSxNQUFNLEVBQUUsS0FBSyxFQUFFLENBQUMsQ0FBQyxLQUFLLEVBQUUsQ0FBQy
xDQUFDLEtBQUssQ0FBQyxDQUFDO0lBQ2pFLE9BQU8sT0FBTyxDQUFDLGNBQWMsQ0FBQyxDQ
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bIi8qKlxuICogQGxpY2Vuc2VcbiAqIENvcHlyaWdodCAyMDIwIEdvb2dsZSBMTEMuIEFsbCBSaWdodHMgUm
VzZXJ2ZWQuXG4gKiBMaWNlbnNlZCB1bmRlciB0aGUgQXBhY2hlIExpY2Vuc2UsIFZlcnNpb24gMi4wICh0a
GUgXCJMaWNlbnNlXCIpO1xuICogeW91IG1heSBub3QgdXNlIHRoaXMgZmlsZSBleGNlcHQgaW4gY29tcGxp
YW5jZSB3aXRoIHRoZSBMaWNlbnNlLlxuICogWW91IG1heSBvYnRhaW4gYSBjb3B5IG9mIHRoZSBMaWNlb
nNlIGF0XG4gKlxuICogaHR0cDovL3d3dy5hcGFjaGUub3JnL2xpY2Vuc2VzL0xJQ0VOU0UtMi4wXG4gKlxuIC
ogVW5sZXNzIHJlcXVpcmVkIGJ5IGFwcGxpY2FibGUgb3IgYSBncmVlZCB0byByBpbiB3cml0aW5nLCBzb2
Z0d2FyZVxuICogZGlzdHJpYnV0ZWQgdW5kZXIgdGhlIExpY2Vuc2UgaXMgZGlzdHJpYnV0ZWQgb24gYW4g
XCJBUyBJU1wiIEJBU0lTLFxuICogV0lUSE9VVCBXQVJSQU5USUVTIE9SIENPTkRJVElPTlMgT0YgQU5ZI
EtJTkQsIGVpdGhlciBleHByZXNzIG9yIGltcGxpZWQuXG4gKiBiBTZWUgdGhlIExpY2Vuc2UgZm9yIHRoZSBzc
GVjaWZpYyBsYW5ndWFnZSBnb3Zlcm5pbmcgcGVybWlzc2lvbnMgYW5kXG4gKiBiBsaW1pdGF0aW9ucyB1bm
RlciB0aGUgTGljZW5zZS5cbiAqID09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09P
T09PT09PT09PT09PT09PT09PT09PT09PT09XG4gKi9cblxuaW1wb3J0IHtiYWNrZW5kX3V0aWwsIE
JhY2tlbmRWYWx1ZXMsIGJ1ZmZlciwgRGF0YVR5cGUsIEtlcm5lbENvbmZpZywgS2VybmVuYywgU2xp
Y2UsIHNsaWNlX3V0aWwsIFNsaWNlQXR0cnMsIFNsaWNlSW5wdXRzLCBUZW5zb3JJbmZvLCBNeXBlZEF
ycmF5LCB1dGlsfSBmcm9tICdAdGVuc29yZmxvdy90ZmpzLWNvcmUnO1xuXG5pbXBvcnQge01hdGhCYWNr
ZW5kQ1BVfSBmcm9tICcuLi9iYWNrZW5kX2NwdSc7XG5pbXBvcnQge2Fzc2VydE5vdENvbXBsZXh9IGZyb2
0gJy4uL2NwdV91dGlsJztcblxuZXhwb3J0IGZ1bmN0aW9uIHNsaWNlSW1wbChhcbiAgICB2YWxzOiBCYWNrZ
W5kVmFsdWVzLCBiZWdpbjogbnVtYmVyW10sIHNpemU6IG51bWJlcltdLCBzaGFwZTogbnVtYmVyW10sXG
4gICAgZHR5cGU6IERhdGFUeXBlKTogQmFja2VuZERhdGFbXSB7XG4gICAgY29uc3QgcmFuayA9IHNoYXBl
Lmxlbmd0aDtcbiAgICBjb25zdCBzbGljZVBhcmFtcyA9IGNvbXB1dGVTbGljZVBhcmFtcyhzaGFwZSwgYmV
naW4sIHNpemUpO1xuICAgIGNvbnN0IHJlc3VsdCA9IGJhY2tlbmQuY3JlYXRlVGVuc29yKFxuICAgICAgICBzbG
ljZVBhcmFtcy5yZXN1bHRTaGFwZSwgZGF0YVR5cGUpO1xuICAgIGNvbnN0IHNsaWNlRGltcyA9IHV0aWw
uZ2V0U2xpY2VEaW0oYmVnaW4sIHNpemUsIHNoYXBlKTtcbiAgICBjb25zdCBpc1NpbXBsZSA9IHNsaWNlRG
ltcy5sZW5ndGggPT09IDE7XG4gICAgY29uc3QgeFZhbHMgPSBiYWNrZW5kLmRhdGFUb0dQVSh4KTtcbiAgI
CAgZHR5cGU6IERhdGFUeXBlKTogQmFja2VuZERhdGFbXSB7XG4gICAgICAgIGNvbnN0IGlzQ29udGludWU3VzdG
4gICAgICAgIGNvbnN0IGlzQ29udGludWU3VzID0gc2xpY2VfdXRpbC5pc1NsaWNlQ29udGludWU3VzKHNoYXBlLCBiZWdpbjogbnVtYmVyW10sXG4gICAgICAgICAgICBzaXplOiBudW1iZXJbXSwgc2l6ZSk7XG

1dGlsLmFzc2VydFBhcmFtc1ZhbGlkKHgsICRiZWdpbiwgJHNpemUpO1xuXG4gIGNvbnN0IHZhbHMgPSBiYWNrZW5kLmRhdGEuZ2V0KHguZGF0YUlkKS52YWx1ZXM7XG4gIGNvbnN0IG91dFZhbHMgPSBzbGljZUltcGwodmFscywgJGJlZ2luLCAkc2l6ZSwgeC5zaGFwZSwgeC5kdHlwZSk7XG4gIHJldHVybiBiYWNrZW5kLm1ha2VUZW5zb3JJbmZvKCRzaXplLCB4LmR0eXBlLCBvdXRWYWxzKTtcbn1cblxuZXhwb3J0IGNvbnN0IHNsaWNlQ29uZmlnOiBLZXJuZWxDb25maWcgPSB7XG4gIGtlcm5lbE5hbWU6IFNsaWNlLFxuICBiYWNrZW5kTmFtZTogJ3dhc20nLFxuICBrZXJuZWxGdW5jOiBzbGljZSxcbn07XG5cbmtlcm5lbEJhY2tlbmROcbn07XG4iXX0=","/**\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, KernelConfig, KernelFunc, Slice, slice_util, SliceAttrs, SliceInputs, TypedArray, util} from '@tensorflow/tfjs-core';\n\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\n const [begin_, size_] = slice_util.parseSliceParams(x, begin, size);\n\n const isContinous = slice_util.isSliceContinous(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 (isContinous) {\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.typedArrayFromHeap(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.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\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\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 * @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 {backend_util, BatchToSpaceND, BatchToSpaceNDAttrs, BatchToSpaceNDInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {reshape} from './Reshape';\nimport {slice} from './Slice';\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: {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\nexport const batchToSpaceNDConfig:
KernelConfig = {\n kernelName: BatchToSpaceND,\n backendName: 'wasm',\n kernelFunc: batchToSpaceND 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 {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\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

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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, Ceil} from '@tensorflow/tfjs-core';\n\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\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\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 License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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';\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 = $inputs.map(t => {\n const innerSize = util.sizeFromShape(t.shape.slice(axis));\n const shape = [-1, innerSize];\n return reshape({inputs: {x: t}, backend, attrs: {shape}});\n });\n\n const inputsValShapes = inputs2D.map(t => {\n return {vals: backend.readSync(t.dataId), shape: t.shape};\n });\n\n // Concats 2d tensors along axis=1.\n outShape =\n backend_util.computeOutShape(inputs2D.map(t => t.shape), 1 /* axis */);\n const simplyConcat = inputs2D[0].shape[0] === 1;\n const outVals = concatImplCPU(\n inputsValShapes, outShape, inputs[0].dtype,\n simplyConcat) as string[];\n\n const finalOutShape =\n backend_util.computeOutShape($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\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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, 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
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==\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

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  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 * @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
*/\n\nimport {Cos, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const cosConfig: KernelConfig = createUnaryKernelConfig(Cos);\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 {Cosh, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const coshConfig: KernelConfig = createUnaryKernelConfig(Cosh);\n","/**\n *
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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
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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","/**\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, 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\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\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 * @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 {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","/**\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, 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 Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF 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 *
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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 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 {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 copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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,\n 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 * @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} 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,\n 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 * @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 {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 compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS 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 {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 *
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*/\n\nimport {FloorDiv, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from './binary_kernel';\n\nconst supportsFullBroadcast = false;\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 use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS 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 {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 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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';\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:\n 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\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 =

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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 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\nexport 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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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}\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\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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\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 const xId = xData.id;\n\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 * @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 {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 {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   },\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 * @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 {Greater, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from './binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const greaterConfig: KernelConfig =\n createBinaryKernelConfig(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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 =\n createBinaryKernelConfig(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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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}\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not

use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 * 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, 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 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.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\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\nfunction max(args: {backend: BackendWasm, inputs: MaxInputs, attrs: MaxAttrs}):\n   TensorInfo {\n const\n {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, 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 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
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License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\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
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  permissions and\n * limitations under the License.\n *
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*/\nimport {KernelConfig, Maximum} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'./binary_kernel';\nconst supportsFullBroadcast = false;\nexport const maximumConfig: KernelConfig =\n
createBinaryKernelConfig(Maximum, supportsFullBroadcast);\n","/**\n * @license\n * Copyright 2019 Google
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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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  permissions and\n * limitations under the License.\n *
==\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
    '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 //\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 * @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, 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\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 * 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
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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';\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\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\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 * @license\n * Copyright 2019 Google
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==========\n
*/\nimport {KernelConfig, Minimum} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'./binary_kernel';\nconst supportsFullBroadcast = false;\nexport const minimumConfig: KernelConfig =\n
createBinaryKernelConfig(Minimum, supportsFullBroadcast);\n","/**\n * @license\n * Copyright 2021 Google
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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\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 *
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*/\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 copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\"
 BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF 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
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==\n
*/\n\nimport {BackendWasm} from '../backend_wasm';\n\n// Analogous to `struct Result` in `non_max_suppression_impl.h`.\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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\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,\n 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 Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 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 {} 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 {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 Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on 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
{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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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, 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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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.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 * @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
*/\n\nimport {KernelConfig, KernelFunc, Pack, PackAttrs, PackInputs, TensorInfo, util} from '@tensorflow/tfjs-

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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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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, 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, 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 * @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
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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, Pow} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = false;\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 * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 = 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 License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {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\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\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 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\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
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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, Range, RangeAttrs, TensorInfo} from '@tensorflow/tfjs-core';\n\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\n const
out = backend.makeOutput([values.length], dtype);\n const outVals = backend.typedArrayFromHeap(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 *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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, RealDiv} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from './binary_kernel';\n\nconst supportsFullBroadcast = true;\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 *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF 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, Relu} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\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 * ==========\n */\nimport {KernelConfig, Relu6} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\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\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\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\nexport const resizeBilinearConfig: KernelConfig = {\n kernelName: ResizeBilinear,\n 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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 '@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 *\n ==\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS

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*/\nimport {KernelConfig, Round} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from './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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF 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';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {CppDType} 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\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\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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\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 * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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\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 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';\n\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 \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n
 * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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, 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\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 * @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
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==\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';\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\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 < 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
  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';\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,\n 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';\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 License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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';\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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} from './binary_kernel';\nconst supportsFullBroadcast = true;\nexport const squaredDifferenceConfig: KernelConfig =\n   createBinaryKernelConfig(SquaredDifference, 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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an

\"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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, 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\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 Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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, slice_util, StridedSlice, StridedSliceAttrs, StridedSliceInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\n\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\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 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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WARRANTIES OR CONDITIONS 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, Sub} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'./binary_kernel';\nconst supportsFullBroadcast = true;\nexport const subConfig: KernelConfig =\n
createBinaryKernelConfig(Sub, supportsFullBroadcast);\n","/**\n * @license\n * Copyright 2019 Google LLC. All
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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 {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\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, 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 * @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
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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, Tan} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const tanConfig: KernelConfig = createUnaryKernelConfig(Tan);\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, Tanh} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const tanhConfig: KernelConfig = createUnaryKernelConfig(Tanh);\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, 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\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.
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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, 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: 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 '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\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 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, KernelFunc, TensorInfo, Unpack, UnpackAttrs, UnpackInputs}\n 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\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}, backend});\n }\n return outs.map(({dataId, dtype}) => ({dataId, dtype,\n   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 */\n\nimport {KernelConfig, KernelFunc, ZerosLike, ZerosLikeInputs} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm}\n 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\n for the specific language governing permissions and\n * limitations under the License.\n *\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 './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 *
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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 {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/IHkBZlHETpA/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","\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 (\nfunction(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&&!ENVIRONMENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var ENVIRONMENT_IS_PTHREAD=Module[\"ENVIRONMENT_IS_PTHREAD\"]||false;if(ENVIRONMENT_IS_PTHREAD){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=nodePath[\"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[\"argv\"].slice(2);process[\"on\"](\"uncaughtException\",function(ex){if(!(ex instanceof ExitStatus)){throw ex}});process[\"on\"](\"unhandledRejection\",abort);quit_=function(status){process[\"exit\"](status)};Module[\"inspect\"]=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){scriptDirectory=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.substr(0,scriptDirectory.lastIndexOf(\"/\")+1)}else{scriptDirectory=\"\"}if(ENVIRONMENT_IS_NODE){read_=function shell_read(filename,binary){if(!nodeFS)nodeFS=require(\"fs\");if(!nodePath)nodePath=require(\"path\");filename=nodePath[\"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]}}moduleOverrides=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;err(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[idx++]&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){wasmMemory=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;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){addOnPreRun(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\"].length){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\"](runDependencies)}}function removeRunDependency(id){runDependencies--
;if(Module[\"monitorRunDependencies\"]){Module[\"monitorRunDependencies\"](runDependencies)}if(runDependencies==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.error(\"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\"][\"I\"];wasmModule=module;if(!ENVIRONMENT_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(wasmBinaryFile)&&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(){__emscripten_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,EBADF: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,ECHRNG:106,EL2NSYNC:156,EL3HLT:107,EL3RST:108,ELNRNG:109,EUNATCH:110,ENOCSI:111,EL2HLT:112,EDEADLK:16,ENOLCK:46,EBADE: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,ENOTSOCK: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,EOVERFLOW:61,ECANCELED:11,ENOTRECOVERABLE:56,EOWNERDEAD:62,ESTRPIPE:135};function _emscripten_futex_wake(addr,count){if(addr<=0||addr>GROWABLE_HEAP_I8().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.pthreads[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.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);__emscripten_thread_init(tb,!ENVIRONMENT_IS_WORKER,1);_emscripten_register_main_browser_thread_id(tb)},initWorker:function(){},pthreads:{},threadExitHandlers:[],setThreadStatus:function(){},runExitHandlers:function(){while(PThread.threadExitHandlers.length>0){PThread.threadExitHandlers.pop()()}if(ENVIRONMENT_IS_PTHREAD&&_pthread_self())___pthread_tsd_run_dtors()},runExitHandlersAndDeinitThread:function(tb,exitCode){Atomics.store(GROWABLE_HEAP_U32(),tb+56>>2,1);Atomics.store(GROWABLE_HEAP_U32(),tb+60>>2,0);PThread.runExitHandlers();Atomics.store(GROWABLE_HEAP_U32(),tb+4>>2,exitCode);Atomics.store(GROWABLE_HEAP_U32(),tb+0>>2,1);_emscripten_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_PTHREAD){postMessage({\"cmd\":\"exit\"})}}},threadCancel:function(){PThread.runExitHandlersAndDeinitThread(_pthread_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)}}PThread.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=[]},freeThreadData:function(pthread){if(!pthread)return;if(pthread.threadInfoStruct){var 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.pthreads[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,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
mory,\"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

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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
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
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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=[]},registerRemoveEventListeners:function(){if(!JSEvents.removeEventListenersRegistered){__ATEXIT__.push(JSEvents.removeAllEventListeners);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,argsList)){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.deferredCalls.splice(i,1);--i}}},canPerformEventHandlerRequests:function(){return JSEvents.inEventHandler&&JSEvents.currentEventHandler.allowsDeferredCalls},runDeferredCalls:function(){if(!JSEvents.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,eventTypeString){for(var i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==target&&(!eventTypeString||eventTypeString==JSEvents.eventHandlers[i].eventTypeString)){JSEvents._removeHandler(i--)}}},_removeHandler:function(i){var h=JSEvents.eventHandlers[i];h.target.removeEventListener(h.eventTypeString,h.eventListenerFunc,h.useCapture);JSEvents.eventHandlers.splice(i,1)},registerOrRemoveHandler:function(eventHandler){var jsEventHandler=function jsEventHandler(event){++JSEvents.inEventHandler;JSEvents.currentEventHandler=eventHandler;JSEvents.runDeferredCalls();eventHandler.handlerFunc(event);JSEvents.runDeferredCalls();--JSEvents.inEventHandler};if(eventHandler.callbackfunc){eventHandler.eventListenerFunc=jsEventHandler;eventHandler.target.addEventListener(eventHandler.eventTypeString,jsEventHandler,eventHandler.useCapture);JSEvents.eventHandlers.push(eventHandler);JSEvents.registerRemoveEventListeners()}else{for(var i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==eventHandler.target&&JSEvents.eventHandlers[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,targetThread,637534208,eventHandlerFunc,eventData,varargs);stackRestore(stackTop)},getTargetThreadForEventCallback:function(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

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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
_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[\"drawBuffersWEBGL\"](n,bufs)};return 1}}function __webgl_enable_WEBGL_multi_draw(ctx){return!!(ctx.multiDrawWebgl=ctx.getExtension(\"WEBGL_multi_draw\"))}var GL={counter:1,buffers:[],programs:[],framebuffers:[],renderbuffers:[],textures:[],uniforms:[],shaders:[],vaos:[],contexts:{},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.enableExtensionsByDefault){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(contextHandle){return GL.contexts[contextHandle]},deleteContext:function(contextHandle){if(GL.currentContext===GL.contexts[contextHandle])GL.currentContext=null;if(typeof JSEvents===\"object\")JSEvents.removeAllHandlersOnTarget(GL.contexts[contextHandle].GLctx.canvas);if(GL.contexts[contextHandle]&&GL.contexts[contextHandle].GLctx.canvas)GL.contexts[contextHandle].GLctx.canvas.GLctxObject=undefined;_free(GL.contexts[contextHandle].handle);GL.contexts[contextHandle]=null},initExtensions:function(context){if(!context)context=GL.currentContext;if(context.initExtensionsDone)return;context.initExtensionsDone=true;var GLctx=context.GLctx;__webgl_enable_ANGLE_instanced_arrays(GLctx);__webgl_enable_OES_vertex_array_object(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.indexOf(\"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)],\"premultipliedAlpha\":!!GROWABLE_HEAP_I32()[a+(16>>2)],\"preserveDrawingBuffer\":!!GROWABLE_HEAP_I32()[a+(20>>2)],\"powerPreference\":__emscripten_webgl_power_preferences[powerPreference],\"failIfMajorPerformanceCaveat\":!!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()[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)})}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 __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()[status>>2]=threadExitCode;Atomics.store(GROWABLE_HEAP_U32(),thread+64>>2,1);if(!ENVIRONMENT_IS_PTHREAD)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_thread_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_write,_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_logical_cores,\"u\":_emscripten_receive_on_main_thread_js,\"q\":_emscripten_resize_heap,\"v\":_emscripten_set_canvas_element_size,\"i\":_emscripten_set_current_thread_status,\"s\":_emscripten_set_thread_name,\"w\":_emscripten_webgl_create_context,\"l\":_fd_close,\"n\":_fd_seek,\"g\":_fd_write,\"o\":initPthreadsJS,\"a\":wasmMemory||Module[\"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,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
_DepthwiseConv2dNative=Module[\"_DepthwiseConv2dNative\"]=function(){return(_DepthwiseConv2dNative=M
odule[\"_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,ar
guments)};var
_Exp=Module[\"_Exp\"]=function(){return(_Exp=Module[\"_Exp\"]=Module[\"asm\"][\"ba\"]).apply(null,argument
s)};var
_FlipLeftRight=Module[\"_FlipLeftRight\"]=function(){return(_FlipLeftRight=Module[\"_FlipLeftRight\"]=Modul
e[\"asm\"][\"ca\"]).apply(null,arguments)};var
_Floor=Module[\"_Floor\"]=function(){return(_Floor=Module[\"_Floor\"]=Module[\"asm\"][\"da\"]).apply(null,arg
uments)};var
_FloorDiv=Module[\"_FloorDiv\"]=function(){return(_FloorDiv=Module[\"_FloorDiv\"]=Module[\"asm\"][\"ea\"]).
apply(null,arguments)};var
_FusedBatchNorm=Module[\"_FusedBatchNorm\"]=function(){return(_FusedBatchNorm=Module[\"_FusedBatchN
orm\"]=Module[\"asm\"][\"fa\"]).apply(null,arguments)};var
_FusedConv2D=Module[\"_FusedConv2D\"]=function(){return(_FusedConv2D=Module[\"_FusedConv2D\"]=Mod
ule[\"asm\"][\"ga\"]).apply(null,arguments)};var
_FusedDepthwiseConv2D=Module[\"_FusedDepthwiseConv2D\"]=function(){return(_FusedDepthwiseConv2D=M
odule[\"_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
_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

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_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
_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
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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

en_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\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

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_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){globalEval(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&&!ENVIRONMENT_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=nodePath[\"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[\"argv\"].slice(2);process[\"on\"](\"uncaughtException\",function(ex){if(!(ex instanceof ExitStatus)){throw ex}});process[\"on\"](\"unhandledRejection\",abort);quit_=function(status){process[\"exit\"](status)};Module[\"inspect\"]=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){scriptDirectory=self.location.href}else if(typeof document!==\"undefined\"&&document.currentScript){scriptDirectory=document.currentScript.src}if(_scriptDir){scriptDirectory=_scriptDir}if(scriptDirectory.indexOf(\"blob:\")!==0){scriptDirectory=scriptDirectory.substr(0,scriptDirectory.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]}}moduleOverrides=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[idx++]&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){addOnPreRun(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[\"monitorRunDependencies\"](runDependencies)}}function removeRunDependency(id){runDependencies--;if(Module[\"monitorRunDependencies\"]){Module[\"monitorRunDependencies\"](runDependencies)}if(runDependencies==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;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.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\"];updateGlobalBufferAndViews(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(wasmBinaryFile)&&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,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\":_fd_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=Module[\"_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\"]=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
_Exp=Module[\"_Exp\"]=function(){return(_Exp=Module[\"_Exp\"]=Module[\"asm\"][\"M\"]).apply(null,argument

s)};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
_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

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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 return WasmBackendModule.ready\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\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, 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

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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 ${dtype}`);\n    }\n  }\n}\n\nfunction
createInstantiateWasmFunc(path: string) {\n  // this will be replace by rollup plugin patchWechatWebAssembly in\n
// minprogram's output.\n  // tslint:disable-next-line:no-any\n  return (imports: any, callback: any) => {\n
util.fetch(path, {credentials: 'same-origin'}).then((response) => {\n    if (!response['ok']) {\n
imports.env.a(`failed to load wasm binary file at '${path}'`);\n    }\n    response.arrayBuffer().then(binary => {\n
  WebAssembly.instantiate(binary, imports).then(output => {\n        callback(output.instance, output.module);\n
});\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 * 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 [`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\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 ;\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, 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\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 intialized.\n */\nexport function getThreadsCount(): number {\n if (actualThreadsCount === -1) {\n   throw new Error(`WASM backend not initialized.`);\n }\n return actualThreadsCount;\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 * @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 './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';\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","sliceImplCPU","Slice","BatchToSpaceND","Cast","Ceil","ClipByValue","concatImplCPU","Concat","Conv2D","Conv2DBackpropInput","Cos","Cosh","CropAndResize","Cumsum","DepthToSpace","DepthwiseConv2dNative","Elu","supportsFullBroadcast","Equal","Exp","ExpandDims","Fill","FlipLeftRight","Floor","FloorDiv","FusedBatchNorm","FusedConv2D","FusedDepthwiseConv2D","GatherNd","gather_util","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","Rsqrt","ScatterNd","scatter_util","Select","Sigmoid","Sin","Softmax","SpaceToBatchND","SplitV","Sqrt","Square","SquaredDifference","Step","StridedSlice","Sub","Sum","Tan","Tanh","Tile","TopK","Transform","Unpack","ZerosLike","registerKernel","env"

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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\nexport const fusedConv2DConfig: KernelConfig = {\n kernelName: FusedConv2D,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: fusedConv2d as {} as KernelFunc\n};\n"]}

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No license file was found, but licenses were detected in source scan.

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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"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Tile.js.map
No license file was found, but licenses were detected in source scan.

{"version":3,"file":"Equal.js","sourceRoot":"","sources":["../../src/kernels/Equal.ts"],"names":[],"mappings":"AAAA;;;;;;;;;;;;;;;GAeG;AACH,OAAO,EAAC,KAAK,EAAE,MAAM,uBAAuB,CAAC;AAE1D,OAAO,EAAC,wBAAwB,EAAC,MAAM,iBAAiB,CAAC;AAEzD,MAAM,qBAAqB,GAAG,KAAK,CAAC;AACpC,MAAM,CAAC,MAAM,WAAW,GAAG,wBAAwB,CAAC,KAAK,EAAE,qBAAqB,EAAE,MAAM,CAAC,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 copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF 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 =\n createBinaryKernelConfig(Equal, supportsFullBroadcast, 'bool');\n"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Equal.js.map
No license file was found, but licenses were detected in source scan.

{"version":3,"file":"Ceil.js","sourceRoot":"","sources":["../../src/kernels/Ceil.ts"],"names":[],"mappings":"AAAA;;;;;;;;;;;;;;;GAeG;AACH,OAAO,EAAC,IAAI,EAAE,YAAY,EAAC,MAAM,uBAAuB,CAAC;AAEzD,OAAO,EAAC,wBAAwB,EAAC,MAAM,iBAAiB,CAAC;AAEzD,MAAM,CAAC,MAAM,UAAU,GAAG,wBAAwB,CAAC,IAAI,EAAE,YAAY,CAAC,CAAC","sourcesContent":["/**\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, Ceil} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\n\nexport const ceilConfig: KernelConfig = createUnaryKernelConfig(Ceil);\n"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Ceil.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
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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 = 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"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
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No license file was found, but licenses were detected in source scan.

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nt":["/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache
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==\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"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/LessEqual.js.map
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kernelName: Prelu,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: prelu as {} as KernelFunc\n};\n"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Prelu.js.map
No license file was found, but licenses were detected in source scan.

{"version":3,"file":"SquaredDifference.js","sourceRoot":"","sources":["../../src/kernels/SquaredDifference.ts"],"names":[],"mappings":"AAAA;;;;;;;;;;;;;;GAeG;AACH,OAAO,EAAE,iBAAiB,EAAC,MAAM,uBAAuB,CAAC;AACtE,OAAO,EAAC,wBAAwB,EAAC,MAAM,iBAAiB,CAAC;AACzD,OAAO,EAAC,qBAAqB,EAAC,MAAM,cAAc,CAAC;AACnC,MAAM,CAAC,MAAM,uBAAuB,GAAG,wBAAwB,CAAC,iBAAiB,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 \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF 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"]}

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/SquaredDifference.js.map
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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):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/tf-backend-wasm.node.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/miniprogram/index.js
No license file was found, but licenses were detected in source scan.

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Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/flags_wasm.js.map
No license file was found, but licenses were detected in source scan.

{"version":3,"file":"ArgMax.js","sourceRoot":"","sources":["../../src/kernels/ArgMax.ts"],"names":[],"mappings":"AAAA;;;;;;;;;;;;;;;GAeG;AAEH,OAAO,EAAC,uBAAuB,EAAC,MAAM,uBAAuB,CAAC;AAIxG,OAAO,EAAC,uBAAuB,EAAC,MAAM,gBAAgB,CAAC;AACvD,OAAO,EAAC,QAAQ,EAAC,MAAM,aAAa,CAAC;AAEjC,IAAI,QAAE3B,SAAS,EAAE,KAAK,EAAE,KAAK,EAAE,KAAK

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AAQ;QACR,QAAQ;QACR,QAAQ;QACR,QA

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\nexport const conv2DBackpropInputConfig: KernelConfig = {\n kernelName: Conv2DBackpropInput,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: conv2DBackpropInput as {} as KernelFunc\n};\n"]}

Found in path(s):
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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/kernel_utils.d.ts
*
 /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/kernel_utils.ts

1.223 @tensorflow/tfjs-backend-webgl 3.11.0

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1.224 @tensorflow/tfjs-backend-cpu 3.11.0

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* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/index.js
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/resnet.js
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* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/util_test.d.ts
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/opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/body_pix_test.d.ts
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* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/single_person/argmax2d_test.d.ts
No license file was found, but licenses were detected in source scan.

{"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_person/build_part_with_score_queue.ts","../src/multi_person/decode_pose.ts","../src/multi_person/decode_multiple_poses.ts","../src/resnet.ts","../src/saved_models.ts","../src/util.ts","../src/body_pix_model.ts","../src/blur.ts","../src/output_rendering_util.ts","../src/part_channels.ts","../src/version.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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 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\n const partMapFlattened = tf.reshape(partMapLocations, [-1]);\n\n return tf.oneHot(partMapFlattened, 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 segmentation\n * mask with a 1 or 0 at each pixel where there is a person or not a person. The\n * segmentation threshold determines the threshold of a score for a pixel for it\n * to be considered part of a person.\n * @param segmentScores A 3d-tensor of the sigmoid of the segmentation output.\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 and the clipping of the colored part image.\n *\n * @returns A segmentation mask with a 1 or 0 at each pixel where there is a\n * person or not a person.\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 value at each pixel corresponding to the\n * part with the highest value. These part ids are clipped by the segmentation\n * mask. Wherever the a pixel is clipped by the segmentation mask, its value\n * will set to -1,

indicating that there is no part in that pixel.\n * @param segmentScores A 3d-tensor of the sigmoid of the segmentation output.\n * @param partHeatmapScores A 3d-tensor of the sigmoid of the part heatmap\n * output. The third dimension corresponds to the part.\n *\n * @returns A 2d tensor of an image with the corresponding value at each pixel\n * corresponding to the part with the highest value. These part ids are clipped\n * by the segmentation mask. It will have values of -1 for pixels that are\n * outside of the body and do not have
 a corresponding part.\n */\nexport function decodePartSegmentation(\n segmentationMask: tf.Tensor2D,\n partHeatmapScores: tf.Tensor3D): tf.Tensor2D {\n const [partMapHeight, partMapWidth, numParts] = partHeatmapScores.shape;\n return tf.tidy(() => {\n const flattenedMap = toFlattenedOneHotPartMap(partHeatmapScores);\n const 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 const partMap = tf.reshape(partMapFlattened, [partMapHeight, partMapWidth]);\n\n const 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 function decodeOnlyPartSegmentation(partHeatmapScores: tf.Tensor3D):\n tf.Tensor2D {\n const [partMapHeight, partMapWidth, numParts] = partHeatmapScores.shape;\n
  return tf.tidy(() => {\n const flattenedMap = toFlattenedOneHotPartMap(partHeatmapScores);\n const 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, [partMapHeight, partMapWidth]);\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 is distributed on an \"AS IS\" BASIS,\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
*/\n\nimport * as tfconv from '@tensorflow/tfjs-converter';\nimport * as tf from '@tensorflow/tfjs-core';\nimport {BodyPixOutputStride} from './types';\n\n/**\n * BodyPix supports using various convolution neural network models\n * (e.g. ResNet and MobileNetV1) as its underlying base model.\n * The following BaseModel interface 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 */\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]}, ${inputShape[2]}] ` +\n `must both be equal to or -1`);\n }\n\n abstract preprocessInput(input: tf.Tensor3D): tf.Tensor3D;\n\n /**\n * Predicts intermediate Tensor representations.\n *\n * @param input The input RGB image of the base model.\n * A Tensor of shape: [`inputResolution`, `inputResolution`, 3].\n *\n * @return A dictionary of base model's intermediate predictions.\n * The returned dictionary should contains the following elements:\n * - heatmapScores: A Tensor3D that represents the keypoint heatmap scores.\n * - offsets: A Tensor3D that represents the offsets.\n * - displacementFwd: A Tensor3D that represents the forward displacement.\n * - displacementBwd: A Tensor3D that represents the backward displacement.\n * - segmentation: A Tensor3D that represents the segmentation of all\n * people.\n * - longOffsets: A Tensor3D
 that represents the long offsets used for\n * instance grouping.\n * - partHeatmaps: A Tensor3D that represents the body part segmentation.\n */\n predict(input: tf.Tensor3D): {\n heatmapScores: 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

return tf.tidy(() => {\n const asFloat = this.preprocessInput(tf.cast(input, 'float32'));\n const asBatch = tf.expandDims(asFloat, 0);\n const results = this.model.predict(asBatch) as tf.Tensor4D[];\n const results3d: tf.Tensor3D[] = results.map(y => tf.squeeze(y, [0]));\n const namedResults = this.nameOutputResults(results3d);\n\n return {\n heatmapScores: tf.sigmoid(namedResults.heatmap),\n offsets: namedResults.offsets,\n displacementFwd: namedResults.displacementFwd,\n displacementBwd: namedResults.displacementBwd,\n segmentation: namedResults.segmentation,\n partHeatmaps: namedResults.partHeatmaps,\n longOffsets: namedResults.longOffsets,\n partOffsets: namedResults.partOffsets\n };\n });\n }\n\n // Because MobileNet and ResNet predict() methods output a different order for\n // these values, we have a method that needs to be implemented to order them.\n abstract 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 the CPU and GPU memory allocated by the model.\n */\n dispose() {\n this.model.dispose();\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
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==========\n */\n\nimport * as tf from '@tensorflow/tfjs-core';\n\nimport {BaseModel} from './base_model';\n\nexport class MobileNet extends BaseModel {\n preprocessInput(input: tf.Tensor3D): tf.Tensor3D {\n // Normalize the pixels [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 * @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\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', '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'], ['leftElbow', 'leftShoulder'],\n ['leftElbow', 'leftWrist'], ['leftHip', 'leftKnee'],\n ['leftKnee', 'leftAnkle'], ['rightHip', 'rightShoulder'],\n ['rightElbow', 'rightShoulder'], ['rightElbow', 'rightWrist'],\n ['rightHip', 'rightKnee'], ['rightKnee', 'rightAnkle'],\n ['leftShoulder', 'rightShoulder'], ['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 */\nexport const POSE_CHAIN: StringTuple[] =

[\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 CONNECTED_PART_INDICES = CONNECTED_PART_NAMES.map(\n   ([jointNameA, jointNameB]) =>\n   ([PART_IDS[jointNameA], PART_IDS[jointNameB]]));\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 {NUM_KEYPOINTS} from '../keypoints';\nimport {Padding, Part, TensorBuffer3D, Vector2D} from '../types';\n\nexport function getScale(\n   [height, width]: [number,\n 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: 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: TensorBuffer3D): Vector2D {\n const {heatmapY, heatmapX, id: keypoint} = part;\n const {y, x} = 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\n\n for (let i = 0; i < size; i++) {\n   result[i] = element;\n }\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 * @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 is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {NUM_KEYPOINTS} from '../keypoints';\nimport {Padding, Pose} from '../types';\n\nimport {getScale} from './util';\n\ninterface Pair {\n x: number;\n y: number;\n}\n\nfunction computeDistance(embedding: Pair[], pose: Pose, minPartScore = 0.3) {\n let distance = 0.0;\n let numKpt = 0;\n for (let p = 0; p < embedding.length; p++) {\n   if (pose.keypoints[p].score > minPartScore) {\n   numKpt += 1;\n   distance += (embedding[p].x - pose.keypoints[p].position.x) ** 2 +\n   (embedding[p].y - pose.keypoints[p].position.y) ** 2;\n   }\n }\n if (numKpt === 0) {\n   distance = Infinity;\n } else {\n   distance = distance / numKpt;\n }\n return distance;\n}\n\nfunction convertToPositionInOuput(\n   position: Pair, [padT, padL]: [number, number],\n   [scaleX, scaleY]: [number, number], stride: number): Pair {\n const y = Math.round(((padT + position.y + 1.0) *

scaleY - 1.0) / stride);\n const x = Math.round(((padL + position.x + 1.0) * scaleX - 1.0) / stride);\n return {x, y};\n}\n\nfunction getEmbedding(\n   location: Pair, keypointIndex: number,\n   convertToPosition: (pair: Pair) => Pair, outputResolutionX: number,\n   longOffsets: Float32Array, refineSteps: number,\n   [height, width]: [number, number]): Pair {\n const newLocation = convertToPosition(location);\n\n const nn = newLocation.y * outputResolutionX + newLocation.x;\n let dy = longOffsets[NUM_KEYPOINTS * (2 * nn) + keypointIndex];\n let dx = longOffsets[NUM_KEYPOINTS * (2 * nn + 1) + keypointIndex];\n let y = location.y + dy;\n let x = location.x
 + dx;\n for (let t = 0; t < refineSteps; t++) {\n   y = Math.min(y, height - 1);\n   x = Math.min(x, width - 1);\n const newPos = convertToPosition({x, y});\n   const nn = newPos.y * outputResolutionX + newPos.x;\n   dy = longOffsets[NUM_KEYPOINTS * (2 * nn) + keypointIndex];\n   dx = longOffsets[NUM_KEYPOINTS * (2 * nn + 1) + keypointIndex];\n   y = y + dy;\n   x = x + dx;\n }\n\n return {x, y};\n}\n\nfunction matchEmbeddingToInstance(\n   location: Pair, longOffsets: Float32Array, poses: Pose[],\n   numKptForMatching: number, [padT, padL]: [number, number],\n   [scaleX, scaleY]: [number, number], outputResolutionX: number,\n   [height, width]: [number, number], stride: number,\n   refineSteps: number): number {\n const embed: Pair[] = [];\n const convertToPosition = (pair: Pair) =>\n   convertToPositionInOuput(pair, [padT, padL], [scaleX, scaleY], stride);\n\n for (let keypointsIndex = 0; keypointsIndex < numKptForMatching;\n   keypointsIndex++) {\n   const embedding = getEmbedding(\n   location, keypointsIndex, convertToPosition, outputResolutionX,\n   longOffsets, refineSteps, [height, width]);\n\n   embed.push(embedding);\n }\n\n let kMin = -1;\n let kMinDist = Infinity;\n for (let k = 0; k < poses.length; k++) {\n   const dist = computeDistance(embed, poses[k]);\n   if (dist < kMinDist) {\n   kMin = k;\n   kMinDist = dist;\n   }\n }\n return kMin;\n}\n\nfunction getOutputResolution(\n [inputResolutionY, inputResolutionX]: [number, number],\n   stride: number): [number, number] {\n const outputResolutionX = Math.round((inputResolutionX - 1.0) / stride + 1.0);\n const outputResolutionY = Math.round((inputResolutionY - 1.0) / stride + 1.0);\n return [outputResolutionX, outputResolutionY];\n}\n\nexport function decodeMultipleMasksCPU(\n   segmentation: Uint8Array, longOffsets: Float32Array,\n   posesAboveScore: Pose[], height: number, width: number, stride: number,\n   [inHeight, inWidth]: [number, number], padding: Padding,\n   refineSteps: number, numKptForMatching = 5): Uint8Array[] {\n const dataArrays =\n   posesAboveScore.map(x => new Uint8Array(height * width).fill(0));\n\n const {top: padT, left: padL} = padding;\n\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] = 1;\n   }\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\n const {top: padT, left: padL} = padding;\n\n const [scaleX, scaleY] =\n   getScale([height, width], [inHeight, inWidth], padding);\n const [outputResolutionX,] =\n   getOutputResolution([inHeight, inWidth], stride);\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   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\n return dataArrays;\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,

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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 * 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\n  const shapedLongOffsets: tf.Tensor4D =\n      tf.reshape(longOffsets, [outHeight, outWidth, 2, NUM_KEYPOINTS]);\n\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\n  const [scaleX, scaleY] =\n      getScale([height, width], [inHeight, inWidth], padding);\n\n  const posesTensor = tf.tensor(poseVals, [maxNumPeople, NUM_KEYPOINTS, 3]);\n\n  const {top: padT, left: padL} = padding;\n\n  const program: tf_webgl.GPGPUProgram = {\n    variableNames: ['segmentation', 'longOffsets', 'poses'],\n    outputShape: [origHeight, origWidth],\n    userCode: `\n    int convertToPositionInOutput(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 convertToPositionInOutputFloat(\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 = getLongOffsets(clH, flW, d, k);\n      float o22 = getLongOffsets(clH, clW, d, k);\n      float o1 = mix(o11, o12, fw);\n      float o2 = mix(o21, o22, fw);\n      return mix(o1, o2, fh);\n    }\n\n    int findNearestPose(int h, int w) {\n  float prob = getSegmentation(h, w);\n
    if (prob < 1.0) {\n        return -1;\n      }\n\n      // Done(Tyler): convert from output space h/w to strided space.\n  float stridedH = convertToPositionInOutputFloat(\n        h, ${padT}, ${scaleY}, ${stride});\n      float stridedW = convertToPositionInOutputFloat(\n        w, ${padL}, ${scaleX}, ${stride});\n\n      float minDist = 1000000.0;\n      int iMin = -1;\n      for (int i = 0; i < ${maxNumPeople}; i++) {\n        float curDistSum = 0.0;\n        int numKpt = 0;\n        for (int k = 0; k < ${NUM_KEYPOINTS}; k++) {\n          float dy = sampleLongOffsets(stridedH, stridedW, 0, k);\n          float dx = sampleLongOffsets(stridedH, stridedW, 1, k);\n\n          float y = float(h) + dy;\n      float x = float(w) + dx;\n\n          for (int s = 0; s < ${refineSteps}; s++) {\n            int yRounded = round(min(y, float(${height - 1.0})));\n            int xRounded = round(min(x, float(${width - 1.0})));\n\n            float yStrided = convertToPositionInOutputFloat(\n                yRounded, ${padT}, ${scaleY}, ${stride});\n            float xStrided = convertToPositionInOutputFloat(\n        xRounded, ${padL}, ${scaleX}, ${stride});\n\n            float dy = sampleLongOffsets(yStrided, xStrided, 0, k);\n            float dx = sampleLongOffsets(yStrided, xStrided, 1, k);\n\n            y = y + dy;\n            x = x + dx;\n          }\n\n          float poseScore = getPoses(i, k, 0);\n          float poseY = getPoses(i, k, 1);\n          float poseX =
```

getPoses(i, k, 2);\n if (poseScore > ${minKptScore}) {\n numKpt = numKpt + 1;\n curDistSum = curDistSum + dist(x, y, poseX, poseY);\n }\n }\n if (numKpt > 0 && curDistSum / float(numKpt) < minDist) {\n minDist = curDistSum / float(numKpt);\n iMin = i;\n }\n }\n return iMin;\n }\n\n void main() {\n ivec2 coords = getOutputCoords();\n int nearestPose = findNearestPose(coords[0], coords[1]);\n

setOutput(float(nearestPose));\n }\n `\n };\n const webglBackend = tf.backend() as tf_webgl.MathBackendWebGL;\n return webglBackend.compileAndRun(\n program, [segmentation, shapedLongOffsets, posesTensor]);\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 is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 tf from '@tensorflow/tfjs-core';\nimport {getBackend} from '@tensorflow/tfjs-core';\n\nimport {Padding, PartSegmentation, PersonSegmentation, Pose} from '../types';\n\nimport {decodeMultipleMasksCPU, decodeMultiplePartMasksCPU} from './decode_multiple_masks_cpu';\nimport {decodeMultipleMasksWebGl} from './decode_multiple_masks_webgl';\n\nexport function toPersonKSegmentation(\n segmentation: tf.Tensor2D, k: number): tf.Tensor2D {\n return tf.tidy(\n () => (tf.cast(tf.equal(\n segmentation, tf.scalar(k)), 'int32') as tf.Tensor2D));\n}\n\nexport function toPersonKPartSegmentation(\n segmentation: tf.Tensor2D, bodyParts: tf.Tensor2D, k: number): tf.Tensor2D {\n return tf.tidy(\n () => tf.sub(tf.mul(tf.cast(tf.equal(\n segmentation, tf.scalar(k)), 'int32'), tf.add(bodyParts, 1)), 1));\n}\n\nfunction isWebGlBackend() {\n return getBackend() === 'webgl';\n}\n\nexport async function decodePersonInstanceMasks(\n segmentation: tf.Tensor2D, longOffsets: tf.Tensor3D, poses: Pose[],\n height: number, width: number, stride: number,\n [inHeight, inWidth]: [number, number], padding: Padding, minPoseScore = 0.2,\n refineSteps = 8, minKeypointScore = 0.3,\n maxNumPeople = 10): Promise<PersonSegmentation[]> {\n // Filter out poses with smaller score.\n const posesAboveScore = poses.filter(pose => pose.score >= minPoseScore);\n\n let personSegmentationsData: Uint8Array[];\n\n if (isWebGlBackend()) {\n const personSegmentations = 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) => 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\n return personSegmentationsData.map(\n (data, i) => ({data, pose: posesAboveScore[i], width, height}));\n}\n\nexport 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 const partSegmentations = tf.tidy(() => {\n   const masksTensorInfo = decodeMultipleMasksWebGl(\n segmentation, longOffsets, posesAboveScore, height, width, stride,\n   [inHeight, inWidth], padding,\n refineSteps, minKeypointScore,\n   maxNumPeople);\n   const masksTensor =\n 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 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],\n padding,\n   refineSteps);\n }\n\n return partSegmentationsByPersonData.map(\n   (data, k) => ({pose: posesAboveScore[k], data, height, width}));\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
 is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS 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// algorithm based on Coursera Lecture from Algorithms, Part 1:\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 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 * @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

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 the License.\n *
==========================================================================\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 */\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
      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 * @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 {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(([\n                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}\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 * 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`-t channel of the displacement tensor). The displaced keypoint\n * vector is refined using
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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\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 * 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, 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; edge < numEdges; ++edge) {\n const sourceKeypointId = childToParentEdges[edge];\n const targetKeypointId = parentToChildEdges[edge];\n if (instanceKeypoints[sourceKeypointId] &&\n !instanceKeypoints[targetKeypointId]) {\n instanceKeypoints[targetKeypointId] = traverseToTargetKeypoint(\n edge, instanceKeypoints[sourceKeypointId], targetKeypointId, scores,\n offsets, outputStride, displacementsFwd);\n }\n }\n\n return instanceKeypoints;\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 is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {Keypoint, Pose, TensorBuffer3D} from '../types';\n\nimport {buildPartWithScoreQueue} from './build_part_with_score_queue';\nimport {decodePose} from './decode_pose';\nimport {getImageCoords, squaredDistance} from './util';\n\nfunction withinNmsRadiusOfCorrespondingPoint(\n poses: Pose[], squaredNmsRadius: number, {x, y}: {x: number, y: number},\n keypointId: number): boolean {\n return poses.some(({keypoints}) => {\n const correspondingKeypoint = keypoints[keypointId].position;\n return

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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
scores of the parts that overlap with any previously detected\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\n  return notOverlappedKeypointScores /= instanceKeypoints.length;\n}\n\n// A point (y, x) is considered
as root part candidate if its score is a\n// maximum in a window |y - y'| <= kLocalMaximumRadius, |x - x'| <=\n//
kLocalMaximumRadius.\nconst kLocalMaximumRadius = 1;\n\n/**\n * Detects multiple poses and finds their parts
from part scores and\n * displacement vectors. It returns up to `maxDetections` object instance\n * detections in
decreasing root score order. It works as follows: We first\n * create a priority
 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
object instance. To avoid\n * duplicate detections, we reject the root candidate if it is within a disk\n * of
`nmsRadius` pixels from the corresponding part of a previously detected\n * instance, which is a form of part-based
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
the displacement vectors\n * along the tree-structured part graph. We assign to the newly detected\n * instance a
score equal to the sum of scores of its parts which have not\n * been claimed by a previous instance (i.e., those at
least `nmsRadius`\n * pixels away from the corresponding part of all previously
 detected\n * instances), divided by the total number of parts `numParts`.\n *\n * @param heatmapScores 3-D tensor
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
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
contains the forward\n * displacements between consecutive part from the root towards the leaves.\n *\n * @param
displacementsBwd 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 contains
 the backward\n * displacements between consecutive part from the root towards the leaves.\n *\n * @param
outputStride The output stride that was used when feed-forwarding\n * through the PoseNet model.  Must be 32, 16,
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
*/\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\n
const queue = buildPartWithScoreQueue(\n      scoreThreshold, kLocalMaximumRadius, scoresBuffer);\n\n  const
squaredNmsRadius = nmsRadius * nmsRadius;\n\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\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\n    // Start a new detection
```

instance at the position of the root.\n const keypoints = decodePose(\n root, scoresBuffer, offsetsBuffer, outputStride, displacementsFwdBuffer,\n displacementsBwdBuffer);\n\n const score = getInstanceScore(poses, squaredNmsRadius, keypoints);\n\n poses.push({keypoints, score});\n }\n\n return poses;\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\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 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\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 * @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\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n * ==========\n */\n\nconst RESNET50_BASE_URL =\n 'https://storage.googleapis.com/tfjs-models/savedmodel/bodypix/resnet50/';\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.\nexport function resNet50SavedModel(stride: number, 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 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: '100', 0.75: '075', 0.50: '050'};\n const graphJson = `model-stride${stride}.json`;\n // quantBytes=4 corresponding to the non-quantized full-precision SavedModel.\n if (quantBytes === 4) {\n return MOBILENET_BASE_URL + `float/${toStr[multiplier]}/` + graphJson;\n } else {\n return MOBILENET_BASE_URL + `quant${quantBytes}/${toStr[multiplier]}/` +\n graphJson;\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 */\n\nimport * as tf from '@tensorflow/tfjs-core';\n\nimport {BodyPixInput, BodyPixOutputStride, Padding} from './types';\nimport {Pose, TensorBuffer3D} from './types';\nimport {BodyPixInternalResolution} from

'./types';\n\nfunction getSizeFromImageLikeElement(input: HTMLImageElement|\n HTMLCanvasElement|\n OffscreenCanvas): [number, number] {\n if ('offsetHeight' in input && input.offsetHeight !== 0\n && 'offsetWidth' in input && input.offsetWidth !== 0) {\n return [input.offsetHeight, input.offsetWidth];\n } else if (input.height != null && input.width != null) {\n return [input.height, input.width];\n } else {\n throw new Error(\n `HTMLImageElement must have height and width attributes set.`);\n }\n}\n\nfunction getSizeFromVideoElement(input: HTMLVideoElement): [number, number] {\n if (input.hasAttribute('height') && input.hasAttribute('width')) {\n // Prioritizes user specified height 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 function getInputSize(input: BodyPixInput): [number, number] {\n if ((typeof (HTMLCanvasElement) !== 'undefined' &&\n input instanceof HTMLCanvasElement) ||\n (typeof (OffscreenCanvas) !== 'undefined' &&\n input instanceof OffscreenCanvas) ||\n (typeof (HTMLImageElement) !== 'undefined' &&\n input instanceof HTMLImageElement)) {\n return getSizeFromImageLikeElement(input);\n } else if (typeof (ImageData) !== 'undefined' && input instanceof ImageData) {\n return [input.height, input.width];\n } else if (\n typeof (HTMLVideoElement) !== 'undefined' &&\n input instanceof 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 (resolution - 1) % outputStride === 0;\n}\n\nexport function toValidInputResolution(\n inputResolution: number, outputStride: BodyPixOutputStride): number {\n if (isValidInputResolution(inputResolution, outputStride)) {\n return inputResolution;\n }\n\n return Math.floor(inputResolution / outputStride) * outputStride + 1;\n}\n\nconst INTERNAL_RESOLUTION_STRING_OPTIONS = {\n low: 'low',\n medium: 'medium',\n high: 'high',\n full: '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 = 0.1;\nconst MAX_INTERNAL_RESOLUTION = 2.0;\n\nfunction toInternalResolutionPercentage(\n internalResolution: BodyPixInternalResolution): number {\n if (typeof internalResolution === 'string') {\n const result = INTERNAL_RESOLUTION_PERCENTAGES[internalResolution];\n\n tf.util.assert(\n typeof result === 'number',\n () => `string value of inputResolution must be one of ${\n Object.values(INTERNAL_RESOLUTION_STRING_OPTIONS)\n .join(',')}\n 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 `was ${internalResolution}`);\n\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\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\n const targetAspect = targetW / targetH;\n const aspect = width / height;\n\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\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\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\n    return padded;\n  });\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\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, nearestNeighbor));\n  });\n}\n\nexport function padAndResizeTo(\n    input: BodyPixInput, [targetH, targetW]: [number, number]):\n    {resized: tf.Tensor3D, padding: Padding} {\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 * (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\nexport async function toTensorBuffers3D(tensors: tf.Tensor3D[]):\n    Promise<TensorBuffer3D[]> {\n  return Promise.all(tensors.map(tensor => tensor.buffer()));\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 * scaleX + offsetX,\n        y: position.y * scaleY + offsetY\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\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\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\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) / (inputResolutionHeight);\n const scaleX =\n (width + padding.left + padding.right) / (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 License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 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 to the model hosted on\n * GCP.\n *\n * `quantBytes`: An optional number with values: 1, 2, or 4. This parameter\n * affects weight quantization in the models. The available options are\n * 1 byte, 2 bytes, and 4 bytes. The higher the value, the larger the model size\n * and thus the longer the loading time, the lower the value, the shorter the\n * loading time but lower the accuracy.\n */\nexport interface ModelConfig {\n architecture: BodyPixArchitecture;\n outputStride: BodyPixOutputStride;\n multiplier?: BodyPixMultiplier;\n modelUrl?: string;\n quantBytes?: BodyPixQuantBytes;\n}\n\n// The default configuration for loading MobileNetV1 based BodyPix.\n//\n// (And for references, the default configuration for loading ResNet\n// based PoseNet is also included).\n//\n// ```\n// const RESNET_CONFIG = {\n// architecture: 'ResNet50',\n// outputStride: 32,\n//

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quantBytes: 4,\n// } as ModelConfig;\n// ```\n\nconst MOBILENET_V1_CONFIG = {\n  architecture: 'MobileNetV1',\n
  outputStride: 16,\n  quantBytes: 4,\n  multiplier: 0.75,\n} as ModelConfig;\n\nconst VALID_ARCHITECTURE: BodyPixArchitecture[] = ['MobileNetV1', 'ResNet50'];\nconst VALID_STRIDE: {[id: string]: BodyPixOutputStride[]} = {\n  'MobileNetV1': [8, 16, 32],\n  'ResNet50': [32, 16]\n};\nconst VALID_MULTIPLIER: {[id: string]: BodyPixMultiplier[]} = {\n  'MobileNetV1': [0.50, 0.75, 1.0],\n  'ResNet50': [1.0]\n};\nconst VALID_QUANT_BYTES: BodyPixQuantBytes[] = [1, 2, 4];\n\nfunction validateModelConfig(config: ModelConfig): ModelConfig {\n  config = config || MOBILENET_V1_CONFIG;\n\n  if (config.architecture == null) {\n    config.architecture = 'MobileNetV1';\n  }\n  if (VALID_ARCHITECTURE.indexOf(config.architecture) < 0) {\n    throw new Error(\n        `Invalid architecture ${config.architecture}. ` +\n        `Should be one of ${VALID_ARCHITECTURE}`);\n  }\n  if (config.outputStride == null) {\n    config.outputStride = 16;\n  }\n  if (VALID_STRIDE[config.architecture].indexOf(config.outputStride)
  < 0) {\n    throw new Error(\n        `Invalid outputStride ${config.outputStride}. ` +\n        `Should be one of ${VALID_STRIDE[config.architecture]} ` +\n        `for architecture ${config.architecture}.`);\n  }\n\n  if (config.multiplier == null) {\n    config.multiplier = 1.0;\n  }\n  if (VALID_MULTIPLIER[config.architecture].indexOf(config.multiplier) < 0) {\n    throw new Error(\n        `Invalid multiplier ${config.multiplier}. ` +\n        `Should be one of ${VALID_MULTIPLIER[config.architecture]} ` +\n
  `for architecture ${config.architecture}.`);\n  }\n\n  if (config.quantBytes == null) {\n    config.quantBytes = 4;\n  }\n  if (VALID_QUANT_BYTES.indexOf(config.quantBytes) < 0) {\n    throw new Error(\n        `Invalid quantBytes ${config.quantBytes}. ` +\n        `Should be one of ${VALID_QUANT_BYTES} ` +\n        `for architecture ${config.architecture}.`);\n  }\n\n  return config;\n}\n\n/**\n * BodyPix inference is configurable using the following config dictionary.\n
  *\n * `flipHorizontal`: If the left-right keypoint of poses/part segmentation\n * should be flipped/mirrored horizontally. This should be set to true for\n * videos where the video is by default flipped horizontally (i.e. a webcam),\n * and you want the person & body part segmentation to be returned in the proper\n * orientation.\n *\n * `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 a\n * 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 *\n * `segmentationThreshold`: The minimum that segmentation values must\n * have to be considered part of the person. Affects the generation of the\n * segmentation mask. More specifically, it is the threshold
  used to binarize\n * the intermediate person segmentation probability. The probability of each\n * pixel belongs to a person is in range [0, 1]. If the probability is greater\n * than the `segmentationThreshold`, it will be set to 1 otherwise 0.\n *\n */\nexport interface InferenceConfig {\n  flipHorizontal?: boolean;\n  internalResolution?: BodyPixInternalResolution;\n  segmentationThreshold?: number;\n}\n\n/**\n * Person Inference Config\n *\n * `maxDetections`: Defaults to 10. Maximum number of person pose detections per\n * image.\n *\n * `scoreThreshold`: Defaults to 0.4. Only return person pose that have root\n * part score greater or equal to this value.\n *\n * `nmsRadius`: Defaults to 20. Non-maximum suppression part distance in pixels.\n * It needs to be strictly positive. Two pose keypoints suppress each other if\n * they are less than `nmsRadius` pixels away.\n */\nexport interface PersonInferenceConfig extends InferenceConfig {\n  maxDetections?: number;\n  scoreThreshold?:
  number;\n  nmsRadius?: number;\n}\n\n/**\n * Multiple Person Instance Inference Config\n *\n * `maxDetections`: Defaults to 10. Maximum number of returned instance\n * segmentation and pose detections per image.\n *\n * `scoreThreshold`: Defaults to 0.4. Only returns and uses person\n * poses for instance segmentation assignment when the pose has root part score\n * greater or equal to this value.\n *\n * `nmsRadius`: Defaults to 20. Non-maximum suppression part distance in pixels.\n * It needs to be strictly positive. Two parts suppress each other if they are\n * less than `nmsRadius` pixels away.\n *\n * `minKeypointScore`: Default to 0.3. Keypoints above the
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score are used\n * for matching and assigning segmentation mask to each person.\n *\n * `refineSteps`: Default to 10. The number of refinement steps used when\n * assigning the instance segmentation. It needs to be strictly positive. The\n * larger the higher the accuracy and slower the inference.\n *\n */\nexport interface MultiPersonInstanceInferenceConfig
extends InferenceConfig {\n maxDetections?: number;\n scoreThreshold?: number;\n nmsRadius?: number;\n minKeypointScore?: number;\n refineSteps?: number;\n}\n\nexport const PERSON_INFERENCE_CONFIG: PersonInferenceConfig = {\n flipHorizontal: false,\n internalResolution: 'medium',\n segmentationThreshold: 0.7,\n maxDetections: 10,\n scoreThreshold: 0.4,\n nmsRadius: 20,\n};\n\nexport const MULTI_PERSON_INSTANCE_INFERENCE_CONFIG:\n MultiPersonInstanceInferenceConfig = {\n flipHorizontal: false,\n internalResolution: 'medium',\n segmentationThreshold: 0.7,\n maxDetections: 10,\n scoreThreshold: 0.4,\n nmsRadius: 20,\n minKeypointScore: 0.3,\n refineSteps: 10\n};\n\nfunction validatePersonInferenceConfig(config: PersonInferenceConfig) {\n const {segmentationThreshold, maxDetections, scoreThreshold, nmsRadius} =\n config;\n\n if (segmentationThreshold < 0.0 || segmentationThreshold > 1.0) {\n throw new Error(\n `segmentationThreshold ${segmentationThreshold}. ` +\n `Should be in range [0.0, 1.0]`);\n }\n\n if (maxDetections <= 0) {\n throw new Error(\n `Invalid maxDetections ${maxDetections}. ` +\n `Should be > 0`);\n }\n\n if (scoreThreshold < 0.0 || scoreThreshold > 1.0) {\n throw new Error(\n `Invalid scoreThreshold ${scoreThreshold}. ` +\n `Should be in range [0.0, 1.0]`);\n }\n\n if (nmsRadius <= 0) {\n throw new Error(`Invalid nmsRadius ${nmsRadius}.`);\n }\n}\n\nfunction validateMultiPersonInstanceInferenceConfig(\n config: MultiPersonInstanceInferenceConfig) {\n const {\n segmentationThreshold,\n maxDetections,\n scoreThreshold,\n nmsRadius,\n minKeypointScore,\n refineSteps\n } = config;\n\n if (segmentationThreshold < 0.0 || segmentationThreshold > 1.0) {\n throw new Error(\n `segmentationThreshold ${segmentationThreshold}. ` +\n `Should be in range [0.0, 1.0]`);\n }\n\n if (maxDetections <= 0) {\n throw new Error(\n `Invalid maxDetections ${maxDetections}. ` +\n `Should be > 0`);\n }\n\n if (scoreThreshold < 0.0 || scoreThreshold > 1.0) {\n throw new Error(\n `Invalid scoreThreshold ${scoreThreshold}. ` +\n `Should be in range [0.0, 1.0]`);\n }\n\n if (nmsRadius <= 0) {\n throw new Error(`Invalid nmsRadius ${nmsRadius}.`);\n }\n\n if (minKeypointScore < 0 || minKeypointScore > 1) {\n throw new Error(\n `Invalid minKeypointScore ${minKeypointScore}.` +\n `Should be in range [0.0, 1.0]`);\n }\n\n if (refineSteps <= 0 || refineSteps > 20) {\n throw new Error(\n `Invalid refineSteps ${refineSteps}.` +\n `Should be in range [1, 20]`);\n }\n}\n\nexport class BodyPix {\n baseModel: BaseModel;\n\n constructor(net: BaseModel) {\n this.baseModel = net;\n }\n\n private predictForPersonSegmentation(input: tf.Tensor3D): {\n segmentLogits: tf.Tensor3D,\n heatmapScores: 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

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    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   *\n   * @param input
ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement)\n   * The input image to feed
through the network.\n   *\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   *\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   *\n   * @return A dictionary containing `segmentation`, `heatmapScores`, `offsets`,\n   * and `padding`:\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\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      } =
this.predictForPersonSegmentation(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      return {\n        segmentation: toMaskTensor(\n
tf.squeeze(scaledSegmentScores), segmentationThreshold),\n        heatmapScores,\n        offsets,\n
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:
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BodyPixInput,\n      config: PersonInferenceConfig = PERSON_INFERENCE_CONFIG):\n
 Promise<SemanticPersonSegmentation> {\n    config = {...PERSON_INFERENCE_CONFIG, ...config};\n\n
validatePersonInferenceConfig(config);\n\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\n
const [height, width] = segmentation.shape;\n\n    const result = await segmentation.data() as Uint8Array;\n
segmentation.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: 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\n    const {resized, padding} =\n
   padAndResizeTo(input, internalResolutionHeightAndWidth);\n    const {\n      segmentation,\n      longOffsets,\n
 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\n      const segmentation = toMaskTensor(\n          tf.squeeze(scaledSegmentScores),
config.segmentationThreshold);\n\n      return {\n        segmentation,\n        longOffsets: scaledLongOffsets,\n
heatmapScoresRaw: heatmapScores,\n        offsetsRaw: offsets,\n        displacementFwdRaw: displacementFwd,\n
  displacementBwdRaw: displacementBwd,\n      };\n    });\n\n    const tensorBuffers = await toTensorBuffers3D(\n
   [heatmapScoresRaw, offsetsRaw, displacementFwdRaw, displacementBwdRaw]);\n    const [scoresBuf,
offsetsBuf, displacementsFwdBuf, displacementsBwdBuf] =\n        tensorBuffers;\n\n    let poses =
```

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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 const instanceMasks = await decodePersonInstanceMasks(\n segmentation, longOffsets, poses, height, width,\n this.baseModel.outputStride, internalResolutionHeightAndWidth, padding,\n config.scoreThreshold, config.refineSteps, config.minKeypointScore,\n config.maxDetections);\n\n resized.dispose();\n segmentation.dispose();\n longOffsets.dispose();\n heatmapScoresRaw.dispose();\n offsetsRaw.dispose();\n displacementFwdRaw.dispose();\n displacementBwdRaw.dispose();\n\n return 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 pixels should have values [0-255].\n *\n * @param input ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement)\n * The input image to feed through the network.\n *\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 *\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 *\n * @return A dictionary containing `partSegmentation`, `heatmapScores`,\n * `offsets`, and `padding`:\n * - `partSegmentation`: A 2d Tensor with a part id from 0-24 for\n * the pixels that are part of a corresponding body part, and -1 otherwise.\n * - `heatmapScores`: A 3d Tensor of the keypoint heatmaps used by\n * single-person pose estimation decoding.\n * - `offsets`: A 3d Tensor of the keypoint offsets used by single-person pose\n * estimation decoding.\n * - `displacementFwd`: A 3d Tensor of the keypoint forward displacement\n * used 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 segmentPersonPartsActivation(\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 [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
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padding,\n internalResolutionHeightAndWidth\n
};\n }\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 *\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 *\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 single person decoding.\n *\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 */\n async segmentPersonParts(\n input: BodyPixInput,\n config: PersonInferenceConfig = PERSON_INFERENCE_CONFIG):\n Promise<SemanticPartSegmentation> {\n config = {...PERSON_INFERENCE_CONFIG, ...config};\n\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 predicts\n * instance-level multiple person body part segmentation & pose for each\n * person.\n *\n * This 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 PartSegmentation object, each containing a width,\n * height, a flattened array (with part id from 0-24 for the pixels that are\n * part of a 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 size is equal to `height` x `width`.\n */\n async segmentMultiPersonParts(\n input: BodyPixInput,\n config: MultiPersonInstanceInferenceConfig =\n MULTI_PERSON_INSTANCE_INFERENCE_CONFIG):
Promise<PartSegmentation[]> {\n config = {...MULTI_PERSON_INSTANCE_INFERENCE_CONFIG, ...config};\n\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

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padAndResizeTo(input, internalResolutionHeightAndWidth);\n  const {\n    segmentation,\n    longOffsets,\n  heatmapScoresRaw,\n    offsetsRaw,\n    displacementFwdRaw,\n    displacementBwdRaw,\n  partSegmentation,\n  } = tf.tidy(()
 => {\n    const {\n      segmentLogits,\n      longOffsets,\n      heatmapScores,\n      offsets,\n  displacementFwd,\n      displacementBwd,\n      partHeatmaps\n    } =
this.predictForMultiPersonInstanceSegmentationAndPart(resized);\n\n    // decoding with scaling.\n    const
scaledSegmentScores = scaleAndCropToInputTensorShape(\n        segmentLogits, [height, width],
internalResolutionHeightAndWidth,\n        [[padding.top, padding.bottom], [padding.left, padding.right]],\n
APPLY_SIGMOID_ACTIVATION);\n\n    // decoding with scaling.\n    const scaledPartSegmentationScores =
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    const segmentation = toMaskTensor(\n
tf.squeeze(scaledSegmentScores), config.segmentationThreshold);\n
    const partSegmentation =\n        decodeOnlyPartSegmentation(scaledPartSegmentationScores);\n    return {\n
   segmentation,\n      longOffsets: scaledLongOffsets,\n      heatmapScoresRaw: heatmapScores,\n
offsetsRaw: offsets,\n      displacementFwdRaw: displacementFwd,\n      displacementBwdRaw:
displacementBwd,\n      partSegmentation\n    };\n  });\n\n  const tensorBuffers = await toTensorBuffers3D(\n
  [heatmapScoresRaw, offsetsRaw, displacementFwdRaw, displacementBwdRaw]);\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
  const instanceMasks = await decodePersonInstancePartMasks(\n      segmentation, longOffsets,
partSegmentation, poses, height, width,\n      this.baseModel.outputStride, internalResolutionHeightAndWidth,
padding,\n      config.scoreThreshold, config.refineSteps, config.minKeypointScore,\n
config.maxDetections);\n\n  resized.dispose();\n  segmentation.dispose();\n  longOffsets.dispose();\n
heatmapScoresRaw.dispose();\n  offsetsRaw.dispose();\n  displacementFwdRaw.dispose();\n
displacementBwdRaw.dispose();\n  partSegmentation.dispose();\n\n  return instanceMasks;\n  }\n\n  public
dispose() {\n  this.baseModel.dispose();\n  }\n}\n\n/**\n * Loads the MobileNet BodyPix model.\n */\nasync
function loadMobileNet(config: ModelConfig): Promise<BodyPix> {\n  const outputStride = config.outputStride;\n
const quantBytes = config.quantBytes;\n  const multiplier = config.multiplier;\n  if (tf == null) {\n  throw new
Error(\n      `Cannot
 find TensorFlow.js. If you are using a <script> tag, please ` +\n      `also include @tensorflow/tfjs on the page
before using this\n      model.`);\n  }\n\n  const url = mobileNetSavedModel(outputStride, multiplier,
quantBytes);\n  const graphModel = await tfconv.loadGraphModel(config.modelUrl || url);\n  const mobilenet = new
MobileNet(graphModel, outputStride);\n  return new BodyPix(mobilenet);\n}\n\n/**\n * Loads the ResNet BodyPix
model.\n */\nasync function loadResNet(config: ModelConfig): Promise<BodyPix> {\n  const outputStride =
config.outputStride;\n  const quantBytes = config.quantBytes;\n  if (tf == null) {\n  throw new Error(\n
`Cannot find TensorFlow.js. If you are using a <script> tag, please ` +\n      `also include @tensorflow/tfjs on the
page before using this\n      model.`);\n  }\n\n  const url = resNet50SavedModel(outputStride, quantBytes);\n  const
graphModel = await tfconv.loadGraphModel(config.modelUrl || url);\n  const resnet = new ResNet(graphModel,
 outputStride);\n  return new BodyPix(resnet);\n}\n\n/**\n * Loads the BodyPix model instance from a checkpoint,
with the ResNet\n * or MobileNet architecture. The model to be loaded is configurable using the\n * config
dictionary ModelConfig. Please find more details in the\n * documentation of the ModelConfig.\n *\n * @param
config ModelConfig dictionary that contains parameters for\n * the BodyPix loading process. Please find more
details of each parameters\n * in the documentation of the ModelConfig interface. The predefined\n *
`MOBILENET_V1_CONFIG` and `RESNET_CONFIG` can also be used as references\n * for defining your
```

customized config.\n */\nexport async function load(config: ModelConfig = MOBILENET_V1_CONFIG):\n Promise<BodyPix> {\n config = validateModelConfig(config);\n if (config.architecture === 'ResNet50') {\n return loadResNet(config);\n } else if (config.architecture === 'MobileNetV1') {\n   return loadMobileNet(config);\n } else {\n   return 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, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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// method copied from bGlur in https://codepen.io/zhaojun/pen/zZmRQe\nexport function cpuBlur(\n canvas: HTMLCanvasElement|OffscreenCanvas,\n   image:
HTMLImageElement|HTMLVideoElement|HTMLCanvasElement|OffscreenCanvas,\n   blur: number) {\n const ctx = 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 : 2;\n for (let y = -blur; y <= blur; y += step) {\n   for (let x = -blur; x <= blur; x += step) {\n   const weight =\n alphaLeft * Math.exp(-(x * x + y * y) / (2 * delta * delta));\n   sum += weight;\n   }\n }\n for (let y = -blur; y <= blur; y += step) {\n   for (let x = -blur; x <= blur; x += step) {\n   ctx.globalAlpha = alphaLeft *\n Math.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 * @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 {cpuBlur} from './blur';\nimport {Color, PartSegmentation, PersonSegmentation} from
'./types';\nimport {SemanticPartSegmentation, SemanticPersonSegmentation} from './types';\nimport {getInputSize}
from './util';\n\nexport type Canvas = HTMLCanvasElement | OffscreenCanvas;\n\nconst offScreenCanvases:
{[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:

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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 * 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 * segmentation value at the pixel from the output.\n */\nexport 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;
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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;
 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\n  return new ImageData(bytes, width, height);\n}\n\nconst
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 *\n * @param partColors A multi-dimensional array of rgb colors indexed by\n * part id.
Must have 24 colors, one for every part.\n *\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 */\nexport 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  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
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  }\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 * Should be an integer between 0 and 20.\n *\n * @param flipHorizontal If the result should be
flipped horizontally.  Defaults\n * to false.\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 =
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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 * 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 */\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 // Draws horizontal grid lines that are `pixelCellWidth` apart from each\n // other.\n for (let i = 0; i < offscreenCanvas.height; i++) {\n   ctx.beginPath();\n   ctx.strokeStyle = '#ffffff';\n   ctx.moveTo(0, pixelCellWidth * i);\n   ctx.lineTo(canvas.width, pixelCellWidth * i);\n   ctx.stroke();\n }\n\n ctx.globalAlpha = 1.0 - maskOpacity;\n ctx.drawImage(image, 0, 0, blurredMask.width, blurredMask.height);\n
  ctx.restore();\n}\n\nfunction createPersonMask(\n   multiPersonSegmentation: PersonSegmentation[]|SemanticPersonSegmentation,\n   edgeBlurAmount: number): Canvas {\n const backgroundMaskImage = toMask(\n   multiPersonSegmentation, {r: 0, g: 0, b: 0, a: 255},\n   {r: 0, g: 0, b: 0, a: 0});\n\n const backgroundMask =\n   renderImageDataToOffScreenCanvas(backgroundMaskImage, CANVAS_NAMES.mask);\n if (edgeBlurAmount === 0) {\n   return backgroundMask;\n } else {\n   return drawAndBlurImageOnOffScreenCanvas(\n   backgroundMask, edgeBlurAmount, CANVAS_NAMES.blurredMask);\n }\n}\n\n/**\n * Given a personSegmentation and an image, draws the image with its background\n * blurred onto the canvas.\n *\n * @param canvas The canvas to draw the background-blurred image onto.\n *\n * @param image The image to blur the background of and draw.\n *\n * @param personSegmentation A SemanticPersonSegmentation or an array of\n * PersonSegmentation object.\n *\n * @param backgroundBlurAmount
 How many pixels in the background blend into each\n * other. Defaults to 3. Should be an integer between 1 and 20.\n *\n * @param edgeBlurAmount How many pixels to blur on the edge between the person\n * 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 drawBokehEffect(\n   canvas: Canvas, image: ImageType,\n   multiPersonSegmentation: SemanticPersonSegmentation|PersonSegmentation[],\n backgroundBlurAmount = 3, edgeBlurAmount = 3, flipHorizontal = false) {\n const blurredImage = drawAndBlurImageOnOffScreenCanvas(\n   image, backgroundBlurAmount, CANVAS_NAMES.blurred);\n canvas.width = blurredImage.width;\n canvas.height = blurredImage.height;\n\n const ctx = canvas.getContext('2d');\n\n if (Array.isArray(multiPersonSegmentation) &&\n   multiPersonSegmentation.length === 0) {\n   ctx.drawImage(blurredImage,
 0, 0);\n   return;\n }\n\n const personMask = createPersonMask(multiPersonSegmentation, edgeBlurAmount);\n\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\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, personMask, '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\nfunction
 createBodyPartMask(\n   multiPersonPartSegmentation: SemanticPartSegmentation|PartSegmentation[],\n bodyPartIdsToMask: number[], edgeBlurAmount: number): Canvas {\n const backgroundMaskImage = toMask(\n
  multiPersonPartSegmentation, {r: 0, g: 0, b: 0, a: 0},\n   {r: 0, g: 0, b: 0, a: 255}, true, bodyPartIdsToMask);\n\n const backgroundMask =\n   renderImageDataToOffScreenCanvas(backgroundMaskImage, CANVAS_NAMES.mask);\n if (edgeBlurAmount === 0) {\n   return backgroundMask;\n } else {\n   return drawAndBlurImageOnOffScreenCanvas(\n   backgroundMask, edgeBlurAmount, CANVAS_NAMES.blurredMask);\n }\n}\n\n/**\n * Given a personSegmentation and an image, draws the image with its background\n * blurred onto the canvas.\n *\n * @param canvas The canvas to draw the background-blurred image onto.\n *\n * @param image The image to blur the background of and draw.\n *\n * @param partSegmentation A SemanticPartSegmentation or an array of\n * PartSegmentation
 object.\n *\n * @param bodyPartIdsToBlur Default to [0, 1] (left-face and right-face). An\n * array of body part ids to blur. Each must be one of the 24 body part ids.\n *\n * @param backgroundBlurAmount How many pixels in the background blend into each\n * other. Defaults to 3. Should be an integer between 1 and 20.\n *\n * @param edgeBlurAmount How many pixels to blur on the edge between the person\n * 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], 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\n const ctx = canvas.getContext('2d');\n\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\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\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];\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","partMapLocations","tf.argMax","partMapFlattened","tf.reshape","tf.oneHot","clipByMask2d","image","mask","tf.mul","toMaskTensor","segmentScores","threshold","tf.tidy","tf.cast","tf.greater","tf.scalar","decodePartSegmentation","segmentationMask","_a","partMapHeight","partMapWidth","flattenedMap","partNumbers","tf.expandDims","tf.range","tf.matMul","partMap","partMapShiftedUpForClipping","tf.add","tf.sub","decodeOnlyPartSegmentation","model","outputStride","this","inputShape","inputs","tf.util","assert","BaseModel","input","asFloat","_this","preprocessInput","asBatch","results3d","predict","map","y","tf.squeeze","namedResults","nameOutputResults","heatmapScores","tf.sigmoid","heatmap","offsets","displacementFwd","displacementBwd","segmentation","partHeatmaps","longOffsets","partOffsets","dispose","__extends","MobileNet","tf.div","results","PART_NAMES","NUM_KEYPOINTS","length","PART_IDS","reduce","result","jointName","i","CONNECTED_PART_NAMES","POSE_CHAIN","CONNECTED_PART_INDICES","jointNameA","jointNameB","getScale","_b","padding","height","width","inputResolutionY","inputResolutionX","padT","padB","getOffsetPoint","x","keypoint","get","getImageCoords","part","heatmapX","heatmapY","clamp","a","min","max","squaredDistance","y1","x1","y2","x2","dy","dx","addVectors","b","computeDistance","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","matchEmbeddingToInstance","poses","numKptForMatching","_c","embed","pair","keypointsIndex","push","kMin","kMinDist","k","dist","getOutputResolution","decodeMultipleMasksCPU","posesAboveScore","inHeight","inWidth","dataArrays","Uint8Array","fill","j","n","decodeMultiplePartMasksCPU","partSegmentaion","Int32Array","decodeMultipleMasksWebGl","minKptScore","maxNumPeople","origHeight","origWidth","slice","outHeight","outWidth","shapedLongOffsets","poseVals","Float32Array","poseOffset","kp","offset","_d","posesTensor","tf.tensor","program","variableNames","outputShape","userCode","tf.backend","compileAndRun","toPersonKSegmentation","tf.equal","toPersonKPartSegmentation","bodyParts","isWebGlBackend","getBackend","decodePersonInstanceMasks","minPoseScore","minKeypointScore","filter","personSegmentations","masksTensorInfo","masksTensor","tf.engine","makeTensorFromDataId","dataId","dtype","_","Promise","all","data","personSegmentationsData","forEach","segmentationsData","longOffsetsData","decodePersonInstancePartMasks","partSegmentation","partSegmentations","partSegmentationsByPersonData","partSegmentaionData","half","floor","maxSize","getElementValue","priorityQueue","Array","numberOfElements","MaxHeap","swim","exchange","sink","less","getValueAt","scoreIsMaximumInLocalWindow","keypointId","localMaximumRadius","scores","localMaximum","yStart","yEnd","yCurrent","xStart","xEnd","xCurrent","buildPartWithScoreQueue","scoreThreshold","numKeypoints","queue","enqueue","id","parentChildrenTuples","parentJoinName","childJoinName","parentToChildEdges","childToParentEdges","getDisplacement","edgeId","point","displacements","numEdges","getStridedIndexNearPoint","traverseToTargetKeypoint","sourceKeypoint","targetKeypointId","scoresBuffer","offsetRefineStep","displacement","targetKeypoint","targetKeypointIndices","offsetPoint"

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Dilation2D.ts","../../src/kernels/Elu.ts","../../src/kernels/EluGrad.ts","../../src/kernels/Equal.ts","../../src/kernels/Erf.ts","../../src/kernels/ExpandDims.ts","../src/fft_gpu.ts","../../src/kernels/FFT_impl.ts","../../src/kernels/FFT.ts","../src/fill_gpu.ts","../../src/kernels/Fill.ts","../src/flip_left_right_gpu.ts","../../src/kernels/FlipLeftRight.ts","../../src/kernels/FloorDiv.ts","../../../src/kernels/FromPixels_utils/from_pixels_gpu.ts","../../../src/kernels/FromPixels_utils/from_pixels_packed_gpu.ts","../../src/kernels/FromPixels.ts","../../src/kernels/FusedConv2D.ts","../../src/kernels/FusedDepthwiseConv2D.ts","../src/gather_nd_gpu.ts","../../src/kernels/GatherNd.ts","../src/gather_gpu.ts","../../src/kernels/GatherV2.ts","../../src/kernels/GreaterEqual.ts","../../src/kernels/IFFT.ts","../../src/kernels/IsFinite.ts","../../src/kernels/IsInf.ts","../../src/kernels/IsNaN.ts","../../src/kernels/LessEqual.ts","../../src/kernels/LinSpace.ts","../../src/kernels/Log1p.ts","../../src/kernels/LogicalAnd.ts","../../src/kernels/LogicalNot.ts","../../src/kernels/LogicalOr.ts","../src/lrn_gpu.ts","../src/lrn_packed_gpu.ts","../../src/kernels/LRN.ts","../src/lrn_grad_gpu.ts","../../src/kernels/LRNGrad.ts","../../src/kernels/Max.ts","../../src/kernels/MaxPool.ts","../../src/kernels/MaxPool3D.ts","../src/max_pool_backprop_gpu.ts","../../src/kernels/MaxPool3DGrad.ts","../../src/kernels/MaxPoolGrad.ts","../../src/kernels/MaxPoolWithArgmax_impl.ts","../../src/kernels/MaxPoolWithArgmax.ts","../../src/kernels/Mean_impl.ts","../../src/kernels/Mean.ts","../../src/kernels/Min.ts","../src/mirror_pad_gpu.ts","../src/mirror_pad_packed_gpu.ts","../../src/kernels/MirrorPad.ts","../../src/kernels/Mod.ts","../src/multinomial_gpu.ts","../../src/kernels/RealDiv.ts","../../src/kernels/Softmax.ts","../../src/kernels/Multinomial.ts","../../src/kernels/NonMaxSuppressionV3.ts","../../src/kernels/NonMaxSuppressionV4.ts","../../src/kernels/NonMaxSuppressionV5.ts","../src/onehot_gpu.ts","../../src/kernels/OneHot.ts","../../src/kernels/ZerosLike.ts","../../src/kernels/OnesLike.ts","../../src/kernels/Pack.ts","../src/pad_gpu.ts","../src/pad_packed_gpu.ts","../../src/kernels/PadV2.ts","../../src/kernels/Pow.ts","../../src/kernels/Range.ts","../../src/kernels/Reciprocal.ts","../../src/kernels/Relu.ts","../../src/kernels/Relu6.ts","../src/resize_bilinear_gpu.ts","../src/resize_bilinear_packed_gpu.ts","../../src/kernels/ResizeBilinear.ts","../src/resize_bilinear_backprop_gpu.ts","../../src/kernels/ResizeBilinearGrad.ts","../src/resize_nearest_neighbor_gpu.ts","../../src/kernels/ResizeNearestNeighbor.ts","../src/resize_nearest_neighbor_backprop_gpu.ts","../../src/kernels/ResizeNearestNeighborGrad.ts","../src/reverse_gpu.ts","../src/reverse_packed_gpu.ts","../../src/kernels/Reverse.ts","../src/rotate_gpu.ts","../../src/kernels/RotateWithOffset.ts","../../src/kernels/Round.ts","../src/scatter_gpu.ts","../../src/kernels/ScatterNd.ts","../src/select_gpu.ts","../../src/kernels/Select.ts","../../src/kernels/Selu.ts","../../src/kernels/Sigmoid.ts","../../src/kernels/Sign.ts","../../src/kernels/Sin.ts","../../src/kernels/Sinh.ts","../../src/kernels/Softplus.ts","../../src/kernels/SpaceToBatchND.ts","../../src/kernels/SparseToDense.ts","../../src/kernels/SplitV.ts","../../src/kernels/Sqrt.ts","../../src/kernels/Square.ts","../../src/kernels/Step.ts","../src/strided_slice_gpu.ts","../../src/kernels/StridedSlice.ts","../../src/kernels/Tan.ts","../../src/kernels/Tanh.ts","../src/tile_gpu.ts","../../src/kernels/Tile.ts","../../src/kernels/TopK.ts","../../src/kernels/Unique.ts","../../src/kernels/Unpack.ts","../src/segment_gpu.ts","../../src/kernels/UnsortedSegmentSum.ts","../src/register_all_kernels.ts","../../src/data/compiled_api.ts","../../../src/operations/custom_op/register.ts","../../../src/operations/executors/utils.ts","../../../src/operations/op_list/arithmetic.ts","../../../src/operations/op_list/basic_math.ts","../../../src/operations/op_list/control.ts","../../../src/operations/op_list/convolution.ts","../../../src/operations/op_list/creation.ts","../../../src/operations/op_list/dynamic.ts","../../../src/operations/op_list/evaluation.ts","../../../src/operations/op_list/graph.ts","../../../src/operations/op_list/hash_table.ts","../../../src/operations/op_list/image.ts","../../../src/operations/op_list/logical.ts","../../../src/operations/op_list/matrices.ts","../../../src/operations/op_list/normalization.ts","../../../src/operations/op_list/reduction.ts","../../../src/operations/op_list/slice_join.ts","../../../src/operations/op_list/spectral.ts","../../../src/operations/op_list/transformation.ts","../../src/operations/operation_mapper.ts","../../../src/operations/custom_op/node_value_impl.ts","../../src/ops/ops_for_converter.ts","../../../src/operations/executors/arithmetic_executor.ts","../../../src/operations/executors/basic_math_executor.ts","../../src/executor/tensor_utils.ts","../../src/executor/tensor_array.ts","../../src/executor/tensor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inish","onMouseDrag","diff","onMouseUp","unbind","attempted","onMouseDown","i1","i2","o1","o2","NumberControllerSlider","preventDefault","bgRect","__background","getBoundingClientRect","onTouchMove","touches","onTouchEnd","__foreground","onTouchStart","addClass","pct","FunctionController","text","__button","fire","ColorContro

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ckpoint","toFloatIfInt$1","ResNet","MOBILENET_V1_C

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,QAAA;AzDoJf,aAAA,OAAA,eAAA,QAAA,aAAA,CAAA,OAAA,IAAA,QAAA,aAAA,cAAA,QAAA,YAAA,QAAA,gBAAA,QAAA,qBAAA,EAAA,MAAA,IAAA,QAAA,gBAAA,QAAA,qBAAA,QAAA,QAAA,aAAA,QAAA,UAAA,QAAA,eAAA,QAAA,o

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,IAC9B,KAAA,qBAAqB,GACtB,IAAI,EAAc,EAAM,UAAU,GAAO,QA5F/C,gBACK,OAAA,KAAK,OAAS,KA
AK,OAAO,UAAY,KAAK,WAGhD,0BACK,OAAA,KAAK,OAAS,KAAK,OAAO,oBACZ,KAAK,qBAGxB,gBACK,OAAA,KAAK,OAAS,KAAK,OAAO,UAAY,KAAK,WAGhD,cAAU,GACN,MAAA,EAAY,OAAO,KAAK,G
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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\nimport {Backend, DataId} from '../tensor';\nimport {BackendValues, DataType} from '../types';\n\nexport const EPSILON_FLOAT32 = 1e-7;\nexport const EPSILON_FLOAT16 = 1e-4;\n\n// Required information for all backends.\nexport interface BackendTimingInfo {\n  kernelMs: number|{error: string};\n  getExtraProfileInfo?(): string;  // a field for additional timing information\n                                   // e.g. 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(\n      dataId: DataId, values: BackendValues, shape: number[], dtype: DataType,\n      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\n  constructor(private backend: KernelBackend, private dataMover: DataMover) {}\n\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\n  set(dataId: DataId, value: T): void {\n    this.dataIdsCount++;\n    this.data.set(dataId, value);\n  }\n\n  has(dataId: DataId): boolean {\n    return this.data.has(dataId);\n  }\n\n  delete(dataId: DataId): boolean {\n    this.dataIdsCount--;\n    return this.data.delete(dataId);\n  }\n\n  numDataIds(): number {\n    return this.dataIdsCount;\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(\n      dataId: DataId, values: BackendValues, shape: number[], dtype: DataType,\n      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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Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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, 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|\n 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 * @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,\n// tslint:disable-next-line:no-any\n array2: any[]|Uint32Array|Int32Array|Float32Array): void {\n\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 * @param b The maximum support (exclusive).\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 * @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  } else if (x === -Infinity) {\n    return -1;\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 * 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\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      setTimeout(tryFn, nextBackoff);\n    };\n\n    tryFn();\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
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  if (size % shapeProd !== 0) {\n    throw Error(\n        `The implicit shape can't be a fractional number. ` +\n
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`Got ${size} / ${shapeProd}`);\n  }\n\n  const newShape = shape.slice();\n  newShape[implicitIdx] = size / shapeProd;\n  return newShape;\n}\n\nexport function parseAxisParam(\n    axis: number|number[], shape: number[]): number[] {\n  const rank = shape.length;\n\n  // Normalize input\n  axis = axis == null ? shape.map((s, i) => i) : [].concat(axis);\n\n  // Check for valid range\n  assert(\n      axis.every(ax => ax >= -rank && ax < rank),\n      () =>\n          `All values in axis param must be in range [-${rank}, ${rank}) but ` +\n          `got axis ${axis}`);\n\n  // Check for only integers\n  assert(\n      axis.every(ax => isInt(ax)),\n      () => `All values in axis param must be integers but ` +\n          `got axis ${axis}`);\n\n  // Handle negative axis.\n  return axis.map(a => a < 0 ? rank + a : a);\n}\n\n/** Reduces the shape by removing all dimensions of shape 1. */\nexport function squeezeShape(shape: number[], axis?: number[]):\n    {newShape: number[], keptDims: number[]} {\n  const newShape: number[] = [];\n  const keptDims: number[] = [];\n  const isEmptyArray = 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 i = 0; i < shape.length; ++i) {\n    if (axes != null) {\n      if (axes[j] === i && shape[i] !== 1) {\n        throw new Error(\n            `Can't squeeze axis ${i} since its dim '${shape[i]}' is not 1`);\n      }\n      if ((axes[j] == null || axes[j] > 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 (dtype === 'bool') {\n    values = new Uint8Array(size);\n  } else {\n    throw new Error(`Unknown data type ${dtype}`);\n  }\n  return values as DataTypeMap[D];\n}\n\nexport function getArrayFromDType<D extends DataType>(\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 (dtype === 'bool') {\n    values = new Uint8Array(size);\n  } else if (dtype === 'string') {\n    values = new Array<'string'>(size);\n  } else {\n    throw new Error(`Unknown data type ${dtype}`);\n  }\n  return values as DataTypeMap[D];\n}\n\nexport function checkConversionForErrors<D 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} being uploaded contains ${num}.`);\n    }\n  }\n}\n\n/** Returns true if the dtype is valid. */\nexport function isValidDtype(dtype: DataType): boolean {\n  return dtype === 'bool' || dtype === 'complex64' || dtype === 'float32' ||\n      dtype === 'int32' || dtype === 'string';\n}\n\n/**\n * Returns true if the new type can't encode the old type without loss of\n * precision.\n */\nexport function hasEncodingLoss(oldType: DataType, newType: DataType): boolean {\n  if (newType === 'complex64') {\n    return false;\n  }\n  if (newType === 'float32' && oldType !== 'complex64') {\n    return false;\n  }\n  if (newType === 'int32' && oldType !== 'float32' && oldType !== 'complex64') {\n    return false;\n  }\n  if (newType === 'bool' && oldType === 'bool') {\n    return false;\n  }\n  return true;\n}\n\nexport function isTypedArray(a: {}): a is Float32Array|Int32Array|Uint8Array {\n  return a instanceof Float32Array || a instanceof Int32Array ||\n      a instanceof Uint8Array;\n}\n\nexport function bytesPerElement(dtype: DataType): number {\n  if (dtype === 'float32' || dtype === 'int32') {\n    return 4;\n  } else if (dtype === 'complex64') {\n    return 8;\n  } else if (dtype === 'bool') {\n    return 1;\n  } else {\n    throw new Error(`Unknown dtype ${dtype}`);\n  }\n}\n\n/**\n * Returns the approximate number of bytes allocated in the string array - 2\n * bytes per character. Computing the exact bytes for a native string in JS is\n * not possible since it depends on the encoding of the html page that serves\n * the website.\n */\nexport function bytesFromStringArray(arr: Uint8Array[]): number {\n  if (arr == null) {\n    return 0;\n  }\n  let bytes = 0;\n  arr.forEach(x => bytes += x.length);\n  return bytes;\n}\n\n/** Returns true if the value is a string. */\nexport function isString(value: {}): value is string {\n  return typeof value === 'string' || value instanceof String;\n}\n\nexport function isBoolean(value: {}): boolean {\n  return typeof value === 'boolean';\n}\n\nexport function isNumber(value: {}): boolean {\n  return typeof value === 'number';\n}\n\nexport function 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 return 'float32';\n}\n\nexport function isFunction(f: Function) {\n return !!(f && f.constructor && f.call && f.apply);\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\nexport function computeStrides(shape: number[]): number[] {\n const rank = shape.length;\n if (rank < 2) {\n return [];\n }\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\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// 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\n return createNestedArray(0, shape, a);\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\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 * 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 ${dtype}`);\n }\n}\n\nexport function assertNonNegativeIntegerDimensions(shape: number[]) {\n shape.forEach(dimSize => {\n assert(\n   Number.isInteger(dimSize) && dimSize >= 0,\n   () =>\n   `Tensor must have a shape comprised of positive integers but got ` +\n   `shape [${shape}].`);\n });\n}\n\n/**\n * Computes flat index for a given location (multidimentionsal index) in a\n * Tensor/multidimensional array.\n *\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 * Computes the location (multidimensional index) in a tensor/multidimentional\n * array for a given flat index.\n *\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 * This method asserts whether an object is a Promise instance.\n * @param object\n */\n// tslint:disable-next-line: no-

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 framework that uses zone.js. zone.js monkey patch\n // the async calls, so it is possible the obj (patched) is comparing to a\n // pre-patched Promise.\n return object && object.then && typeof object.then === 'function';\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\nimport {Platform} from './platforms/platform';\nimport {isPromise} from './util_base';\n\n// Expects flags from URL in the format ?tfjsflags=FLAG1:1,FLAG2:true.\nconst TENSORFLOWJS_FLAGS_PREFIX = 'tfjsflags';\n\ntype FlagValue = number|boolean;\ntype FlagEvaluationFn = (() => FlagValue)|(() => Promise<FlagValue>);\nexport type Flags = {\n [featureName: string]: FlagValue\n};\nexport type FlagRegistryEntry = {\n evaluationFn: FlagEvaluationFn;\n setHook?: (value: FlagValue) => void;\n};\n\n/**\n * The environment contains evaluated flags as well as the registered platform.\n * This is always used as a global singleton and can be retrieved with\n * `tf.env()`.\n *\n * @doc {heading: 'Environment'}\n */\nexport class Environment {\n private flags: Flags = {};\n private flagRegistry: {[flagName: string]: FlagRegistryEntry} = {};\n\n private urlFlags: Flags = {};\n\n platformName: string;\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 != null) {\n   console.warn(\n   `Platform ${this.platformName} has already been set. ` +\n   `Overwriting the 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   this.flagRegistry[flagName] = {evaluationFn, setHook};\n\n   // Override the flag value from the URL. This has to happen here because the\n   // environment is initialized before flags get 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, flagValue);\n   }\n }\n\n async getAsync(flagName: string): Promise<FlagValue> {\n   if (flagName in this.flags) {\n   return this.flags[flagName];\n   }\n\n   this.flags[flagName] = await this.evaluateFlag(flagName);\n   return this.flags[flagName];\n }\n\n get(flagName: string): FlagValue {\n   if (flagName in this.flags) {\n   return 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() instead.`);\n   }\n\n   this.flags[flagName] = flagValue as number | boolean;\n\n   return this.flags[flagName];\n }\n\n getNumber(flagName: string): number {\n   return this.get(flagName) as number;\n }\n\n getBool(flagName: string): boolean {\n   return this.get(flagName) as boolean;\n }\n\n getFlags(): Flags {\n   return this.flags;\n }\n // For backwards compatibility.\n get features(): Flags {\n   return this.flags;\n }\n\n set(flagName: string, value: FlagValue): void {\n   if (this.flagRegistry[flagName] == null) {\n   throw new Error(\n   `Cannot set flag ${flagName} as it has not been registered.`);\n   }\n   this.flags[flagName] = value;\n   if (this.flagRegistry[flagName].setHook != null) {\n   this.flagRegistry[flagName].setHook(value);\n   }\n }\n\n private evaluateFlag(flagName: string): FlagValue|Promise<FlagValue> {\n   if (this.flagRegistry[flagName] == null) {\n   throw new Error(\n   `Cannot evaluate flag '${flagName}': no evaluation function found.`);\n   }\n   return this.flagRegistry[flagName].evaluationFn();\n }\n\n setFlags(flags: Flags) {\n   this.flags = Object.assign({}, flags);\n }\n\n reset() {\n   this.flags = {};\n   this.urlFlags = {};\n   this.populateURLFlags();\n }\n\n private populateURLFlags(): void {\n   if (typeof

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(/[?&]([^=?&]+)(?:=([^&]*))?/g, (s, ...t)
=> {\n decodeParam(params, t[0], t[1]);\n return t.join('=');\n });\n return params;\n}\n\nfunction decodeParam(\n params: {[key: string]: string}, name: string, value?: string) {\n params[decodeURIComponent(name)] = decodeURIComponent(value || '');\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 * 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 */\nexport function env() {\n return ENV;\n}\n\nexport let ENV: Environment = null;\nexport function setEnvironmentGlobal(environment: Environment) {\n ENV = environment;\n}\n","//
shim for using process in browser\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\nvar cachedSetTimeout;\nvar cachedClearTimeout;\n\nfunction defaultSetTimout() {\n throw new Error('setTimeout has not been defined');\n}\nfunction defaultClearTimeout () {\n throw new Error('clearTimeout has not been defined');\n}\n(function () {\n try {\n if (typeof setTimeout === 'function') {\n cachedSetTimeout = setTimeout;\n } else {\n cachedSetTimeout = defaultSetTimout;\n }\n } catch (e) {\n cachedSetTimeout = defaultSetTimout;\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} ())\nfunction runTimeout(fun) {\n if (cachedSetTimeout === setTimeout) {\n //normal enviroments in sane situations\n return setTimeout(fun, 0);\n }\n // if setTimeout wasn't available but was latter defined\n if ((cachedSetTimeout === defaultSetTimout || !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 evaled 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', hopfully 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 enviroments 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 evaled 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', hopfully 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}\nvar queue = [];\nvar draining = false;\nvar currentQueue;\nvar queueIndex = -1;\n\nfunction cleanUpNextTick() {\n if (!draining ||

!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\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 predictible objects\nfunction Item(fun, array) {\n this.fun = fun;\n this.array = array;\n}\nItem.prototype.run = function () {\n this.fun.apply(null, this.array);\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};\nprocess.umask = function() { return 0; };\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// tslint:disable-next-line:no-any\nlet globalNameSpace: {_tfGlobals: Map<string, any>};\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 * the first time it is fetched.\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 * @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// 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 =

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 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 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 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 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 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 =

'Dilation2DBackpropInput';\nexport type Dilation2DBackpropInputInputs
=\n Pick<NamedTensorInfoMap, 'x'|'filter'|'dy'>;\n\nexport const Dilation2DBackpropFilter =
'Dilation2DBackpropFilter';\nexport type Dilation2DBackpropFilterInputs =\n Pick<NamedTensorInfoMap,
'x'|'filter'|'dy'>;\n\nexport const RealDiv = 'RealDiv';\nexport type RealDivInputs = BinaryInputs;\n\nexport const
Elu = 'Elu';\nexport type EluInputs = Pick<NamedTensorInfoMap, 'x'>;\n\nexport const EluGrad =
'EluGrad';\nexport type EluGradInputs = Pick<NamedTensorInfoMap, 'dy'|'y'>;\n\nexport const Erf = 'Erf';\nexport
type ErfInputs = UnaryInputs;\n\nexport const Equal = 'Equal';\nexport type EqualInputs = BinaryInputs;\n\nexport
const Exp = 'Exp';\nexport type ExpInputs = UnaryInputs;\n\nexport const ExpandDims = 'ExpandDims';\nexport
type ExpandDimsInputs = Pick<NamedTensorInfoMap, 'input'>;\nexport interface ExpandDimsAttrs {\n dim:
number;\n}\n\nexport const Expm1 = 'Expm1';\nexport type Expm1Inputs = UnaryInputs;\n\nexport const FFT =
'FFT';\nexport type FFTInputs =
Pick<NamedTensorInfoMap, 'input'>;\n\nexport const Fill = 'Fill';\nexport interface FillAttrs {\n shape:
number[];\n value: number|string;\n dtype: DataType;\n}\n\nexport const FlipLeftRight = 'FlipLeftRight';\nexport
type FlipLeftRightInputs = Pick<NamedTensorInfoMap, 'image'>;\n\nexport const Floor = 'Floor';\nexport type
FloorInputs = UnaryInputs;\n\nexport const FloorDiv = 'FloorDiv';\nexport type FloorDivInputs =
BinaryInputs;\n\nexport const FusedBatchNorm = 'FusedBatchNorm';\nexport type FusedBatchNormInputs =\n
Pick<NamedTensorInfoMap, 'x'|'scale'|'offset'|'mean'|'variance'>;\nexport interface FusedBatchNormAttrs {\n
varianceEpsilon: number;\n}\n\nexport const GatherV2 = 'GatherV2';\nexport type GatherV2Inputs =
Pick<NamedTensorInfoMap, 'x'|'indices'>;\nexport interface GatherV2Attrs {\n axis: number;\n batchDims:
number;\n}\n\nexport const GatherNd = 'GatherNd';\nexport type GatherNdInputs = Pick<NamedTensorInfoMap,
'params'|'indices'>;\n\nexport const Greater = 'Greater';\nexport
type GreaterInputs = BinaryInputs;\n\nexport const GreaterEqual = 'GreaterEqual';\nexport type GreaterEqualInputs
= BinaryInputs;\n\nexport const Identity = 'Identity';\nexport type IdentityInputs = Pick<NamedTensorInfoMap,
'x'>;\n\nexport const IFFT = 'IFFT';\nexport type IFFTInputs = Pick<NamedTensorInfoMap, 'input'>;\n\nexport
const Imag = 'Imag';\nexport type ImagInputs = Pick<NamedTensorInfoMap, 'input'>;\n\nexport const IsFinite =
'IsFinite';\nexport type IsFiniteInputs = UnaryInputs;\n\nexport const IsInf = 'IsInf';\nexport type IsInfInputs =
UnaryInputs;\n\nexport const IsNan = 'IsNan';\nexport type IsNanInputs = UnaryInputs;\n\nexport const LeakyRelu
= 'LeakyRelu';\nexport type LeakyReluInputs = Pick<NamedTensorInfoMap, 'x'>;\nexport interface LeakyReluAttrs
{\n alpha: number;\n}\n\nexport const Less = 'Less';\nexport type LessInputs = BinaryInputs;\n\nexport const
LessEqual = 'LessEqual';\nexport type LessEqualInputs = BinaryInputs;\n\nexport const LinSpace =
'LinSpace';\nexport interface LinSpaceAttrs {\n start: number;\n stop: number;\n num: number;\n}\nexport const
Log = 'Log';\nexport type LogInputs = UnaryInputs;\n\nexport const Log1p = 'Log1p';\nexport type Log1pInputs =
UnaryInputs;\n\nexport const LogicalAnd = 'LogicalAnd';\nexport type LogicalAndInputs = BinaryInputs;\n\nexport
const LogicalNot = 'LogicalNot';\nexport type LogicalNotInputs = Pick<NamedTensorInfoMap, 'x'>;\n\nexport
const LogicalOr = 'LogicalOr';\nexport type LogicalOrInputs = BinaryInputs;\n\nexport const LogSoftmax =
'LogSoftmax';\nexport type LogSoftmaxInputs = Pick<NamedTensorInfoMap, 'logits'>;\nexport interface
LogSoftmaxAttrs {\n axis: number;\n}\n\nexport const LRN = 'LRN';\nexport type LRNInputs =
Pick<NamedTensorInfoMap, 'x'>;\nexport interface LRNAttrs {\n depthRadius: number;\n bias: number;\n alpha:
number;\n beta: number;\n}\n\nexport const LRNGrad = 'LRNGrad';\nexport type LRNGradInputs =
Pick<NamedTensorInfoMap, 'x'|'y'|'dy'>;\nexport interface
LRNGradAttrs {\n depthRadius: number;\n bias: number;\n alpha: number;\n beta: number;\n}\n\nexport const
Max = 'Max';\nexport type MaxInputs = Pick<NamedTensorInfoMap, 'x'>;\nexport interface MaxAttrs {\n
reductionIndices: number|number[];\n keepDims: boolean;\n}\n\nexport const Maximum = 'Maximum';\nexport
type MaximumInputs = BinaryInputs;\n\nexport const MaxPool = 'MaxPool';\nexport type MaxPoolInputs =
Pick<NamedTensorInfoMap, 'x'>;\nexport interface MaxPoolAttrs {\n filterSize: [number, number]|number;\n
strides: [number, number]|number;\n pad: 'valid'|'same'|number;\n dimRoundingMode?:
'floor'|'round'|'ceil';\n}\n\nexport const MaxPoolGrad = 'MaxPoolGrad';\nexport type MaxPoolGradInputs =
Pick<NamedTensorInfoMap, 'dy'|'input'|'output'>;\nexport interface MaxPoolGradAttrs {\n filterSize: [number,

number]|number;\n strides: [number, number]|number;\n pad: 'valid'|'same'|number;\n dimRoundingMode?: 'floor'|'round'|'ceil';\n}\n\nexport const MaxPool3D = 'MaxPool3D';\nexport
 type MaxPool3DInputs = Pick<NamedTensorInfoMap, 'x'>;\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\nexport const MaxPool3DGrad = 'MaxPool3DGrad';\nexport type MaxPool3DGradInputs =\n   Pick<NamedTensorInfoMap, 'dy'|'input'|'output'>;\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\nexport const MaxPoolWithArgmax = 'MaxPoolWithArgmax';\nexport type MaxPoolWithArgmaxInputs = Pick<NamedTensorInfoMap, 'x'>;\nexport interface MaxPoolWithArgmaxAttrs {\n filterSize: [number, number]|number;\n strides: [number, number]|number;\n pad: 'valid'|'same'|number;\n includeBatchInIndex: boolean;\n}\n\nexport const Mean = 'Mean';\nexport
 type MeanInputs = Pick<NamedTensorInfoMap, 'x'>;\nexport interface MeanAttrs {\n axis: number|number[];\n keepDims: boolean;\n}\n\nexport const Min = 'Min';\nexport type MinInputs = Pick<NamedTensorInfoMap, 'x'>;\nexport interface MinAttrs {\n axis: number|number[];\n keepDims: boolean;\n}\n\nexport const Minimum = 'Minimum';\nexport type MinimumInputs = BinaryInputs;\n\nexport const MirrorPad = 'MirrorPad';\nexport type MirrorPadInputs = Pick<NamedTensorInfoMap, 'x'>;\nexport interface MirrorPadAttrs {\n paddings: Array<[number, number]>;\n mode: 'reflect'|'symmetric';\n}\n\nexport const Mod = 'Mod';\nexport type ModInputs = BinaryInputs;\n\nexport const Multinomial = 'Multinomial';\nexport type MultinomialInputs = Pick<NamedTensorInfoMap, 'logits'>;\nexport interface MultinomialAttrs {\n numSamples: number;\n seed: number;\n normalized: boolean;\n}\n\nexport const Multiply = 'Multiply';\nexport type MultiplyInputs = BinaryInputs;\n\nexport const Neg = 'Neg';\nexport type
 NegInputs = UnaryInputs;\n\nexport const NotEqual = 'NotEqual';\nexport type NotEqualInputs = BinaryInputs;\n\nexport const NonMaxSuppressionV3 = 'NonMaxSuppressionV3';\nexport type NonMaxSuppressionV3Inputs =\n   Pick<NamedTensorInfoMap, 'boxes'|'scores'>;\nexport interface NonMaxSuppressionV3Attrs {\n maxOutputSize: number;\n iouThreshold: number;\n scoreThreshold: number;\n}\n\nexport const NonMaxSuppressionV4 = 'NonMaxSuppressionV4';\nexport type NonMaxSuppressionV4Inputs =\n   Pick<NamedTensorInfoMap, 'boxes'|'scores'>;\nexport interface NonMaxSuppressionV4Attrs {\n maxOutputSize: number;\n iouThreshold: number;\n scoreThreshold: number;\n padToMaxOutputSize: boolean;\n}\n\nexport const NonMaxSuppressionV5 = 'NonMaxSuppressionV5';\nexport type NonMaxSuppressionV5Inputs =\n   Pick<NamedTensorInfoMap, 'boxes'|'scores'>;\nexport interface NonMaxSuppressionV5Attrs {\n maxOutputSize: number;\n iouThreshold: number;\n scoreThreshold: number;\n softNmsSigma: number;\n}\n\nexport
 const OnesLike = 'OnesLike';\nexport type OnesLikeInputs = UnaryInputs;\n\nexport const OneHot = 'OneHot';\nexport type OneHotInputs = Pick<NamedTensorInfoMap, 'indices'>;\nexport interface OneHotAttrs {\n depth: number;\n onValue: number;\n offValue: number;\n}\n\nexport const Pack = 'Pack';\nexport type PackInputs = TensorInfo[];\nexport interface PackAttrs {\n axis: number;\n}\n\nexport const PadV2 = 'PadV2';\nexport type PadV2Inputs = Pick<NamedTensorInfoMap, 'x'>;\nexport interface PadV2Attrs {\n paddings: Array<[number, number]>;\n constantValue: number;\n}\n\nexport const Pool = 'Pool';\nexport type PoolInputs = Pick<NamedTensorInfoMap, 'input'>;\n\nexport const Pow = 'Pow';\nexport type PowInputs = BinaryInputs;\n\nexport const Prelu = 'Prelu';\nexport type PreluInputs = Pick<NamedTensorInfoMap, 'x'|'alpha'>;\n\nexport const Prod = 'Prod';\nexport type ProdInputs = Pick<NamedTensorInfoMap, 'x'>;\nexport interface ProdAttrs {\n axis: number|number[];\n keepDims: boolean;\n}\n\nexport
 const Range = 'Range';\nexport interface RangeAttrs {\n start: number;\n stop: number;\n step: number;\n dtype: 'float32'|'int32';\n}\n\nexport const Real = 'Real';\nexport type RealInputs = Pick<NamedTensorInfoMap, 'input'>;\n\nexport const Reciprocal = 'Reciprocal';\nexport type ReciprocalInputs = UnaryInputs;\n\nexport const Relu = 'Relu';\nexport type ReluInputs = Pick<NamedTensorInfoMap, 'x'>;\n\nexport const Reshape = 'Reshape';\nexport type ReshapeInputs = Pick<NamedTensorInfoMap, 'x'>;\nexport interface ReshapeAttrs {\n

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}\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

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}\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// 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}\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}\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 * @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 {env} from './environment';\n\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\ntype 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/** 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.

*/\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 *\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 *\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 *\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 '${kernelName}'`);\n }\n }\n gradRegistry.set(kernelName, config);\n}\n\n/**\n * Removes the kernel function from the registry.\n *\n * @param kernelName The official name of the kernel.\n * @param backendName The official name of the backend.\n *\n */\nexport function unregisterKernel(\n kernelName: string, backendName: string): void {\n const key = makeKey(kernelName, backendName);\n if (!kernelRegistry.has(key)) {\n throw new Error(\n `The kernel '${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

```
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==========================================================================\n
*/\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  if (noConversionNeeded(a, dtype)) {\n    return a as
TypedArray;\n  }\n  if (dtype == null || dtype === 'float32' || dtype === 'complex64') {\n    return new
Float32Array(a as number[]);\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 * ```js\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 * ```js\n * const resource = await
tf.util.fetch('https://unpkg.com/@tensorflow/tfjs');\n * // handle response\n * ```\n *\n * @doc {heading: 'Util'}\n
*/\nexport 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 * @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 * @license\n * Copyright 2018 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 *
==========================================================================\n
*/\n\nimport {BackendTimer, BackendTimingInfo} from './backends/backend';\nimport {env} from
```

'./environment';\nimport
{Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {DataType, DataTypeMap,
TypedArray} 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:
Promise<string>\n};\n\nexport class Profiler {\n constructor(private backendTimer: BackendTimer, private logger?:
Logger) {\n if (logger == null) {\n this.logger = new Logger();\n }\n }\n\n profileKernel(kernelName: string,
inputs: NamedTensorMap, f: () => Tensor[]):\n KernelProfile {\n let outputs: Tensor[];\n const
holdResultWrapperFn = () => {\n outputs = f();\n };\n let timer: Promise<BackendTimingInfo>;\n const
start = util.now();\n if (this.backendTimer.timerAvailable()) {\n timer =
this.backendTimer.time(holdResultWrapperFn);\n } else {\n holdResultWrapperFn();\n outputs.map(output
=> output.dataSync());\n
timer = Promise.resolve({kernelMs: util.now() - start});\n }\n if
(env().getBool('CHECK_COMPUTATION_FOR_ERRORS')) {\n for (let i = 0; i < outputs.length; i++) {\n
const output = outputs[i];\n // Dangling promise here because we don't want to propagate up\n //
asynchronicity.\n output.data().then(tensorVals => {\n checkComputationForErrors(tensorVals,
output.dtype, kernelName);\n });\n }\n }\n\n const kernelProfile = {\n kernelName,\n outputs,\n
inputs,\n timeMs: timer.then(timing => timing.kernelMs),\n extraInfo: timer.then(\n timing =>
timing.getExtraProfileInfo != null ?\n timing.getExtraProfileInfo() :\n '')\n };\n return
kernelProfile;\n }\n\n logKernelProfile(kernelProfile: KernelProfile): void {\n const {kernelName, outputs,
timeMs, inputs, extraInfo} = kernelProfile;\n\n outputs.forEach(result => {\n Promise.all([result.data(),
timeMs, extraInfo]).then(valueContainer => {\n this.logger.logKernelProfile(\n kernelName, result,
valueContainer[0], valueContainer[1], inputs,\n valueContainer[2]);\n });\n });\n }\n}\n\nexport
function checkComputationForErrors<D extends DataType>(\n vals: DataTypeMap[D], dtype: D, kernelName:
string): boolean {\n if (dtype !== 'float32') {\n // Only floating point computations will generate NaN values\n
return false;\n }\n for (let i = 0; i < vals.length; i++) {\n const num = vals[i] as number;\n if (isNaN(num) ||
!isFinite(num)) {\n // Throwing custom exception so behavior is testable.\n console.warn(`Found ${num} in
the result of '${kernelName}'`);\n return true;\n }\n }\n return false;\n}\n\nexport class Logger {\n
logKernelProfile(\n name: string, result: Tensor, vals: TypedArray,\n timeMs: number|{error: string}, inputs:
NamedTensorMap,\n extraInfo?: string) {\n const time
= typeof timeMs === 'number' ? util.rightPad(`${timeMs}ms`, 9) :\n timeMs['error'];\n
const paddedName = util.rightPad(name, 25);\n const rank = result.rank;\n const size = result.size;\n const
shape = util.rightPad(result.shape.toString(), 14);\n let inputShapesDescription = '';\n\n for (const name in
inputs) {\n const input = inputs[name];\n if (input != null) {\n // The input might be a non-tensor (e.g
HTMLImageElement), in which case\n // we claim the output shape as input shape.\n const inputShape =
input.shape || result.shape;\n const inputRank = inputShape.length;\n inputShapesDescription +=\n
`${name}: ${inputRank}D ${inputRank > 0 ? inputShape : ''} `;\n }\n }\n\n console.log(\n
`%c${paddedName}\\t%c${time}\\t%c${rank}D ${shape}\\t%c${size}\\t%c${\n
inputShapesDescription}\\t%c${extraInfo}`,\n 'font-weight:bold', 'color:red',
'color:blue', 'color: orange',\n 'color: green', 'color: steelblue');\n }\n}\n","/**\n * @license\n * Copyright 2017
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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 {NamedTensorMap} from './tensor_types';\nimport * as util from
'./util';\n\nexport interface TapeNode {\n id: number;\n kernelName: string;\n

```
 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\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
getFilteredNodesXToY(\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\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 =
nodeInputs[inputName];\n\n      let anyInputFromX = false;\n      for (let j = 0; j < xs.length; j++) {\n        if
(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\n      if
(anyInputFromX) {\n        break;\n      }\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\n  for (let i = tape.length - 1; i >= 0; i--) {\n    const node =
tape[i];\n    const nodeInputs = node.inputs;\n\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        for (const inputName in nodeInputs) {\n          tensorsLeadToY[nodeInputs[inputName].id] = true;\n
nodesToY[node.id] = true;\n        }\n        break;\n      }\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\n    if
(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\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\n      filteredTape.push(prunedNode);\n
    }\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
backpropagateGradients(\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
= filteredTape[i];\n\n    const dys: Tensor[] = [];\n    node.outputs.forEach(o => {\n      const gradTensor =
tensorAccumulatedGradientMap[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\n    if
(node.gradient == null) {\n      throw new Error(\n          `Cannot compute gradient: gradient function not found ` +\n
        `for ${node.kernelName}.`);\n    }\n\n    // Backprop dy through this node and accumulate gradients over the
inputs.\n    const inputGradients = node.gradient(dys);\n\n    for (const inputName in node.inputs) {\n      if
(!(inputName in inputGradients)) {\n        throw new Error(\n            `Cannot backprop through input
${inputName}. ` +\n            `Available gradients found: ${Object.keys(inputGradients)}.`);\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 ${\n                node.kernelName}. The gradient of input ` +\n
    `${inputName} must have 'float32' dtype, but
 has '${dx.dtype}'`);\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 ${\n                node.kernelName}. The gradient of input ` +\n
          `'${inputName}' has shape '${dx.shape}', which does not match ` +\n            `the shape of the input
```

'${x.shape}'`);\n }\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","/**\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 {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\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\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\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\n if (rank === 1) {\n if (size > FORMAT_LIMIT_NUM_VALS) {\n const firstValsSize = FORMAT_NUM_FIRST_LAST_VALS * storagePerElement;\n\n let firstVals = Array.from<number|string|[number, number]>(\n vals.slice(0, firstValsSize));\n let lastVals = Array.from<number|string|[number, number]>(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  return [\n  '[' +\n  firstVals.map((x, i) => valToString(x, padPerCol[i], dtype))\n  .join(', ')
+\n  ', ..., ' +\n  lastVals\n  .map(\n  (x, i) => valToString(\n  x, padPerCol[size -
FORMAT_NUM_FIRST_LAST_VALS + i], dtype))\n  .join(', ') +\n  ']'\n  ];\n  }\n  const
displayVals: Array<number|string|[number, number]> =\n  dtype === 'complex64' ? createComplexTuples(vals)
:\n  Array.from<number|string>(vals);\n\n  return [\n  '[' +\n  displayVals.map((x, i) =>
valToString(x, padPerCol[i], dtype))\n  .join(', ') +\n  ']'\n  ];\n  }\n\n  // The array is rank 2 or more.\n  const
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 <
FORMAT_NUM_FIRST_LAST_VALS;
 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
= start + stride;\n  lines.push(...subTensorToString(\n  vals.slice(start, end), subshape, dtype, substrides,
padPerCol,\n  i === size - 1 /* isLast */));\n  }\n  } else {\n  for (let i = 0; i < size; 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  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]
 + 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
lines;\n}\n\nfunction createComplexTuples(vals: Array<{}>|\n  TypedArray): Array<[number,
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 *
@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 {getGlobal} from './global_util';\nimport {tensorToString} from './tensor_format';\nimport {ArrayMap,
BackendValues, DataType, DataTypeMap, DataValues, NumericDataType, Rank, ShapeMap, SingleValueMap,
TypedArray} from './types';\nimport * as util from './util';\nimport {computeStrides, toNestedArray} from
'./util';\n\nexport interface TensorData<D extends DataType> {\n  dataId?: DataId;\n  values?:
DataTypeMap[D];\n}\n\n// This interface mimics KernelBackend (in backend.ts), which would create a\n// circular
dependency if imported.\nexport interface Backend {}\n\n/**\n * A mutable object, similar to `tf.Tensor`, that
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
*/\nexport class TensorBuffer<R extends Rank, D extends DataType = 'float32'> {\n  size: number;\n  shape:
ShapeMap[R];\n  strides: number[];\n  values: DataTypeMap[D];\n\n  constructor(shape: ShapeMap[R], public
dtype: D, values?: DataTypeMap[D]) {\n  this.shape = shape.slice() as ShapeMap[R];\n  this.size =
util.sizeFromShape(shape);\n\n  if (values != null) {\n  const n = values.length;\n  util.assert(\n  n ===
this.size,\n  () => `Length of values '${n}' does not match the size ` +\n  `inferred by the shape
'${this.size}'.`);\n  }\n  if (dtype === 'complex64') {\n  throw new Error(\n  `complex64 dtype
TensorBuffers are not supported. Please create ` +\n  `a TensorBuffer for the real and imaginary parts
separately and ` +\n  `call tf.complex(real, imag).`);\n  }\n  this.values = values ||
 util.getArrayFromDType(dtype, this.size);\n  this.strides = computeStrides(shape);\n  }\n\n  /**\n  * Sets a value
in the buffer at a given location.\n  *\n  * @param value The value to set.\n  * @param locs  The location
indices.\n  *\n  * @doc {heading: 'Tensors', subheading: 'Creation'}\n  */\n  set(value: SingleValueMap[D], ...locs:
```

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 (${locs.length}) must ` +\n `match the rank (${this.rank})`);\n\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 *\n * @param locs The location indices.\n *\n * @doc {heading: 'Tensors', subheading: 'Creation'}\n */\n get(...locs: number[]): SingleValueMap[D] {\n if (locs.length === 0) {\n locs = [0];\n }\n let i = 0;\n for (const loc of locs) {\n if (loc < 0 || loc >= this.shape[i]) {\n const msg = `Requested out of range 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] * 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 = 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 (this.rank === 1) {\n return [index];\n }\n const locs: number[] = new Array(this.shape.length);\n for (let i = 0; i < locs.length - 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 *\n * @doc {heading: 'Tensors', subheading: 'Creation'}\n */\n toTensor(): Tensor<R> {\n return trackerFn().makeTensor(this.values, this.shape, this.dtype) as\n Tensor<R>;\n }\n}\n\nexport interface TensorTracker {\n makeTensor(\n values: DataValues, shape: number[], dtype: DataType,\n backend?: Backend): Tensor;\n makeVariable(\n initialValue: Tensor, trainable?: boolean, name?: string,\n dtype?: DataType): Variable;\n incRef(a: Tensor, backend: Backend): void;\n disposeTensor(t: Tensor): void;\n disposeVariable(v: Variable): void;\n read(dataId: DataId): Promise<BackendValues>;\n readSync(dataId: DataId): BackendValues;\n}\n\n/**\n * The Tensor class calls into this handler to delegate chaining operations.\n */\nexport interface OpHandler {\n cast<T extends Tensor>(x: T, dtype: DataType): T;\n buffer<R extends Rank, D extends DataType>(\n shape: ShapeMap[R], dtype: D,\n values?: DataTypeMap[D]): TensorBuffer<R, D>;\n print<T extends Tensor>(x: T, 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.\nlet trackerFn: () => TensorTracker = null;\n// Used by chaining methods to call into ops.\nlet opHandler: OpHandler = null;\n// Used to warn about deprecated methods.\nlet deprecationWarningFn: (msg: string) => void = null;\n// This here so that we can use this method on dev branches and keep the\n// functionality at master.\n// tslint:disable-next-line:no-unused-expression\n[deprecationWarningFn];\n\n/**\n * An external consumer can register itself as the tensor tracker. This way\n * the Tensor class can
notify the tracker for every tensor created and\n * disposed.\n */\nexport function setTensorTracker(fn: () => TensorTracker) {\n trackerFn = fn;\n}\n\n/**\n * An external consumer can register itself as the op handler. This way the\n * Tensor class can have chaining methods that call into ops via the op\n * handler.\n */\nexport function setOpHandler(handler: OpHandler) {\n opHandler = handler;\n}\n\n/**\n * Sets the deprecation warning function to be used by this file. This way the\n * Tensor class can be a leaf but still use the environment.\n */\nexport function setDeprecationWarningFn(fn: (msg: string) => void) {\n deprecationWarningFn = fn;\n}\n\n/**\n * We wrap data id since we use weak map to avoid memory leaks.\n * Since we have our own memory management, we have a reference counter\n * mapping a tensor to its data, so there is always a pointer (even if that\n * data is otherwise garbage collectable).\n * See https://developer.mozilla.org/en-US/docs/Web/JavaScript/Reference/\n * Global_Objects/WeakMap\n */\nexport type DataId = object; // object instead of {} to force non-primitive.\n\n// Declare this namespace to make Tensor class augmentation work in google3.\nexport declare namespace Tensor {}\n/**\n * A `tf.Tensor` object represents an immutable, multidimensional array of\n * numbers that has a shape and a data type.\n *\n * See `tf.tensor` for details on how to create a `tf.Tensor`.\n *\n * @doc {heading: 'Tensors', subheading: 'Classes'}\n */\nexport class Tensor<R extends Rank = Rank> {\n /** Unique id of this tensor. */\n

```
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/\\\n   * 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   * @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  /** 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
```

return opHandler.print(this, verbose);\n }\n\n /**\n   * Returns a copy of the tensor. See `tf.clone` for details.\n   * @doc {heading: 'Tensors', subheading: 'Classes'}\n   */\n clone<T 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', subheading: 'Classes'}\n   */\n toString(verbose = false): string {\n   const vals = this.dataSync();\n   return 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 variable(trainable = true, name?: string, dtype?: DataType): Variable<R> {\n   this.throwIfDisposed();\n   return trackerFn().makeVariable(this, trainable, name, dtype) as\n   Variable<R>;\n }\n}\nObject.defineProperty(Tensor, Symbol.hasInstance, {\n value: (instance: Tensor) => {\n   // Implementation note: we should use properties of the object that will be\n   // defined before the constructor body has finished executing (methods).\n   // This is because when this code is transpiled by babel, babel will call\n   // classCallCheck before the constructor body is run.\n   // See https://github.com/tensorflow/tfjs/issues/3384 for backstory.\n   return !!instance && instance.data != null && instance.dataSync != null &&\n   instance.throwIfDisposed != null;\n }\n});\n\nexport function getGlobalTensorClass() {\n // Use getGlobal so that we can augment the Tensor class across package\n // boundaries becase the node resolution alg may result in different modules\n // being returned for this file depending on the path they are loaded from.\n return getGlobal('Tensor', () => {\n   return Tensor;\n });\n}\n\n// Global side effect. Cache global reference to Tensor class\ngetGlobalTensorClass();\n\nexport interface NumericTensor<R extends Rank = Rank> extends Tensor<R> {\n dtype: NumericDataType;\n dataSync<D extends DataType = NumericDataType>(): DataTypeMap[D];\n data<D extends DataType = NumericDataType>(): Promise<DataTypeMap[D]>;\n}\n\nexport interface StringTensor<R extends Rank = Rank> extends Tensor<R> {\n dtype: 'string';\n dataSync<D extends DataType = 'string'>(): DataTypeMap[D];\n data<D extends DataType = 'string'>(): Promise<DataTypeMap[D]>;\n}\n\n/** @doclink Tensor */\nexport type Scalar = Tensor<Rank.R0>;\n/** @doclink Tensor */\nexport type Tensor1D = Tensor<Rank.R1>;\n/** @doclink Tensor */\nexport type Tensor2D = Tensor<Rank.R2>;\n/** @doclink Tensor */\nexport type Tensor3D = Tensor<Rank.R3>;\n/** @doclink Tensor */\nexport type Tensor4D = Tensor<Rank.R4>;\n/** @doclink Tensor */\nexport type Tensor5D = Tensor<Rank.R5>;\n/** @doclink Tensor */\nexport type Tensor6D = Tensor<Rank.R6>;\n\n/**\n * A mutable `tf.Tensor`, useful for persisting state, e.g. for training.\n *\n * @doc {heading: 'Tensors', subheading: 'Classes'}\n */\nexport class Variable<R extends Rank = Rank> extends Tensor<R> {\n name: string;\n\n constructor(\n   initialValue: Tensor<R>, public trainable: boolean,\n   name: string,\n   tensorId: number) {\n   super(\n   initialValue.shape, initialValue.dtype, initialValue.dataId, tensorId);\n   this.name = name;\n }\n\n /**\n   * Assign a new `tf.Tensor` to this variable. The new `tf.Tensor` must have\n   * the same shape and dtype as the old `tf.Tensor`.\n   *\n   * @param newValue New tensor to be assigned to this variable.\n   *\n   * @doc {heading: 'Tensors', subheading: 'Classes'}\n   */\n assign(newValue: Tensor<R>): void {\n   if (newValue.dtype !== this.dtype) {\n   throw new Error(\n   `dtype of the new value (${newValue.dtype}) and ` +\n   `previous value (${this.dtype}) must match`);\n   }\n   if (!util.arraysEqual(newValue.shape, this.shape)) {\n   throw new Error(\n   `shape of the new value (${newValue.shape}) and ` +\n   `previous value (${this.shape}) must match`);\n   }\n   trackerFn().disposeTensor(this);\n   this.dataId = newValue.dataId;\n   trackerFn().incRef(this, null /* backend */);\n }\n\n dispose(): void {\n   trackerFn().disposeVariable(this);\n   this.isDisposedInternal = true;\n }\n}\n\nObject.defineProperty(Variable, Symbol.hasInstance, {\n value: (instance: Variable) => {\n   return instance instanceof Tensor && instance.assign != null &&\n   instance.assign instanceof Function;\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/** @docalias number[] */\nexport interface ShapeMap {\n R0: number[];\n R1: [number];\n R2: [number, number];\n R3: [number, number, number];\n R4: [number, number, number, number];\n R5: [number, number, number, number, number];\n R6: [number, number, number, number, number, number];\n}\n\n/** @docalias number[] */\nexport interface ArrayMap {\n R0: number;\n R1: number[];\n R2: number[][];\n R3: number[][][];\n R4: number[][][][];\n R5: number[][][][][];\n R6: number[][][][][][];\n}\n\nexport interface DataTypeMap {\n float32: Float32Array;\n int32: Int32Array;\n bool: Uint8Array;\n complex64: Float32Array;\n string: string[];\n}\n\nexport interface SingleValueMap {\n bool: boolean;\n int32: number;\n float32: number;\n complex64: number;\n string: string;\n}\n\n/** @docalias 'float32'|'int32'|'bool'|'complex64'|'string' */\nexport type DataType = keyof DataTypeMap;\nexport type NumericDataType = 'float32'|'int32'|'bool'|'complex64';\nexport type TypedArray = Float32Array|Int32Array|Uint8Array;\n/** Tensor data used in tensor creation and user-facing API. */\nexport type DataValues = DataTypeMap[DataType];\n/** The underlying tensor data that gets stored in a backend. */\nexport type BackendValues = Float32Array|Int32Array|Uint8Array|Uint8Array[];\n\nexport enum Rank {\n R0 = 'R0',\n R1 = 'R1',\n R2 = 'R2',\n R3 = 'R3',\n R4 = 'R4',\n R5 = 'R5',\n R6 = 'R6'\n}\n\nexport type FlatVector = boolean[]|number[]|TypedArray;\nexport type RegularArray<T> = \n T[]|T[][]|T[][][]|T[][][][]|T[][][][][]|T[][][][][][];\n\n// tslint:disable-next-line:no-any\nexport interface RecursiveArray<T extends any> {\n [index: number]: T|RecursiveArray<T>;\n}\n\n// Looks for upcasting types. Used, for example, in operations with mixed dtype\n// inputs.\nenum UpcastInt32AndMap {\n 'float32' = 'float32',\n 'int32' = 'int32',\n 'bool' = 'int32',\n 'complex64' = 'complex64'\n}\n\nenum UpcastBoolAndMap {\n 'float32' = 'float32',\n 'int32' = 'int32',\n 'bool' = 'bool',\n 'complex64' = 'complex64'\n}\n\nenum UpcastFloat32AndMap {\n 'float32' = 'float32',\n 'int32' = 'float32',\n 'bool' = 'float32',\n 'complex64' = 'complex64'\n}\n\nenum UpcastComplex64AndMap {\n 'float32' = 'complex64',\n 'int32' = 'complex64',\n 'bool' = 'complex64',\n 'complex64' = 'complex64'\n}\n\nconst upcastTypeMap = {\n 'float32': UpcastFloat32AndMap,\n 'int32': UpcastInt32AndMap,\n 'bool': UpcastBoolAndMap,\n 'complex64': UpcastComplex64AndMap\n};\n\nexport function upcastType(typeA: DataType, typeB: DataType): DataType {\n if (typeA === 'string' || typeB === 'string') {\n if (typeA === 'string' && typeB === 'string') {\n return 'string';\n }\n throw new Error(`Can not upcast ${typeA} with ${typeB}`);\n }\n return upcastTypeMap[typeA][typeB];\n}\n\n/** Returns the output type after summation. */\nexport function sumOutType(type: DataType): DataType {\n return upcastType(type, 'int32');\n}\n\n/** @docalias TypedArray|Array */\nexport type TensorLike =\n TypedArray|number|boolean|string|RecursiveArray<number|number[]|TypedArray>|\n RecursiveArray<boolean>|RecursiveArray<string>|Uint8Array[];\nexport type ScalarLike = number|boolean|string|Uint8Array;\n/** @docalias TypedArray|Array */\nexport type TensorLike1D = TypedArray|number[]|boolean[]|string[]|Uint8Array[];\n/** @docalias TypedArray|Array */\nexport type TensorLike2D = TypedArray|number[]|number[][]|boolean[]|boolean[][]|\n string[]|string[][]|Uint8Array[]|Uint8Array[][];\n/** @docalias TypedArray|Array */\nexport type TensorLike3D = TypedArray|number[]|number[][][]|boolean[]|\n boolean[][][]|string[]|string[][][]|Uint8Array[]|Uint8Array[][][];\n/** @docalias TypedArray|Array */\nexport type TensorLike4D = TypedArray|number[]|number[][][][]|boolean[]|\n boolean[][][][]|string[]|string[][][][]|Uint8Array[]|Uint8Array[][][][];\n/** @docalias TypedArray|Array */\nexport type TensorLike5D =\n TypedArray|number[]|number[][][][][]|boolean[]|boolean[][][][][]|string[]|\n string[][][][][]|Uint8Array[]|Uint8Array[][][][][];\n/** @docalias TypedArray|Array */\nexport type TensorLike6D =\n TypedArray|number[]|number[][][][][][]|boolean[]|boolean[][][][][][]|\n string[]|string[][][][][][]|Uint8Array[]|Uint8Array[][][][][];\n\n/** Type for representing image data in Uint8Array type. */\nexport interface PixelData {\n width: number;\n height: number;\n data: Uint8Array;\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 {Tensor} from './tensor';\nimport {TensorContainer, TensorContainerArray} from './tensor_types';\nimport {upcastType} from './types';\nimport {assert} from './util';\n\nexport 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\nexport 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\nexport 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 */\nexport function getTensorsInContainer(result: TensorContainer): Tensor[] {\n const list: Tensor[] = [];\n const seen = new Set<{}|void>();\n walkTensorContainer(result, list, seen);\n return list;\n}\n\nfunction walkTensorContainer(\n container: TensorContainer, list: Tensor[], seen: Set<{}|void>): void {\n if (container == null) {\n   return;\n }\n if (container instanceof Tensor) {\n   list.push(container);\n
    return;\n }\n if (!isIterable(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\nfunction isIterable(obj: any): boolean {\n return Array.isArray(obj) || typeof obj === 'object';\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 {BackendTimingInfo, DataMover, KernelBackend} from './backends/backend';\nimport {Environment, setEnvironmentGlobal} from './environment';\nimport {getGlobalNamespace} from './global_util';\nimport {Add, Cast, Identity} from './kernel_names';\nimport {getGradient, getKernel, getKernelsForBackend, GradFunc, NamedAttrMap, TensorInfo} from './kernel_registry';\nimport {KernelProfile, Profiler} from './profiler';\nimport {backpropagateGradients, getFilteredNodesXToY, TapeNode} from './tape';\nimport {DataId, setTensorTracker, Tensor, TensorTracker, Variable} from './tensor';\nimport {GradSaveFunc, NamedTensorMap, NamedVariableMap, TensorContainer} from './tensor_types';\nimport {getTensorsInContainer} from './tensor_util';\nimport {BackendValues, DataType, DataValues} from './types';\nimport
 * as util from './util';\nimport {bytesFromStringArray, makeOnesTypedArray, now, sizeFromShape} from './util';\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 */\nexport type ForwardFunc<T> = (backend: KernelBackend, save?: GradSaveFunc) => T;\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\ntype
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\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\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\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 new Error(\n          `The highest priority backend '${name}' has not yet been ` +\n          `initialized. Make sure to await tf.ready() or ` +\n          `await tf.setBackend() before calling other methods`);\n    }\n    this.setBackend(name);\n  }\n  return this.backendInstance;\n }\n\n backendNames(): string[] {\n  return Object.keys(this.registryFactory);\n
 }\n\n findBackend(backendName: string): KernelBackend {\n  if (!(backendName in this.registry)) {\n    // If the backend hasn't been initialized but we have a registry entry for\n    // it, initialize it and return it.\n    if (backendName in this.registryFactory) {\n      const {asyncInit} = this.initializeBackend(backendName);\n      if (asyncInit) {\n        // Backend is not ready yet.\n        return null;\n      }\n    } else {\n      return null;\n    }\n  }\n  return this.registry[backendName];\n }\n\n findBackendFactory(backendName: string):\n    () => KernelBackend | Promise<KernelBackend> {\n  if (!(backendName in this.registryFactory)) {\n    return null;\n  }\n  return this.registryFactory[backendName].factory;\n }\n\n registerBackend(\n    backendName: string,\n    factory: () => KernelBackend | Promise<KernelBackend>,\n    priority = 1): boolean {\n  if (backendName in this.registryFactory) {\n
    console.warn(\n        `${backendName} backend was already registered. ` +\n        `Reusing existing backend 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] == null) {\n    throw new Error(`Backend name '${backendName}' not found in registry`);\n  }\n  this.backendName = backendName;\n  if (this.registry[backendName] == null) {\n    this.backendInstance = null;\n    const {success, asyncInit} = this.initializeBackend(backendName);\n    const result = asyncInit ? await success : 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\n  return true;\n }\n\n private setupRegisteredKernels():
 void {\n  const kernels = getKernelsForBackend(this.backendName);\n  kernels.forEach(kernel => {\n    if (kernel.setupFunc != null) {\n      kernel.setupFunc(this.backendInstance);\n    }\n  });\n }\n\n private disposeRegisteredKernels(backendName: string): void {\n  const kernels = 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 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 suceeded. Throws an error if\n  * there is no backend in the factory registry.\n  */\n private initializeBackend(backendName: string):\n    {success: boolean|Promise<boolean>, asyncInit: boolean} {\n  const registryFactoryEntry = this.registryFactory[backendName];\n  if (registryFactoryEntry
 == null) {\n    throw new Error(\n        `Cannot initialize backend ${backendName}, no registration found.`);\n  }\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 for custom Promise\n    implementations (e.g. Angular) */\n    if (backend && !(backend instanceof KernelBackend) &&\n        typeof backend.then === 'function') {\n      const promiseId = ++this.pendingBackendInitId;\n      const success =\n          backend\n              .then(backendInstance => {\n
        // Outdated promise. Another backend was set in the meantime.\n
        if (promiseId < this.pendingBackendInitId) {\n
          return false;\n
        }\n
        this.registry[backendName] = backendInstance;\n
        this.pendingBackendInit = null;\n
        return true;\n
      })\n
      .catch(err => {\n
        // Outdated promise. Another backend was set in the meantime.\n
        if (promiseId < this.pendingBackendInitId) {\n
          return false;\n
        }\n
        this.pendingBackendInit = null;\n
        console.warn(\n
            `Initialization of 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
  }
```

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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\n    if (backendName in this.registry) {\n
this.disposeRegisteredKernels(backendName);\n      this.registry[backendName].dispose();\n      delete
this.registry[backendName];\n    }\n\n    delete this.registryFactory[backendName];\n\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\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\n  private
initializeBackendsAndReturnBest():\n      {name: string, asyncInit: boolean} {\n    const sortedBackends =
this.getSortedBackends();\n\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\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\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\n  private static nextTensorId = 0;\n
private nextTensorId():
 number {\n    return Engine.nextTensorId++;\n  }\n\n  private static nextVariableId = 0;\n  private nextVariableId():
number {\n    return Engine.nextVariableId++;\n  }\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\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   *\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 output\n   * 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 '${kernelName}' not registered for backend '${\n          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\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\n    // Account for the number of moves during kernel execution. A \"data move\"\n    // can happen in the middle of a kernel execution, placing a new (key,value)\n    // pair in the data storage.
 Since data moves have net zero effect (we\n    // 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(\n          `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 Func\n   *\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\n    if (this.shouldCheckForMemLeaks()) {\n      this.state.numDataMovesStack.push(0);\n    }\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\n    let out: TensorInfo|TensorInfo[];\n\n    const kernelOrScopeName = isRegisteredKernelInvocation(kernelParams) ?\n        kernelParams.kernelName :\n        this.state.activeScope != null ? this.state.activeScope.name : '';\n\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\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(\n          kernel != null,\n          () => `Cannot find registered kernel '${kernelName}' for backend '${\n              this.backendName}'`);\n\n      kernelFunc = () => {\n        const numDataIdsBefore = this.backend.numDataIds();\n        out = kernel.kernelFunc({inputs, attrs, backend: this.backend});\n
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const outInfos = Array.isArray(out) ? out : [out];\n if (this.shouldCheckForMemLeaks()) {\n this.checkKernelForMemLeak(kernelName, numDataIdsBefore, outInfos);\n }\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\n // Save any required inputs and outputs.\n\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\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 //\n // Run the kernelFunc. Optionally profiling it.\n //\n const {inputs, attrs} = kernelParams;\n const backwardsFunc = isRegisteredKernelInvocation(kernelParams) ?\n null :\n kernelParams.backwardsFunc;\n\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 });\n\n if (isTapeOn) {\n this.addTapeNode(\n kernelOrScopeName, inputs, outputs, backwardsFunc, saved, attrs);\n }\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\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\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    // We return an empty list rather than throw an error because the kernel we\n    // are looking up may not actually be relevant to backproping through the\n    // overall function\n    //\n    // See 'does not error if irrelevant (pruned) ops are missing grads' test\n    // in gradients_test.ts for an example.\n    return [];\n  }\n\n  /**\n   * Internal method used by public APIs for tensor creation. Makes a new\n   * tensor with
 the provided shape, dtype and values. It always\n   * creates a new data id and writes the values to the underlying backend.\n   */\n  makeTensor(\n      values: DataValues, shape: number[], dtype: DataType,\n      backend?: KernelBackend): Tensor {\n    if (values == null) {\n      throw new Error('Values passed to engine.makeTensor() are null');\n    }\n    dtype = dtype || 'float32';\n    backend = backend || this.backend;\n    let backendVals = values as BackendValues;\n    if (dtype === 'string' && util.isString(values[0])) {\n      backendVals = (values as 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 bytes for string tensors.\n    if (dtype === 'string') {\n      const info = this.state.tensorInfo.get(dataId);\n      const newBytes = bytesFromStringArray(backendVals as Uint8Array[]);\n      this.state.numBytes
 += newBytes - info.bytes;\n      info.bytes = newBytes;\n    }\n    return t;\n  }\n\n  /**\n   * Internal method used by backends. Makes a new tensor\n   * that is a wrapper around an existing data id. It doesn't create\n   * a new data id, only increments the ref count used in memory tracking.\n   */\n  makeTensorFromDataId(\n      dataId: DataId, shape: number[], dtype: DataType,\n      backend?: KernelBackend): Tensor {\n    dtype = dtype || 'float32';\n    const t = new Tensor(shape, dtype, dataId, this.nextTensorId());\n    this.trackTensor(t, backend);\n    return t;\n  }\n\n  makeVariable(\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,
 this.nextTensorId());\n    if (this.state.registeredVariables[v.name]
 != 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\n  trackTensor(a: 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 !== 'string') {\n      bytes = a.size * util.bytesPerElement(a.dtype);\n    }\n    this.state.numBytes += bytes;\n\n    if (!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\n    if (!(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  // TODO(pyu10055): This is currently used by makeVariable method, to increase\n  // refCount on the backend for the dataId. It can potentially be replaced with\n  // Identity op indead of calling backend directly.\n  incRef(a: Tensor, backend: KernelBackend): void {\n    this.trackTensor(a, backend);\n    this.backend.incRef(a.dataId);\n  }\n\n  removeDataId(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  disposeTensor(a: Tensor): void {\n    if (!this.state.tensorInfo.has(a.dataId)) {\n      return;\n    }\n    const info = this.state.tensorInfo.get(a.dataId);\n\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 their\n    // components.\n    if (a.dtype !== 'complex64' && a.dtype !== 'string') {\n      const bytes = a.size * util.bytesPerElement(a.dtype);\n      this.state.numBytes -= bytes;\n    }\n\n    // Remove the reference to dataId if 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 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\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\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\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\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 avoide 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        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        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        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        const gradMap: {[key:
string]: () => Tensor} = {};\n        grads.forEach((grad, i) => {\n          gradMap[i] = () => grad;\n        });\n
return gradMap;\n      };\n\n      return this.runKernelFunc({\n        forwardFunc,\n        backwardsFunc,\n
inputs: inputMap,\n      });\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
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 this.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 this.pendingBackendInit = null;\n }\n}\n\nfunction ones(shape: number[]): Tensor {\n const values = makeOnesTypedArray(sizeFromShape(shape), 'float32');\n return ENGINE.makeTensor(values, shape, 'float32');\n}\n\nexport function getOrMakeEngine(): Engine {\n const ns = getGlobalNamespace() as {} as {_tfengine: Engine};\n if (ns._tfengine == null) {\n const environment = new Environment(ns);\n ns._tfengine = new Engine(environment);\n }\n setEnvironmentGlobal(ns._tfengine.ENV);\n\n // Tell the current tensor interface that the global engine is responsible\n // for tracking.\n setTensorTracker(() => ns._tfengine);\n return ns._tfengine;\n}\n\nexport const ENGINE = getOrMakeEngine();\n\n/**\n * A implementation of the add op for use within engine and tape.\n *\n * This allows us to avoid a circular dependency between add.ts and engine.\n * It is exported to be available in tape tests.\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 ENGINE.runKernel(Add, inputs as {} as NamedTensorMap);\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// tslint:disable-next-line:no-any\nfunction _isNavigatorDefined(): boolean {\n return typeof navigator !== 'undefined' && navigator != null;\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 /(android|bb\\d+|meego).+mobile|avantgo|bada\\/|blackberry|blazer|compal|elaine|fennec|hiptop|iemobile|ip(hone|od)|iris|kindle|lge |maemo|midp|mmp|mobile.+firefox|netfront|opera m(ob|in)i|palm(os)?|phone|p(ixi|re)\\/|plucker|pocket|psp|series(4|6)0|symbian|treo|up\\.(browser|link)|vodafone|wap|windows ce|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\\-)|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)|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|cldc|cmd\\-|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 u|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(\\-| |_|a|g|p|s|t)|tp)|hu(aw|tc)|i\\-(20|go|ma)|i230|iac(|\\-|\\/)|ibro|idea|ig01|ikom|im1k|inno|ipaq|iris|ja(t|v)a|jbro|jemu|jigs|kddi|keji|kgt(|\\/)|klon|kpt |kwc\\-|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\\-cr|me(rc|ri)|mi(o8|oa|ts)|mmef|mo(01|02|bi|de|do|t(\\-| |o|v)|zz)|mt(50|p1|v)|mwbp|mywa|n10[0-2]|n20[2-3]|n30(0|2)|n50(0|2|5)|n7(0(0|1)|10)|ne((c|m)\\-|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(ck|rt|se)|prox|psio|pt\\-g|qa\\-a|qc(07|12|21|32|60|\\-[2-7]|i\\-)|qtek|r380|r600|raks|rim9|ro(ve|zo)|s55\\/|sa(ge|ma|mm|ms|ny|va)|sc(01|h\\-|oo|p\\-)|sdk\\/|se(c(\\-|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|g1|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-ignore\n (typeof WorkerGlobalScope !== 'undefined');\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 './engine';\n\nimport * as device_util from './device_util';\nimport {env} from './environment';\n\nconst ENV = env();\n\n/**\n * This file contains environment-related flag registrations.\n */\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.');\n }\n});\n\n/** Whether we are in a browser (as versus, say, node.js) environment. */\nENV.registerFlag('IS_BROWSER', () => device_util.isBrowser());\n\n/** Whether we are in a browser (as versus, say, node.js) environment. */\nENV.registerFlag(\n 'IS_NODE',\n () => (typeof process !== 'undefined') &&\n (typeof process.versions !== 'undefined') &&\n (typeof process.versions.node !== 'undefined'));\n\n/** Whether this browser is Chrome. */\nENV.registerFlag(\n 'IS_CHROME',\n () => typeof navigator !== 'undefined' && navigator != null &&\n navigator.userAgent != null && /Chrome/.test(navigator.userAgent) &&\n /Google Inc/.test(navigator.vendor));\n\n/**\n * True when the environment is \"production\" where we disable safety checks\n * to gain performance.\n */\nENV.registerFlag('PROD', () => false);\n\n/**\n * Whether to do sanity checks when inferring a shape from user-provided\n * values, used when creating a new tensor.\n */\nENV.registerFlag(\n 'TENSORLIKE_CHECK_SHAPE_CONSISTENCY',\n () => ENV.getBool('DEBUG'));\n\n/** Whether deprecation warnings are enabled. */\nENV.registerFlag('DEPRECATION_WARNINGS_ENABLED', () => true);\n\n/** True if running unit tests. */\nENV.registerFlag('IS_TEST', () => false);\n\n/** Whether to check computation result for errors. */\nENV.registerFlag('CHECK_COMPUTATION_FOR_ERRORS', () => true);\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 {env} from './environment';\nimport {Tensor} from './tensor';\nimport {DataType, TensorLike} from './types';\nimport {assert, flatten, inferDtype, isTypedArray, toTypedArray} from './util';\n\nexport function inferShape(val: TensorLike, dtype?: DataType): number[] {\n let firstElem: typeof val = val;\n\n if (isTypedArray(val)) {\n return dtype === 'string' ? [] : [val.length];\n }\n if (!Array.isArray(val)) {\n return []; // Scalar.\n }\n const shape: number[] = [];\n\n while (Array.isArray(firstElem) ||\n isTypedArray(firstElem) && dtype !== 'string') {\n shape.push(firstElem.length);\n firstElem = firstElem[0];\n }\n if (Array.isArray(val) &&\n env().getBool('TENSORLIKE_CHECK_SHAPE_CONSISTENCY')) {\n deepAssertShapeConsistency(val,

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 ${val.length} elements`);\n const subShape = shape.slice(1);\n for (let i = 0; i < val.length; ++i) {\n   deepAssertShapeConsistency(val[i], subShape, indices.concat(i));\n }\n}\n\nfunction assertDtype(\n   expectedDtype: DataType|'numeric'|'string_or_numeric',\n actualDType: DataType, argName: string, functionName: string)
 {\n if (expectedDtype === 'string_or_numeric') {\n   return;\n }\n if (expectedDtype == null) {\n   throw new Error(`Expected dtype cannot be null.`);\n }\n if (expectedDtype !== 'numeric' && expectedDtype !== actualDType ||\n   expectedDtype === 'numeric' && actualDType === 'string') {\n   throw new Error(\n `Argument '${argName}' passed to '${functionName}' must ` +\n   `be ${expectedDtype} tensor, but got ${actualDType} tensor`);\n }\n}\n\nexport function convertToTensor<T extends Tensor>(\n   x: T|TensorLike, argName: string, functionName: string,\n   parseAsDtype: DataType|'numeric'|'string_or_numeric' = 'numeric'): T {\n if (x instanceof Tensor) {\n   assertDtype(parseAsDtype, x.dtype, argName, functionName);\n   return x;\n }\n let inferredDtype = inferDtype(x);\n // If the user expects a bool/int/float, use that info to update the\n // inferredDtype when it is not a string.\n if (inferredDtype !== 'string' &&\n   ['bool', 'int32', 'float32'].indexOf(parseAsDtype)
 >= 0) {\n   inferredDtype = parseAsDtype as DataType;\n }\n assertDtype(parseAsDtype, inferredDtype, argName, functionName);\n\n if ((x == null) ||\n   (!isTypedArray(x) && !Array.isArray(x) && typeof x !== 'number' &&\n   typeof x !== 'boolean' && typeof x !== 'string')) {\n   const type = x == null ? 'null' : (x as {}).constructor.name;\n   throw new Error(\n   `Argument '${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:
 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}[${i}]`, functionName, parseAsDtype));\n}\n","/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
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 ==\n
 */\nimport {ENGINE} from '../engine';\nimport {isPromise} from '../util';\n\nexport const OP_SCOPE_SUFFIX = '__op';\n\n/**\n * Used for wrapping functions that perform math operations on\n * Tensors. The function will be wrapped in a named scope that cleans all\n * memory usage after the function is done.\n */\nexport function op<T extends Function>(f: {[name: string]: T}): T {\n const keys = Object.keys(f);\n if (keys.length !== 1) {\n   throw new Error(\n   `Please provide an object with a single key ` +\n   `(operation name) mapping to a function. Got an object with ` +\n   `${keys.length} keys.`);\n }\n\n let opName = keys[0];\n const fn = f[opName];\n\n // Strip the underscore from the end of the function name.\n if (opName.endsWith('_')) {\n   opName =

opName.substring(0,
opName.length - 1);\n }\n\n // add an __op suffix to distinguish ops from kernels in tf.profile\n opName =
opName + OP_SCOPE_SUFFIX;\n\n // tslint:disable-next-line:no-any\n const f2 = (...args: any[]) => {\n
ENGINE.startScope(opName);\n try {\n const result = fn(...args);\n if (isPromise(result)) {\n
console.error('Cannot return a Promise inside of tidy.');\n }\n ENGINE.endScope(result);\n return result;\n
} catch (ex) {\n ENGINE.endScope(null);\n throw ex;\n }\n };\n Object.defineProperty(f2, 'name', {value:
opName, configurable: true});\n\n // tslint:disable-next-line:no-any\n return f2 as any as T;\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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License for the specific language governing permissions and\n * limitations under the License.\n *
==========\n
*/\nimport {ENGINE} from '../engine';\nimport {Complex, ComplexInputs} 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 * Converts two real numbers to a complex number.\n *\n * Given a tensor `real` representing
the real part of a complex number, and a\n * tensor `imag` representing the imaginary part of a complex number,
this\n * operation returns complex numbers elementwise
of the form [r0, i0, r1, i1],\n * where r represents the real part and i represents the imag part.\n *\n * The input
tensors real and imag must have the same shape.\n *\n * ```js\n * const real = tf.tensor1d([2.25, 3.25]);\n * const
imag = tf.tensor1d([4.75, 5.75]);\n * const complex = tf.complex(real, imag);\n *\n * complex.print();\n * ```\n *\n *
@doc {heading: 'Tensors', subheading: 'Creation'}\n */\nfunction complex_<T extends Tensor>(real: T|TensorLike,
imag: T|TensorLike): T {\n const $real = convertToTensor(real, 'real', 'complex');\n const $imag =
convertToTensor(imag, 'imag', 'complex');\n util.assertShapesMatch(\n $real.shape, $imag.shape,\n `real and
imag shapes, ${$real.shape} and ${$imag.shape}, ` +\n `must match in call to tf.complex().`);\n\n const
inputs: ComplexInputs = {real: $real, imag: $imag};\n return ENGINE.runKernel(Complex, inputs as {} as
NamedTensorMap);\n}\n\nexport const complex = op({complex_});\n","/**\n * @license\n * Copyright
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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 {ENGINE} from '../engine';\nimport {Tensor} from '../tensor';\nimport {TensorLike, TypedArray}
from '../types';\nimport {DataType} from '../types';\nimport {assert, assertNonNegativeIntegerDimensions, flatten,
inferDtype, isTypedArray, sizeFromShape, toTypedArray} from '../util';\n\n/** This is
shared code across all tensor creation methods. */\nexport function makeTensor(\n values: TensorLike, shape:
number[], inferredShape: number[],\n dtype?: DataType): Tensor {\n if (dtype == null) {\n dtype =
inferDtype(values);\n }\n if (dtype === 'complex64') {\n throw new Error(\n `Cannot construct a complex64
tensor directly. ` +\n `Please use tf.complex(real, imag).`);\n }\n if (!isTypedArray(values) &&
!Array.isArray(values) &&\n typeof values !== 'number' && typeof values !== 'boolean' &&\n typeof values
!== 'string') {\n throw new Error(\n 'values passed to tensor(values) must be a number/boolean/string or ' +\n
'an array of numbers/booleans/strings, or a TypedArray');\n }\n if (shape != null) {\n
assertNonNegativeIntegerDimensions(shape);\n\n const providedSize = sizeFromShape(shape);\n const
inferredSize = sizeFromShape(inferredShape);\n assert(\n providedSize === inferredSize,\n () =>\n

`Based on the provided shape, [${shape}], the tensor should have ` +\n `${providedSize} values but has ${inferredSize}`);\n\n for (let i = 0; i < inferredShape.length; ++i) {\n const inferred = inferredShape[i];\n const flatDimsDontMatch = i === inferredShape.length - 1 ?\n inferred !== sizeFromShape(shape.slice(i)) :\n true;\n assert(\n inferredShape[i] === shape[i] || !flatDimsDontMatch,\n () => `Error creating a new Tensor. Inferred shape ` +\n `(${inferredShape}) does not match the provided ` +\n `shape (${shape}). `);\n }\n }\n\n if (!isTypedArray(values) && !Array.isArray(values)) {\n values = [values] as number[];\n }\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 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} from '../tensor';\nimport {inferShape} from '../tensor_util_env';\nimport {TensorLike} from '../types';\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 *\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 *\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 */\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,\n 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 */\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 */\nexport declare type WeightsManifestConfig = WeightsManifestGroupConfig[];\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 */\nexport declare interface WeightsManifestGroupConfig {\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 /**\n * Specifications of the weights

stored in the paths.\n */\n weights: WeightsManifestEntry[];\n}\n\n/**\n * Group to which the weight belongs.\n *\n * - 'optimizer': Weight from a stateful optimizer.\n */\nexport type WeightGroup = 'model'|'optimizer';\n\n/**\n * An entry in the weight manifest.\n *\n * The entry contains specification of a weight.\n */\nexport declare interface WeightsManifestEntry {\n /**\n * Name of the weight, e.g., 'Dense_1/bias'\n */\n name: string;\n\n /**\n * Shape of the weight.\n */\n shape: number[];\n\n /**\n * Data type of the weight.\n */\n dtype: 'float32'|'int32'|'bool'|'string'|'complex64';\n\n /**\n * Type of the weight.\n *\n * Optional.\n *\n * The value 'optimizer' indicates the weight belongs to an optimizer\n * (i.e., used only during model training and not during inference).\n */\n group?: WeightGroup;\n\n /**\n * Information for dequantization of the weight.\n */\n quantization?: {\n scale?: number, // The scaling constant to multiply by.\n min?: number, // The (possibly nudged) minimum weight to add.\n dtype: 'uint16'|'uint8'|'float16' // The dtype of the quantized weights.\n };\n}\n\n/**\n * Options for saving a model.\n * @innamespace io\n */\nexport interface SaveConfig {\n /**\n * Whether to save only the trainable weights of the model, ignoring the\n * non-trainable ones.\n */\n trainableOnly?: boolean;\n\n /**\n * Whether the optimizer will be saved (if exists).\n *\n * Default: `false`.\n */\n includeOptimizer?: boolean;\n}\n\n/**\n * Result of a saving operation.\n */\nexport interface SaveResult {\n /**\n * Information about the model artifacts saved.\n */\n modelArtifactsInfo: ModelArtifactsInfo;\n\n /**\n * HTTP responses from the server that handled the model-saving request (if\n * any). This is applicable only to server-based saving routes.\n */\n responses?: Response[];\n\n /**\n * Error messages and related data (if any).\n */\n errors?: Array<{}|string>;\n}\n\nexport declare interface ModelArtifactsInfo {\n /**\n * Timestamp for when the model is saved.\n */\n dateSaved: Date;\n\n /**\n * TODO (cais,yassogba) consider removing GraphDef as GraphDefs now\n * come in a JSON format and none of our IOHandlers support a non json\n * format. We could conder replacing this with 'Binary' if we want to\n * allow future handlers to save to non json formats (though they will\n * probably want more information than 'Binary').\n * Type of the model topology\n *\n * Type of the model topology\n *\n * Possible values:\n * - JSON: JSON config (human-readable, e.g., Keras JSON).\n * - GraphDef: TensorFlow\n * [GraphDef](https://www.tensorflow.org/extend/tool_developers/#graphdef)\n * protocol buffer (binary).\n */\n modelTopologyType: 'JSON'|'GraphDef';\n\n /**\n * Size of model topology (Keras JSON or GraphDef), in bytes.\n */\n modelTopologyBytes?: number;\n\n /**\n * Size of weight specification or manifest, in bytes.\n */\n weightSpecsBytes?: number;\n\n /**\n * Size of weight value data, in bytes.\n */\n weightDataBytes?: number;\n}\n\n/** Model training configuration. */\nexport declare interface TrainingConfig {\n // TODO(cais): Tighten the typing once keras spec is available to tfjs-core.\n // See\n // tslint:disable-next-line:max-line-length\n // https://github.com/tensorflow/tfjs-layers/blob/master/src/keras_format/training_config.ts\n /** Optimizer used for the model training. */\n optimizer_config: {};\n\n // TODO(cais): Tighten the typing once keras spec is available to tfjs-core.\n /** Loss function(s) for the model's output(s). */\n loss: string|string[]|{[key: string]: string};\n\n // TODO(cais): Tighten the typing once keras spec is available to tfjs-core.\n /** Metric function(s) for the model's output(s). */\n metrics?: string[]|{[key: string]: string};\n\n // TODO(cais): Tighten the typing once keras spec is available to tfjs-core.\n weighted_metrics?: string[];\n\n // TODO(cais): Tighten the typing once keras spec is available to tfjs-core.\n sample_weight_mode?: string;\n\n loss_weights?: number[]|{[key: string]: number};\n}\n\n/**\n * The serialized artifacts of a model, including topology and weights.\n *\n * The `modelTopology`, `trainingConfig`, `weightSpecs` and `weightData` fields\n * of this interface are optional, in order to support topology- or weights-only\n * saving and loading.\n *\n * Note this interface is used internally in IOHandlers. For the file format\n * written to disk as `model.json`, see `ModelJSON`.\n */\nexport declare interface ModelArtifacts {\n /**\n * Model topology.\n *\n * For Keras-style `tf.Model`s, this is a JSON object.\n * For TensorFlow-style models (e.g., `SavedModel`), this is the JSON\n * encoding of the `GraphDef` protocol buffer.\n */\n modelTopology?: {}|ArrayBuffer;\n\n /**\n * Serialized configuration for the model's training.\n */\n trainingConfig?: TrainingConfig;\n\n /**\n * Weight specifications.\n *\n * This corresponds to the weightsData below.\n */\n weightSpecs?: WeightsManifestEntry[];\n\n /**\n * Binary buffer for all weight values concatenated in the order specified\n * by `weightSpecs`.\n */\n weightData?: ArrayBuffer;\n\n /**\n *

Hard-coded format name for models saved from TensorFlow.js or converted\n * by TensorFlow.js Converter.\n */\n format?: string;\n\n /**\n * What library is responsible for originally generating this artifact.\n *\n * Used for debugging purposes. E.g., 'TensorFlow.js v1.0.0'.\n */\n generatedBy?: string;\n\n /**\n * What library or tool is responsible for converting the original model\n * to this format, applicable only if the model is output by a converter.\n *\n * Used for debugging purposes. E.g., 'TensorFlow.js Converter v1.0.0'.\n *\n * A value of `null` means the model artifacts are generated without any\n * conversion process (e.g., saved directly from a TensorFlow.js\n * `tf.LayersModel` instance.)\n */\n convertedBy?: string|null;\n\n /**\n * Inputs and outputs signature for saved model.\n */\n signature?: {};\n\n /**\n * User-defined metadata about the model.\n */\n userDefinedMetadata?: {[key: string]: {}};\n\n /**\n * Initializer for the model.\n */\n modelInitializer?: {};\n}\n\n/**\n * The on-disk format of the `model.json` file.\n *\n * TF.js 1.0 always populates the optional fields when writing model.json.\n * Prior versions did not provide those fields.\n */\nexport declare interface ModelJSON {\n /**\n * Model topology.\n *\n * For Keras-style `tf.Model`s, this is a JSON object.\n * For TensorFlow-style models (e.g., `SavedModel`), this is the JSON\n * encoding of the `GraphDef` protocol buffer.\n */\n modelTopology: {};\n\n /** Model training configuration. */\n trainingConfig?: TrainingConfig;\n\n /**\n * Weights manifest.\n *\n * The weights manifest consists of an ordered list of weight-manifest\n * groups. Each weight-manifest group consists of a number of weight values\n * stored in a number of paths. See the documentation of\n * `WeightsManifestConfig` for more details.\n */\n weightsManifest: WeightsManifestConfig;\n\n /**\n * Hard-coded format name for models saved from TensorFlow.js or converted\n * by TensorFlow.js Converter.\n */\n format?: string;\n\n /**\n * What library is responsible for originally generating this artifact.\n *\n * Used for debugging purposes. E.g., 'TensorFlow.js v1.0.0'.\n */\n generatedBy?: string;\n\n /**\n * What library or tool is responsible for converting the original model\n * to this format, applicable only if the model is output by a converter.\n *\n * Used for debugging purposes. E.g., 'TensorFlow.js Converter v1.0.0'.\n *\n * A value of `null` means the model artifacts are generated without any\n * conversion process (e.g., saved directly from a TensorFlow.js\n * `tf.LayersModel` instance.)\n */\n convertedBy?: string|null;\n\n /**\n * Inputs and outputs signature for saved model.\n */\n signature?: {};\n\n /**\n * User-defined metadata about the model.\n */\n userDefinedMetadata?: {[key: string]: {}};\n\n /**\n * Initializer for the model.\n */\n modelInitializer?: {};\n}\n\n/**\n * Type definition for handlers of loading operations.\n */\nexport type LoadHandler = () => Promise<ModelArtifacts>;\n\n/**\n * Type definition for handlers of saving operations.\n */\nexport type SaveHandler = (modelArtifact: ModelArtifacts) =>\n Promise<SaveResult>;\n\n/**\n * Interface for a model import/export handler.\n *\n * The `save` and `load` handlers are both optional, in order to allow handlers\n * that support only saving or loading.\n */\n// tslint:disable-next-line:interface-name\nexport interface IOHandler {\n save?: SaveHandler;\n load?: LoadHandler;\n}\n\n/**\n * An interface for the manager of a model store.\n *\n * A model store is defined as a storage medium on which multiple models can\n * be stored. Each stored model has a unique `path` as its identifier.\n * A `ModelStoreManager` for the store allows actions including\n *\n * - Listing the models stored in the store.\n * - Deleting a model from the store.\n */\nexport interface ModelStoreManager {\n /**\n * List all models in the model store.\n *\n * @returns A dictionary mapping paths of existing models to their\n * model artifacts info. Model artifacts info include type of the model's\n * topology, byte sizes of the topology, weights, etc.\n */\n listModels(): Promise<{[path: string]: ModelArtifactsInfo}>;\n\n /**\n * Remove a model specified by `path`.\n *\n * @param path\n * @returns ModelArtifactsInfo of the deleted model (if and only if deletion\n * is successful).\n * @throws Error if deletion fails, e.g., if no model exists at `path`.\n */\n removeModel(path: string): Promise<ModelArtifactsInfo>;\n}\n\n/**\n * Callback for the progress of a long-running action such as an HTTP\n * request for a large binary object.\n *\n * `fraction` should be a number in the [0, 1] interval, indicating how\n * much of the action has completed.\n */\nexport type OnProgressCallback = (fraction: number) => void;\n\n/** @innamespace io */\nexport interface LoadOptions {\n /**\n * RequestInit (options) for HTTP requests.\n *\n * For detailed information on the supported fields, see\n * [https://developer.mozilla.org/en-US/docs/Web/API/Request/Request](\n *

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 `window.fetch` function.\n */\n fetchFunc?: Function;\n\n /**\n * Strict loading model: whether extraneous weights or missing\n * weights should trigger an `Error`.\n *\n *
If `true`, require that the provided weights exactly match those\n * required by the layers. `false` means that both extra weights\n * and missing weights will be silently ignored.\n *\n * Default: `true`.\n */\n strict?: boolean;\n\n /**\n * Path prefix for weight files, by default this is calculated from the\n * path of the model JSON file.\n *\n * For instance, if the path to the model JSON file is\n * `http://localhost/foo/model.json`, then the default path prefix will be\n * `http://localhost/foo/`. If a weight file has the path value\n * `group1-shard1of2` in the weight manifest, then the weight file will be\n * loaded from `http://localhost/foo/group1-shard1of2` by default. However,\n * if you provide a `weightPathPrefix` value of\n * `http://localhost/foo/alt-weights`, then the 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
module or model is to be loaded from TF Hub.\n *\n * Setting this to `true` allows passing a TF-Hub module 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 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 func you can convert the weight file name to any URL.\n */\n weightUrlConverter?: (weightFileName: string) => Promise<string>;\n}\n\n/**\n * Additional options for Platform.fetch\n */\nexport interface RequestDetails {\n /**\n * Is this request for a binary file (as opposed to a json file)\n */\n isBinary?:
boolean;\n}\n","'use strict'\n\nexports.byteLength = byteLength\nexports.toByteArray = toByteArray\nexports.fromByteArray = fromByteArray\n\nvar lookup = []\nvar revLookup = []\nvar Arr = typeof Uint8Array !== 'undefined' ? Uint8Array : Array\n\nvar code = 'ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz0123456789+/'\nfor (var i = 0, len = code.length; i < len; ++i) {\n lookup[i] = code[i]\n revLookup[code.charCodeAt(i)] = i\n}\n\n// Support decoding URL-safe base64 strings, as Node.js does.\n// See: https://en.wikipedia.org/wiki/Base64#URL_applications\nrevLookup['-'.charCodeAt(0)] = 62\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 bytes are found\n // See: https://github.com/beatgammit/base64-js/issues/42\n var validLen = b64.indexOf('=')\n if (validLen === -1) validLen = len\n\n var
placeHoldersLen = validLen === len\n ? 0\n : 4 - (validLen % 4)\n\n return [validLen, 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 return ((validLen + 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 Arr(_byteLength(b64, validLen, placeHoldersLen))\n\n var curByte = 0\n\n // if there are placeholders, only get up to the last complete 4 chars\n var len = placeHoldersLen > 0\n ? validLen - 4\n : validLen\n\n var i\n for (i = 0; i < len; i += 4) {\n tmp =\n (revLookup[b64.charCodeAt(i)] << 18) |\n (revLookup[b64.charCodeAt(i + 1)] << 12) |\n (revLookup[b64.charCodeAt(i + 2)] << 6) |\n revLookup[b64.charCodeAt(i + 3)]\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 arr[curByte++] = tmp & 0xFF\n }\n\n if (placeHoldersLen === 1) {\n tmp =\n (revLookup[b64.charCodeAt(i)] << 10) |\n (revLookup[b64.charCodeAt(i + 1)] << 4) |\n (revLookup[b64.charCodeAt(i + 2)] >> 2)\n arr[curByte++] = (tmp >> 8) & 0xFF\n arr[curByte++] = tmp &

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   ((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","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\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\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\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","var toString = {}.toString;\n\nmodule.exports = Array.isArray || function (arr) {\n return toString.call(arr) == '[object Array]';\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/* eslint-disable no-proto */\n\n'use strict'\n\nvar base64 = require('base64-js')\nvar ieee754 = require('ieee754')\nvar isArray = require('isarray')\n\nexports.Buffer = Buffer\nexports.SlowBuffer = SlowBuffer\nexports.INSPECT_MAX_BYTES = 50\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 * 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

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\" 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 **/\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\" argument must be a number')\n } else if (size < 0) {\n throw new RangeError('\"size\" 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 interpretted 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 **/\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 * */\nBuffer.allocUnsafe = function (size) {\n return allocUnsafe(null, size)\n}\n/**\n * Equivalent to SlowBuffer(num), by default creates a non-zero-filled Buffer instance.\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
 // 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' &&\n        obj.buffer instanceof ArrayBuffer) || 'length' in obj) {\n      if (typeof obj.length !== 'number' || isnan(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
      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  if (typeof ArrayBuffer !== 'undefined' && typeof ArrayBuffer.isView === 'function' &&\n      (ArrayBuffer.isView(string) || string instanceof ArrayBuffer))
 {\n    return string.byteLength\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}\n\nBuffer.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 coersion 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\n   case 'utf8':\n   case 'utf-8':\n   return utf8Slice(this, start, end)\n\n   case 'ascii':\n   return asciiSlice(this, start, end)\n\n   case 'latin1':\n   case 'binary':\n   return latin1Slice(this, start, end)\n\n   case 'base64':\n   return base64Slice(this, start, end)\n\n   case 'ucs2':\n   case 'ucs-2':\n   case 'utf16le':\n   case 'utf-16le':\n   return utf16leSlice(this, start, end)\n\n   default:\n   if (loweredCase) throw new TypeError('Unknown encoding: ' + encoding)\n   encoding = (encoding + '').toLowerCase()\n   loweredCase = true\n   }\n }\n}\n\n// The property is used by `Buffer.isBuffer` and `is-buffer` (in Safari 5-7) to detect\n// Buffer instances.\nBuffer.prototype._isBuffer = true\n\nfunction swap (b, n, m) {\n var i = b[n]\n b[n] = b[m]\n b[m] = i\n}\n\nBuffer.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\nBuffer.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\nBuffer.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\nBuffer.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\nBuffer.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\nBuffer.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\nBuffer.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\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\n if (start < 0 || end > target.length || thisStart < 0 || thisEnd > this.length) {\n   throw new RangeError('out of range index')\n }\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\n start >>>= 0\n end >>>= 0\n thisStart >>>= 0\n thisEnd >>>= 0\n\n if (this === target) return 0\n\n var x = thisEnd - thisStart\n var y = end - start\n var len = Math.min(x, y)\n\n var thisCopy = this.slice(thisStart, thisEnd)\n var targetCopy = target.slice(start, end)\n\n for (var i = 0; i < len; ++i) {\n   if (thisCopy[i] !==

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//\n// Arguments:\n// - buffer - a Buffer to search\n// - val - a string, Buffer, or number\n// -
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)
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 &&\n 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\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' ||\n 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 } else {\n if (foundIndex !== -1) i -= i - foundIndex\n foundIndex = -1\n }\n }\n } else {\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\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\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.length - offset), 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

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\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 > 0x7FF && (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 = 0xFFFD\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 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

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\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\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\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\n if (!start || start < 0) start = 0\n if (!end || end < 0 || end > len) end = len\n\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\n if (start < 0) {\n   start += len\n   if (start < 0) start = 0\n } else if (start > len) {\n   start = len\n }\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\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\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\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\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\n var val = this[offset + --byteLength]\n var mul = 1\n while (byteLength > 0 && (mul *= 0x100)) {\n   val += this[offset + --byteLength] * mul\n }\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\n return ((this[offset]) |\n   (this[offset + 1] << 8) |\n   (this[offset + 2] << 16)) +\n   (this[offset + 3] * 0x1000000)\n}\n\nBuffer.prototype.readUInt32BE = function readUInt32BE (offset, noAssert) {\n if (!noAssert) checkOffset(offset, 4, this.length)\n\n return (this[offset] * 0x1000000) +\n   ((this[offset + 1] << 16) |\n   (this[offset + 2] << 8) |\n   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\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\n if (val >= mul) val -= Math.pow(2, 8 * byteLength)\n\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\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\n if (val >= mul) val -= Math.pow(2, 8 * byteLength)\n\n

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

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\n  // Copy 0 bytes; we're done\n  if (end === start) return 0\n  if (target.length === 0 || this.length === 0) return 0\n\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\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\n  var len = end - start\n  var i\n\n  if (this === target && start < targetStart && targetStart < end) {\n    // descending copy from end\n    for (i = len
 - 1; 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\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\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\n  if (end <= start) {\n    return this\n  }\n\n  start = start >>> 0\n  end = end === undefined ? this.length : end >>> 0\n\n  if (!val) val = 0\n\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)\n      ? val\n      : 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\n  return this\n}\n\n// HELPER FUNCTIONS\n// ================\n\nvar INVALID_BASE64_RE = /[^+\\/0-9A-Za-z-_]/g\n\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 ''\n  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}\n\nfunction stringtrim (str) {\n  if (str.trim) return str.trim()\n  return str.replace(/^\\s+|\\s+$/g, '')\n}\n\nfunction toHex (n) {\n  if (n < 16) return '0' + n.toString(16)\n  return n.toString(16)\n}\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\n  for (var i = 0; i < length;
 ++i) {\n    codePoint = string.charCodeAt(i)\n\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\n        // valid lead\n        leadSurrogate = codePoint\n\n        continue\n      }\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\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    }\n\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    } 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\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 * @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';\n\nimport {tensor} from '../ops/tensor';\nimport {NamedTensor, NamedTensorMap} from '../tensor_types';\nimport {TypedArray} from '../types';\nimport {sizeFromShape} from '../util';\n\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):\n    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' &&\n        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\n  const tensorValues = await Promise.all(dataPromises);\n  return {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 * @param specs Specifications of
 the names, dtypes and shapes of the tensors\n *    whose value are encoded by `buffer`.\n * @return A map from tensor name to tensor value, with the names corresponding\n *    to names in `specs`.\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\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          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}': ${dtype}`);\n      }\n      offset += size * quantizationSizeFactor;\n    } else if (dtype === 'string') {\n      const size = sizeFromShape(spec.shape);\n      values = [];\n      for (let i = 0; i < size; i++) {\n        const byteLength = new Uint32Array(\n            buffer.slice(offset, offset + NUM_BYTES_STRING_LENGTH))[0];\n        offset += NUM_BYTES_STRING_LENGTH;\n        const bytes = new Uint8Array(buffer.slice(offset, offset + byteLength));\n        (values as Uint8Array[]).push(bytes);\n        offset += byteLength;\n      }\n    } else {\n      const dtypeFactor
 = DTYPE_VALUE_SIZE_MAP[dtype];\n      const byteBuffer = buffer.slice(offset, offset + size * dtypeFactor);\n\n      if (dtype === 'float32') {\n        values = new Float32Array(byteBuffer);\n      } else if (dtype === 'int32') {\n        values = new Int32Array(byteBuffer);\n      } else if (dtype === 'bool') {\n        values = new Uint8Array(byteBuffer);\n      } else if (dtype === 'complex64') {\n        values = new Float32Array(byteBuffer);\n        const real = new Float32Array(values.length / 2);\n        const image = new Float32Array(values.length / 2);\n        for (let i = 0; i < real.length; i++) {\n          real[i] = values[i * 2];\n          image[i] = values[i * 2 + 1];\n        }\n
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const realTensor = tensor(real, shape, 'float32');\n        const imageTensor = tensor(image, shape, 'float32');\n
out[name] = complex(realTensor, imageTensor);\n        realTensor.dispose();\n        imageTensor.dispose();\n      }
else {\n        throw new Error(`Unsupported
 dtype in weight '${name}': ${dtype}`);\n      }\n      offset += size * dtypeFactor;\n    }\n    if (dtype !==
'complex64') {\n      out[name] = tensor(values, shape, dtype);\n    }\n  }\n  return out;\n}\n\n/**\n * Concatenate
TypedArrays into an ArrayBuffer.\n */\nexport function concatenateTypedArrays(xs: TypedArray[]): ArrayBuffer
{\n  // TODO(adarob, cais): Support quantization.\n  if (xs === null) {\n    throw new Error(`Invalid input value:
${JSON.stringify(xs)}`);\n  }\n\n  let totalByteLength = 0;\n\n  // `normalizedXs` is here for this reason: a
`TypedArray`'s `buffer'\n  // can have a different byte length from that of the `TypedArray` itself,\n  // for example,
when the `TypedArray` is created from an offset in an\n  // `ArrayBuffer`. `normliazedXs` holds `TypedArray`s
whose `buffer`s match\n  // the `TypedArray` in byte length. If an element of `xs` does not show\n  // this property, a
new `TypedArray` that satisfy this property will be\n  // constructed and pushed
 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 ===
x.buffer.byteLength ? x :\n                                    new (x.constructor as any)(x));\n    if (!(x as any instanceof
Float32Array || x as any instanceof Int32Array ||\n          x as any instanceof Uint8Array)) {\n      throw new
Error(`Unsupported TypedArray subtype: ${x.constructor.name}`);\n    }\n    // tslint:enable:no-any\n  });\n\n  const
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\n  return y.buffer;\n}\n\n// Use Buffer
on Node.js instead of Blob/atob/btoa\nconst useNodeBuffer = typeof Buffer !== 'undefined' &&\n    (typeof Blob
=== 'undefined' || typeof atob === 'undefined' ||\n     typeof btoa === 'undefined');\n\n/**\n
 * Calculate the byte length of a JavaScript string.\n *\n * Note that a JavaScript string can contain wide characters,
therefore the\n * length of the string is not necessarily equal to the byte length.\n *\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
encoded string.\n *\n * @param buffer `ArrayBuffer` to be converted.\n * @returns A string that base64-encodes
`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,
l = buf.length; i < l; i++) {\n    s += String.fromCharCode(buf[i]);\n  }\n  return btoa(s);\n}\n\n/**\n * Decode a
base64 string as an ArrayBuffer.\n *\n * @param
 str Base64 string.\n * @returns Decoded `ArrayBuffer`.\n */\nexport function base64StringToArrayBuffer(str:
string): ArrayBuffer {\n  if (useNodeBuffer) {\n    const buf = Buffer.from(str, 'base64');\n    return
buf.buffer.slice(buf.byteOffset, buf.byteOffset + buf.byteLength);\n  }\n  const s = atob(str);\n  const buffer = new
Uint8Array(s.length);\n  for (let i = 0; i < s.length; ++i) {\n    buffer.set([s.charCodeAt(i)], i);\n  }\n  return
buffer.buffer;\n}\n\n/**\n * Concatenate a number of ArrayBuffers into one.\n *\n * @param buffers A number of
array buffers to concatenate.\n * @returns Result of concatenating `buffers` in order.\n */\nexport function
concatenateArrayBuffers(buffers: ArrayBuffer[]): ArrayBuffer {\n  if (buffers.length === 1) {\n    return
buffers[0];\n  }\n\n  let totalByteLength = 0;\n  buffers.forEach((buffer: ArrayBuffer) => {\n    totalByteLength +=
buffer.byteLength;\n  });\n\n  const temp = new Uint8Array(totalByteLength);\n  let offset = 0;\n
buffers.forEach((buffer:
 ArrayBuffer) => {\n    temp.set(new Uint8Array(buffer), offset);\n    offset += buffer.byteLength;\n  });\n  return
temp.buffer;\n}\n\n/**\n * Get the basename of a path.\n *\n * Behaves in a way analogous to Linux's basename
command.\n *\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
items = path.split(SEPARATOR);\n  return items[items.length - 1];\n}\n\n/**\n * Populate ModelArtifactsInfo
fields for a model with JSON topology.\n * @param modelArtifacts\n * @returns A ModelArtifactsInfo object.\n
*/\nexport function getModelArtifactsInfoForJSON(modelArtifacts: ModelArtifacts):\n    ModelArtifactsInfo {\n  if
(modelArtifacts.modelTopology instanceof ArrayBuffer) {\n    throw new Error('Expected JSON model topology,
```

received ArrayBuffer.');\n }\n\n return {\n   dateSaved: new Date(),\n   modelTopologyType:
'JSON',\n   modelTopologyBytes: modelArtifacts.modelTopology == null ?\n   0 :\n
stringByteLength(JSON.stringify(modelArtifacts.modelTopology)),\n   weightSpecsBytes:
modelArtifacts.weightSpecs == null ?\n   0 :\n
stringByteLength(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 *\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\n   while ((m & 0x00800000) ===
0) {\n   e -= 0x00800000;\n   m <<= 1;\n   }\n   m &= ~0x00800000;\n   e += 0x38800000;\n\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 *\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 *\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\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
    const bufferUint32View = new Uint32Array(buffer);\n   for (let index = 0; index < quantizedArray.length;
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 *
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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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WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {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\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

```
IORouterRegistry();\n    }\n    return IORouterRegistry.instance;\n  }\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   *
  @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[],
  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,
  loadOptions);\n      if (handler !== null) {\n        validHandlers.push(handler);\n      }\n    });\n    return
  validHandlers;\n  }\n}\n\nexport const registerSaveRouter = (loudRouter: IORouter) =>\n
  IORouterRegistry.registerSaveRouter(loudRouter);\nexport const registerLoadRouter = (loudRouter: IORouter)
  =>\n    IORouterRegistry.registerLoadRouter(loudRouter);\nexport
  const getSaveHandlers = (url: string|string[]) =>\n    IORouterRegistry.getSaveHandlers(url);\nexport const
  getLoadHandlers =\n    (url: string|string[], loadOptions?: LoadOptions) =>\n
  IORouterRegistry.getLoadHandlers(url, loadOptions);\n","/**\n * @license\n * Copyright 2018 Google LLC. All
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  ==========================================================================\n
  */\n\nimport '../flags';\n\nimport {env} from '../environment';\n\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\n//    as 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\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  }\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.');\n  }\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 *\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\n    if (modelPath == null || !modelPath) {\n      throw new Error(\n          'For IndexedDB, modelPath must not be null, undefined or empty.');\n    }\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.');\n    }\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\n        Promise<ModelArtifacts>;\n  }\n\n  /**\n   * Perform database action to put model artifacts into or read model artifacts\n   * from IndexedDB object store.\n   *\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   *\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`\n   *   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\n      openRequest.onsuccess = () => {\n        const db = openRequest.result;\n\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
};\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 }\n };\n openRequest.onerror = error
=> reject(openRequest.error);\n });\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};\nIORouterRegistry.registerSaveRouter(indexedDBRouter);\nIORouterRegistry.registerLoadRouter(indexedD
BRouter);\n\n/**\n
 * Creates a browser IndexedDB IOHandler for saving and loading models.\n *\n * ```js\n * const model =
tf.sequential();\n * model.add(\n * tf.layers.dense({units: 1, inputShape: [100], activation: 'sigmoid'}));\n *\n *
const saveResult = await model.save('indexeddb://MyModel'));\n * console.log(saveResult);\n * ```\n *\n * @param
modelPath A unique identifier for the model to be saved. Must be a\n * non-empty string.\n * @returns An
instance of `BrowserIndexedDB` (sublcass of `IOHandler`),\n * 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\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\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\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\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 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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';\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 '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:\n [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) :\n      key;\n}\n\ndeclare 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 *\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   *\n   * See the documentation to `browserLocalStorage` for details on the saved\n   * artifacts.\n   *\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\n      const modelArtifactsInfo: ModelArtifactsInfo =\n getModelArtifactsInfoForJSON(modelArtifacts);\n\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,\n 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\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\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   *\n   * See the documentation to `browserLocalStorage` for details on the saved\n   * artifacts.\n   *\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 '${this.modelPath}'`);\n    }\n\n    if (info.modelTopologyType !== 'JSON') {\n      throw new Error(\n 'BrowserLocalStorage does not support loading non-JSON model ' +\n          'topology yet.');\n    }\n\n    const out: ModelArtifacts = {};\n\n    // Load topology.\n    const topology =
JSON.parse(this.LS.getItem(this.keys.topology));\n    if (topology == null) {\n      throw new Error(\n          `In local
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storage, the topology of model '${this.modelPath}' ` +\n `is missing.`);\n }\n out.modelTopology = topology;\n\n // Load weight specs.\n const weightSpecs = JSON.parse(this.LS.getItem(this.keys.weightSpecs));\n if (weightSpecs == null) {\n throw new Error(\n `In local storage, the weight specs of model '${this.modelPath}' ` +\n `are missing.`);\n }\n out.weightSpecs = weightSpecs;\n\n // Load meta-data fields.\n const metadataString = this.LS.getItem(this.keys.modelMetadata);\n if (metadataString != null) {\n const metadata = JSON.parse(metadataString) as ModelArtifacts;\n out.format = metadata['format'];\n out.generatedBy = metadata['generatedBy'];\n out.convertedBy = metadata['convertedBy'];\n if (metadata['signature'] != null) {\n out.signature = metadata['signature'];\n }\n if (metadata['userDefinedMetadata'] != null) {\n out.userDefinedMetadata = metadata['userDefinedMetadata'];\n }\n if (metadata['modelInitializer'] != null) {\n out.modelInitializer = metadata['modelInitializer'];\n }\n }\n\n // Load weight data.\n const weightDataBase64 = this.LS.getItem(this.keys.weightData);\n if (weightDataBase64 == null) {\n throw new Error(\n `In local storage, the binary weight values of model ` +\n `'${this.modelPath}' are missing.`);\n }\n out.weightData = base64StringToArrayBuffer(weightDataBase64);\n\n return out;\n }\n}\n\nexport const localStorageRouter: IORouter = (url: string|string[]) => {\n if (!env().getBool('IS_BROWSER')) {\n return null;\n } else {\n if (!Array.isArray(url) && url.startsWith(BrowserLocalStorage.URL_SCHEME)) {\n return browserLocalStorage(\n url.slice(BrowserLocalStorage.URL_SCHEME.length));\n } else {\n return null;\n }\n }\n};\nIORouterRegistry.registerSaveRouter(localStorageRouter);\nIORouterRegistry.registerLoadRouter(localStorageRouter);\n\n/**\n * Factory function for local storage IOHandler.\n *\n * This `IOHandler` supports both `save` and `load`.\n *\n * For each model's saved artifacts, four items are saved to local storage.\n * - `${PATH_SEPARATOR}/${modelPath}/info`: Contains meta-info about the\n * model, such as date saved, type of the topology, size in bytes, etc.\n * - `${PATH_SEPARATOR}/${modelPath}/topology`: Model topology. For Keras-\n * style models, this is a stringized JSON.\n * - `${PATH_SEPARATOR}/${modelPath}/weight_specs`: Weight specs of the\n * model, can be used to decode the saved binary weight values (see\n * item below).\n * - `${PATH_SEPARATOR}/${modelPath}/weight_data`: Concatenated binary\n * weight values, stored as a base64-encoded string.\n *\n * Saving may throw an `Error` if the total size of the artifacts exceed the\n * browser-specific quota.\n *\n * @param modelPath A unique identifier for the model to be saved. Must be a\n * non-empty string.\n * @returns An instance of `IOHandler`, which can be used with, e.g.,\n * `tf.Model.save`.\n */\nexport function browserLocalStorage(modelPath: string): IOHandler {\n return new BrowserLocalStorage(modelPath);\n}\n\nexport class BrowserLocalStorageManager implements ModelStoreManager {\n private readonly LS: Storage;\n\n constructor() {\n assert(\n env().getBool('IS_BROWSER'),\n () => 'Current environment is not a web browser');\n assert(\n typeof window === 'undefined' ||\n typeof window.localStorage !== 'undefined',\n () => 'Current browser does not appear to support localStorage');\n this.LS = window.localStorage;\n }\n\n async listModels(): Promise<{[path: string]: ModelArtifactsInfo}> {\n const out: {[path: string]: ModelArtifactsInfo} = {};\n const prefix = PATH_PREFIX + PATH_SEPARATOR;\n const suffix = PATH_SEPARATOR + INFO_SUFFIX;\n for (let i = 0; i < this.LS.length; ++i) {\n const key = this.LS.key(i);\n if (key.startsWith(prefix) && key.endsWith(suffix)) {\n const modelPath = getModelPathFromKey(key);\n out[modelPath] = JSON.parse(this.LS.getItem(key)) as ModelArtifactsInfo;\n }\n }\n return out;\n }\n\n async removeModel(path: string): Promise<ModelArtifactsInfo> {\n path = maybeStripScheme(path);\n const keys = getModelKeys(path);\n if (this.LS.getItem(keys.info) == null) {\n throw new Error(`Cannot find model at path '${path}'`);\n }\n const info = JSON.parse(this.LS.getItem(keys.info)) as ModelArtifactsInfo;\n\n this.LS.removeItem(keys.info);\n this.LS.removeItem(keys.topology);\n this.LS.removeItem(keys.weightSpecs);\n this.LS.removeItem(keys.weightData);\n return info;\n }\n}\n","/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version

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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/**\n * Classes and functions for model management across multiple storage mediums.\n *\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';\n\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\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
 = new ModelStoreManagerRegistry();\n    }\n    return ModelStoreManagerRegistry.instance;\n  }\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 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(\n        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/**\n * Helper method for parsing a URL string into a scheme and a path.\n *\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 */\nfunction parseURL(url: string): {scheme: string, path: string} {\n  if (url.indexOf(URL_SCHEME_SUFFIX) === -1) {\n    throw new Error(\n        `The url string provided does not contain a scheme. ` +\n        `Supported schemes are: ` +\n        `${ModelStoreManagerRegistry.getSchemes().join(',')}`);\n  }\n  return {\n    scheme: url.split(URL_SCHEME_SUFFIX)[0],\n    path: url.split(URL_SCHEME_SUFFIX)[1],\n  };\n}\n\nasync function cloneModelInternal(\n    sourceURL: string, destURL: string,\n    deleteSource = false): Promise<ModelArtifactsInfo> {\n  assert(\n      sourceURL !== destURL,\n      () => `Old path and new path are the same: '${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
```

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 * 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 */\nasync function listModels(): Promise<{[url: string]: ModelArtifactsInfo}> {\n const schemes = ModelStoreManagerRegistry.getSchemes();\n const out: {[url: string]: ModelArtifactsInfo} = {};\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 reigstered 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
  * 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 * @returns ModelArtifactsInfo of the deleted model (if and only if deletion\n *   is successful).\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 */\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 * 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 * 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

copying.\n * @param destURL Destination URL of copying.\n * @returns ModelArtifactsInfo of the copied model (if and only if copying\n * is successful).\n * @throws Error if copying fails, e.g., if no model exists at `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 */\nasync 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 * `tf.io.moveModel('localstorage://model-1', 'localstorage://model-2')`\n * 2. Moving between two storage mediums, e.g.,\n * `tf.io.moveModel('localstorage://model-1', 'indexeddb://model-1')`\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 * // Move the model, from Local Storage to IndexedDB.\n * await tf.io.moveModel(\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 the moved model.\n * await 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 model (if and only if copying\n * is successful).\n * @throws Error if moving fails, e.g., if no model exists at `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 */\nasync 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, listModels};\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 '../flags';\n\nimport {env} from '../environment';\nimport {BrowserIndexedDB, BrowserIndexedDBManager} from '../io/indexed_db';\nimport {BrowserLocalStorage, BrowserLocalStorageManager} from '../io/local_storage';\nimport {ModelStoreManagerRegistry} from '../io/model_management';\n\nimport {Platform} from './platform';\n\nexport class PlatformBrowser implements Platform {\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: TextEncoder;\n\n fetch(path: string, init?: RequestInit): Promise<Response> {\n return fetch(path, init);\n }\n\n now(): number {\n return performance.now();\n }\n\n encode(text: string, encoding: string): Uint8Array {\n if (encoding !== 'utf-8' && encoding !== 'utf8') {\n throw new Error(\n `Browser's encoder only supports utf-8, but got ${encoding}`);\n }\n if (this.textEncoder == null) {\n this.textEncoder = new TextEncoder();\n }\n return this.textEncoder.encode(text);\n }\n decode(bytes: Uint8Array, encoding: string): string {\n return new TextDecoder(encoding).decode(bytes);\n }\n}\n\nif (env().get('IS_BROWSER')) {\n env().setPlatform('browser', new PlatformBrowser());\n\n // Register LocalStorage IOHandler\n try {\n ModelStoreManagerRegistry.registerManager(\n BrowserLocalStorage.URL_SCHEME, new BrowserLocalStorageManager());\n } catch (err) {\n }\n\n // Register IndexedDB IOHandler\n try {\n ModelStoreManagerRegistry.registerManager(\n BrowserIndexedDB.URL_SCHEME, new

BrowserIndexedDBManager());\n } catch (err) {\n }\n}\n","/**\n * @license\n
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==========\n
*/\nimport {env} from '../environment';\n\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// These getters and setters are for testing so we don't export a mutable\n// variable.\nexport function resetSystemFetch() {\n systemFetch = null;\n}\nexport function setSystemFetch(fetchFn: FetchFn) {\n systemFetch = fetchFn;\n}\nexport function getSystemFetch(): FetchFn {\n return systemFetch;\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, requestInits?: RequestInit): Promise<Response> {\n   if (env().global.fetch != null) {\n   return env().global.fetch(path,
 requestInits);\n   }\n\n   if (systemFetch == null) {\n   systemFetch = getNodeFetch.importFetch();\n   }\n return systemFetch(path, requestInits);\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 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 * @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 *
 those values.\n *\n * ```js\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 * @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 */\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

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
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==========\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';\n\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
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==========\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';\n\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 *\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 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

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 * @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// 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// 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 * @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 * 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   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   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

```
'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:
modelArtifacts.weightSpecs\n      }];\n      const modelTopologyAndWeightManifest: ModelJSON = {\n
modelTopology: modelArtifacts.modelTopology,\n        format: modelArtifacts.format,\n        generatedBy:
modelArtifacts.generatedBy,\n        convertedBy: modelArtifacts.convertedBy,\n        weightsManifest\n      };\n
if (modelArtifacts.signature != null) {\n        modelTopologyAndWeightManifest.signature =
modelArtifacts.signature;\n
    }\n      if (modelArtifacts.userDefinedMetadata != null) {\n
modelTopologyAndWeightManifest.userDefinedMetadata =\n            modelArtifacts.userDefinedMetadata;\n      }\n
   if (modelArtifacts.modelInitializer != null) {\n        modelTopologyAndWeightManifest.modelInitializer =\n
 modelArtifacts.modelInitializer;\n      }\n      const modelTopologyAndWeightManifestURL =\n
window.URL.createObjectURL(new Blob(\n              [JSON.stringify(modelTopologyAndWeightManifest)],\n
   {type: 'application/json'}));\n\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
? document.createElement('a') :\n                                          this.jsonAnchor;\n      jsonAnchor.download =
this.modelTopologyFileName;\n      jsonAnchor.href = modelTopologyAndWeightManifestURL;\n
    // Trigger downloads by evoking a click event on the download anchors.\n      // When multiple downloads are
started synchronously, Firefox will only\n      // save the last one.\n      await defer(() =>
jsonAnchor.dispatchEvent(new MouseEvent('click')));\n\n      if (modelArtifacts.weightData != null) {\n        const
weightDataAnchor = this.weightDataAnchor == null ?\n            document.createElement('a') :\n
this.weightDataAnchor;\n        weightDataAnchor.download = this.weightDataFileName;\n
weightDataAnchor.href = weightsURL;\n        await defer(\n            () => weightDataAnchor.dispatchEvent(new
MouseEvent('click')));\n      }\n\n      return {modelArtifactsInfo:
getModelArtifactsInfoForJSON(modelArtifacts)};\n    }\n  }\n}\n\nclass BrowserFiles implements IOHandler {\n
private readonly files: File[];\n\n  constructor(files: File[]) {\n    if (files == null || files.length < 1) {\n      throw new
Error(\n          `When calling browserFiles, at least
 1 file is required, ` +\n          `but received ${files}`);\n    }\n    this.files = files;\n  }\n\n  async load():
Promise<ModelArtifacts> {\n    const jsonFile = this.files[0];\n    const weightFiles = this.files.slice(1);\n\n    return
new Promise<ModelArtifacts>((resolve, reject) => {\n      const jsonReader = new FileReader();\n
jsonReader.onload = (event: Event) => {\n        // tslint:disable-next-line:no-any\n        const modelJSON =
JSON.parse((event.target as any).result) as ModelJSON;\n        const modelTopology =
modelJSON.modelTopology;\n        if (modelTopology == null) {\n          reject(new Error(\n
`modelTopology field is missing from file ${jsonFile.name}`));\n          return;\n        }\n\n        if
(weightFiles.length === 0) {\n          resolve({modelTopology});\n        }\n\n        const weightsManifest =
modelJSON.weightsManifest;\n        if (weightsManifest == null) {\n          reject(new Error(\n
`weightManifest field
 is missing from file ${jsonFile.name}`));\n          return;\n        }\n\n        let pathToFile: {[path: string]: File};\n
try {\n          pathToFile =\n              this.checkManifestAndWeightFiles(weightsManifest, weightFiles);\n        }
catch (err) {\n          reject(err);\n          return;\n        }\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\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:
ModelArtifacts = {\n                  modelTopology,\n                  weightSpecs,\n                  weightData:
```

```
concatenateArrayBuffers(perFileBuffers),\n format: modelJSON.format,\n generatedBy:
modelJSON.generatedBy,\n convertedBy: modelJSON.convertedBy\n };\n if
(modelJSON.signature != null) {\n result.signature = modelJSON.signature;\n }\n if
(modelJSON.userDefinedMetadata != null) {\n result.userDefinedMetadata =
modelJSON.userDefinedMetadata;\n }\n if (modelJSON.modelInitializer != null) {\n
result.modelInitializer = modelJSON.modelInitializer;\n
 }\n resolve(result);\n }\n };\n weightFileReader.onerror = error =>\n
  reject(`Failed to weights data from file of path '${path}'.`);\n
weightFileReader.readAsArrayBuffer(pathToFile[path]);\n });\n });\n };\n jsonReader.onerror =
error => reject(\n `Failed to read model topology and weights manifest JSON ` +\n `from file
'${jsonFile.name}'. BrowserFiles supports loading ` +\n `Keras-style tf.Model artifacts only.`);\n
jsonReader.readAsText(jsonFile);\n });\n }\n\n /**\n  * Check the compatibility between weights manifest and
weight files.\n  */\n  private checkManifestAndWeightFiles(\n  manifest: WeightsManifestConfig, files: File[]):
{[path: string]: File} {\n  const basenames: string[] = [];\n  const fileNames = files.map(file =>
basename(file.name));\n  const pathToFile: {[path: string]: File} = {};\n  for (const
 group of manifest) {\n  group.paths.forEach(path => {\n  const pathBasename = basename(path);\n  if
(basenames.indexOf(pathBasename) !== -1) {\n  throw new Error(\n  `Duplicate file basename found in
weights manifest: ` +\n  `'${pathBasename}'`);\n  }\n  basenames.push(pathBasename);\n  if
(fileNames.indexOf(pathBasename) === -1) {\n  throw new Error(\n  `Weight file with basename
'${pathBasename}' is not provided.`);\n  } else {\n  pathToFile[path] =
files[fileNames.indexOf(pathBasename)];\n  }\n  });\n  }\n\n  if (basenames.length !== files.length) {\n
throw new Error(\n  `Mismatch in the number of files in weights manifest ` +\n  `(${basenames.length})
and the number of weight files provided ` +\n  `(${files.length}).`);\n  }\n  return pathToFile;\n
}\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) &&
url.startsWith(BrowserDownloads.URL_SCHEME)) {\n  return
browserDownloads(url.slice(BrowserDownloads.URL_SCHEME.length));\n  } else {\n  return null;\n  }\n
}\n};\nIORouterRegistry.registerSaveRouter(browserDownloadsRouter);\n\n/**\n * Creates an IOHandler that
triggers file downloads from the browser.\n *\n * The returned `IOHandler` instance can be used as model exporting
methods such\n * as `tf.Model.save` and supports only saving.\n *\n * ```js\n * const model = tf.sequential();\n *
model.add(tf.layers.dense(\n *  {units: 1, inputShape: [10], activation: 'sigmoid'}));\n * const saveResult = await
model.save('downloads://mymodel');\n * // This will trigger downloading of two files:\n * //  'mymodel.json' and
'mymodel.weights.bin'.\n * console.log(saveResult);\n * ```\n *\n * @param fileNamePrefix Prefix name of the files
to be downloaded. For use with\n *  `tf.Model`,
 `fileNamePrefix` should follow either of the following two\n *  formats:\n *  1. `null` or `undefined`, in which
case the default file\n *  names will be used:\n *  - 'model.json' for the JSON file containing the model topology
and\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
provided, the downloaded JSON\n *  file and binary weights file will be named 'foo.json' and\n *
'foo.weights.bin', respectively.\n * @param config Additional configuration for triggering downloads.\n * @returns
An instance of `BrowserDownloads` `IOHandler`.\n *\n * @doc {\n *  heading: 'Models',\n *  subheading:
'Loading',\n *  namespace: 'io',\n *  ignoreCI: true\n * }\n */\nexport function browserDownloads(fileNamePrefix =
'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
loading from files such as user-selected files\n * in the browser.\n * When used in conjunction with
`tf.loadLayersModel`, an instance of\n * `tf.LayersModel` (Keras-style) can be constructed from the loaded
artifacts.\n *\n * ```js\n * // Note: This code snippet won't run properly without the actual file input\n * //  elements
in 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 = document.getElementById('upload-weights');\n * const model = await tf.loadLayersModel(tf.io.browserFiles(\n * [uploadJSONInput.files[0], uploadWeightsInput.files[0]]));\n * ```\n *\n * @param files `File`s to load from. Currently, this function supports only\n * loading from files that contain Keras-style models (i.e., `tf.Model`s), for\n * which an `Array` of `File`s is expected (in that order):\n * - A JSON file containing the model topology and weight manifest.\n * - Optionally, One or more binary files containing the binary weights.\n * These files must have names that match the paths in the `weightsManifest`\n * contained by the aforementioned JSON file, or errors will be thrown\n * during loading. These weights files have the same format as the ones\n * generated by `tensorflowjs_converter` that comes with the `tensorflowjs`\n * Python PIP package. If no weights files are provided, only the model\n * topology will be loaded from the JSON file above.\n * @returns An instance of `Files` `IOHandler`.\n *\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 BrowserFiles(files);\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 {assert} from '../util';\n\nimport {OnProgressCallback} from './types';\n\n/**\n * Monitor Promise.all progress, fire onProgress callback function.\n *\n * @param promises Promise list going to be monitored\n * @param onProgress Callback function. Fired when a promise resolved.\n * @param startFraction Optional fraction start. Default to 0.\n * @param endFraction Optional fraction end. Default to 1.\n */\nexport function monitorPromisesProgress(\n promises: Array<Promise<{}|void>>, onProgress: OnProgressCallback,\n startFraction?: number, endFraction?: number) {\n checkPromises(promises);\n startFraction = startFraction == null ? 0 : startFraction;\n endFraction = endFraction == null ? 1 : endFraction;\n checkFraction(startFraction, endFraction);\n let resolvedPromise = 0;\n\n const registerMonitor = (promise: Promise<{}>) => {\n promise.then(value => {\n const fraction = startFraction +\n ++resolvedPromise / promises.length * (endFraction - startFraction);\n // pass fraction as parameter to callback function.\n onProgress(fraction);\n return value;\n });\n return promise;\n };\n\n function checkPromises(promises: Array<Promise<{}|void>>): void {\n assert(\n promises != null && Array.isArray(promises) && promises.length > 0,\n () => 'promises must be a none empty array');\n }\n\n function checkFraction(startFraction: number, endFraction: number): void {\n assert(\n startFraction >= 0 && startFraction <= 1,\n () => `Progress fraction must be in range [0, 1], but ` +\n `got startFraction ${startFraction}`);\n assert(\n endFraction >= 0 && endFraction <= 1,\n () => `Progress fraction must be in range [0, 1], but ` +\n `got endFraction ${endFraction}`);\n assert(\n endFraction >= startFraction,\n () => `startFraction must be no more than endFraction, but ` +\n `got startFraction ${startFraction} and endFraction ` +\n `${endFraction}`);\n }\n\n return Promise.all(promises.map(registerMonitor));\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 {env} from '../environment';\n\nimport {NamedTensorMap} from '../tensor_types';\nimport * as util from '../util';\nimport {decodeWeights} from './io_utils';\nimport {monitorPromisesProgress} from

'./progress';\nimport {DTYPE_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\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\n const responses = loadOptions.onProgress == null
?\n await Promise.all(requests) :\n await monitorPromisesProgress(\n requests, loadOptions.onProgress, fetchStartFraction,\n fetchEndFraction);\n\n const bufferPromises = responses.map(response => response.arrayBuffer());\n\n const bufferStartFraction = 0.5;\n const bufferEndFraction = 1;\n\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\n const fetchWeights = (fetchUrls: string[]) =>\n loadWeightsAsArrayBuffer(fetchUrls, {requestInit});\n const loadWeights = weightsLoaderFactory(fetchWeights);\n\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 * ```js\n * // example for creating a nodejs weight loader, which reads the weight files\n * // from disk using fs.readFileSync\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[]):
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)

```
?\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\n          const weightsTensorMap: NamedTensorMap =
{};\n          let bufferIndexOffset = 0;\n          groupIndicesToFetch.forEach(i => {\n          const numBuffers =
manifest[i].paths.length;\n\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 *
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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';\nimport {concatenateArrayBuffers,
getModelArtifactsInfoForJSON} from './io_utils';\nimport {IORouter, IORouterRegistry} from
'./router_registry';\nimport {IOHandler, LoadOptions, ModelArtifacts, ModelJSON, OnProgressCallback,
SaveResult, WeightsManifestConfig, WeightsManifestEntry} from './types';\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
```

```
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
readonly onProgress: OnProgressCallback;\n\n  constructor(path:
 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
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 =
env().platform.fetch;\n    }\n\n    assert(\n        path != null && path.length > 0,\n        () => 'URL path for http must
not be null, undefined or ' +\n            'empty.');\n\n    if (Array.isArray(path)) {\n      assert(\n          path.length ===
2,\n          () => 'URL paths for http must have a length of 2, ' +\n              `(actual
 length is ${path.length}).`);\n    }\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-
existing body, but has one.');\n    }\n    this.requestInit = loadOptions.requestInit || {};\n  }\n\n  async
save(modelArtifacts: ModelArtifacts): Promise<SaveResult> {\n    if (modelArtifacts.modelTopology instanceof
ArrayBuffer) {\n      throw new Error(\n          'BrowserHTTPRequest.save() does not support saving model topology
' +\n          'in binary formats yet.');\n    }\n\n    const init = Object.assign({method: this.DEFAULT_METHOD},
this.requestInit);\n    init.body = new FormData();\n\n    const weightsManifest: WeightsManifestConfig = [{\n
paths: ['./model.weights.bin'],\n      weights: modelArtifacts.weightSpecs,\n    }];\n    const
modelTopologyAndWeightManifest: ModelJSON = {\n      modelTopology: modelArtifacts.modelTopology,\n
format:
 modelArtifacts.format,\n      generatedBy: modelArtifacts.generatedBy,\n      convertedBy:
modelArtifacts.convertedBy,\n      weightsManifest\n    };\n    if (modelArtifacts.signature != null) {\n
modelTopologyAndWeightManifest.signature = modelArtifacts.signature;\n    }\n    if
(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
(modelArtifacts.weightData != null) {\n      init.body.append(\n          'model.weights.bin',\n          new
Blob([modelArtifacts.weightData], {type: OCTET_STREAM_MIME_TYPE}),\n          'model.weights.bin');\n
   }\n\n    const response = await this.fetch(this.path, init);\n\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   *\n   * See the
documentation to `tf.io.http` for details on the saved\n   * artifacts.\n   *\n   * @returns The loaded model artifacts (if
loading succeeds).\n   */\n  async load(): Promise<ModelArtifacts> {\n    const modelConfigRequest = await
this.fetch(this.path, this.requestInit);\n\n    if (!modelConfigRequest.ok) {\n      throw new Error(\n          `Request to
${this.path} failed with status code ` +\n          `${modelConfigRequest.status}. Please verify this URL points to ` +\n
          `the model JSON of the model to
 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      //
TODO(nsthorat): Remove this after some time when we're comfortable that\n      // .pb files are mostly gone.\n      if
(this.path.endsWith('.pb')) {\n        message += ' Your path contains a .pb file extension. ' +\n            'Support for .pb
models have been removed in TensorFlow.js 1.0 ' +\n            'in favor of .json models. You can re-convert your
Python ' +\n            'TensorFlow model using the TensorFlow.js 1.0 conversion scripts ' +\n            'or you can
convert your.pb models with the \\'pb2json\\'' +\n            'NPM script in the tensorflow/tfjs-converter repository.';\n
```

} else {\n message += ' Please make sure the server is serving valid ' +\n 'JSON for this request.';\n }\n throw new Error(message);\n }\n
const modelTopology = modelConfig.modelTopology;\n const weightsManifest = modelConfig.weightsManifest;\n const generatedBy = modelConfig.generatedBy;\n const convertedBy = modelConfig.convertedBy;\n const format = modelConfig.format;\n const signature = modelConfig.signature;\n const userDefinedMetadata = modelConfig.userDefinedMetadata;\n\n // We do not allow both modelTopology and weightsManifest to be missing.\n if (modelTopology == null && weightsManifest == null) {\n throw new Error(\n `The JSON from HTTP path ${this.path} contains neither model ` +\n `topology or manifest for weights.`);\n }\n\n let weightSpecs: WeightsManifestEntry[];\n let weightData: ArrayBuffer;\n if (weightsManifest != null) {\n const results = await this.loadWeights(weightsManifest);\n [weightSpecs, 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 = signature;\n }\n if (userDefinedMetadata != null) {\n artifacts.userDefinedMetadata = userDefinedMetadata;\n }\n\n const initializer = modelConfig.modelInitializer;\n if (initializer) {\n artifacts.modelInitializer = initializer;\n }\n\n return artifacts;\n }\n\n private async loadWeights(weightsManifest: WeightsManifestConfig):\n Promise<[WeightsManifestEntry[], ArrayBuffer]> {\n const weightPath = Array.isArray(this.path) ? this.path[1] : this.path;\n const [prefix, suffix] = parseUrl(weightPath);\n const pathPrefix = this.weightPathPrefix || prefix;\n\n const weightSpecs = [];\n for (const entry of weightsManifest) {\n weightSpecs.push(...entry.weights);\n }\n\n const fetchURLs: string[] = [];\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 + suffix);\n }\n }\n }\n\n if (this.weightUrlConverter) {\n fetchURLs.push(...await 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 return [weightSpecs, concatenateArrayBuffers(buffers)];\n }\n}\n\n/**\n * Extract the prefix and suffix of the url, where the prefix is the path before\n * the last file, and suffix is the search params after the last file.\n * ```\n * const url = 'http://tfhub.dev/model/1/tensorflowjs_model.pb?tfjs-format=file'\n * [prefix, suffix] = parseUrl(url)\n * // prefix = 'http://tfhub.dev/model/1/'\n * // suffix = '?tfjs-format=file'\n * ```\n * @param url the model url to be parsed.\n */\nexport function parseUrl(url: string): [string, string] {\n const lastSlash = 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 + '/', suffix];\n}\n\nexport function isHTTPScheme(url: string): boolean {\n return url.match(HTTPRequest.URL_SCHEME_REGEX) != null;\n}\n\nexport const httpRouter: IORouter =\n (url: string, loadOptions?: LoadOptions) => {\n if (typeof fetch === 'undefined' &&\n (loadOptions == null || loadOptions.fetchFunc == null)) {\n // `http` uses `fetch` or `node-fetch`, if one wants to use it in\n // an 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 => isHTTPScheme(urlItem));\n } else {\n isHTTP = isHTTPScheme(url);\n }\n if (isHTTP) {\n return http(url, loadOptions);\n }\n }\n return null;\n};\nIORouterRegistry.registerSaveRouter(httpRouter);\nIORouterRegistry.registerLoadRouter(httpRouter);\n\n/**\n * Creates an IOHandler subtype that sends model artifacts to HTTP server.\n *\n * An HTTP request of the `multipart/form-data` mime type will be sent to the\n * `path` URL. The form data includes artifacts that represent the topology\n * and/or weights of the model. In the case of Keras-style `tf.Model`, two\n * blobs (files) exist in form-data:\n * - A JSON file consisting of `modelTopology` and `weightsManifest`.\n * - A binary weights file 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 *\n * The following code snippet

exemplifies
the client-side code that uses this\n * function:\n *\n * ```js\n * const model = tf.sequential();\n * model.add(\n * tf.layers.dense({units: 1, inputShape: [100], activation: 'sigmoid'}));\n *\n * const saveResult = await model.save(tf.io.http(\n * 'http://model-server:5000/upload', {requestInit: {method: 'PUT'}}));\n * console.log(saveResult);\n * ```\n *\n * If the default `POST` method is to be used, without any custom parameters\n * such as headers, you can simply pass an HTTP or HTTPS URL to `model.save`:\n *\n * ```js\n * const saveResult = await model.save('http://model-server:5000/upload');\n * ```\n *\n * The following GitHub Gist\n * https://gist.github.com/dsmilkov/1b6046fd6132d7408d5257b0976f7864\n * implements a server based on [flask](https://github.com/pallets/flask) that\n * can receive the request. Upon receiving the model artifacts via the requst,\n * this particular server reconsistutes instances of [Keras\n * Models](https://keras.io/models/model/) in memory.\n
*\n *\n * @param path A URL path to the model.\n * Can be an absolute HTTP path (e.g.,\n * 'http://localhost:8000/model-upload)') or a relative path (e.g.,\n * './model-upload').\n * @param requestInit Request configurations to be used when sending\n * HTTP request to server using `fetch`. It can contain fields such as\n * `method`, `credentials`, `headers`, `mode`, etc. See\n * https://developer.mozilla.org/en-US/docs/Web/API/Request/Request\n * for more information. `requestInit` must not have a body, because the\n * body will be set by TensorFlow.js. File blobs representing the model\n * topology (filename: 'model.json') and the weights of the model (filename:\n * 'model.weights.bin') will be appended to the body. If `requestInit` has a\n * `body`, an Error will be thrown.\n * @param loadOptions Optional configuration for the loading. It includes the\n * following fields:\n * - weightPathPrefix Optional, this specifies the path prefix for weight\n * files, by default this is calculated from the path param.\n * - fetchFunc Optional, custom `fetch` function. E.g., in Node.js,\n * the `fetch` from node-fetch can be used here.\n * - onProgress Optional, progress callback function, fired periodically\n * before the load is completed.\n * @returns An instance of `IOHandler`.\n *\n * @doc {\n * heading: 'Models',\n * subheading: 'Loading',\n * namespace: 'io',\n * ignoreCI: true\n * }\n */\nexport function http(path: string, loadOptions?: LoadOptions): IOHandler {\n return new HTTPRequest(path, loadOptions);\n}\n\n/**\n * Deprecated. Use `tf.io.http`.\n * @param path\n * @param loadOptions\n */\nexport function browserHTTPRequest(\n path: string, loadOptions?: LoadOptions): IOHandler {\n return http(path, loadOptions);\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/**\n * IOHandlers that pass through the in-memory ModelArtifacts format.\n */\n\nimport {IOHandler, ModelArtifacts, SaveResult, TrainingConfig, WeightsManifestEntry} from './types';\n\nclass PassthroughLoader implements IOHandler {\n constructor(private readonly modelArtifacts?: ModelArtifacts) {}\n\n async load(): Promise<ModelArtifacts> {\n   return this.modelArtifacts;\n }\n}\n\nclass PassthroughSaver implements IOHandler {\n constructor(\n   private readonly saveHandler:\n   (artifacts: ModelArtifacts) => Promise<SaveResult>) {}\n\n async save(modelArtifacts: ModelArtifacts) {\n   return this.saveHandler(modelArtifacts);\n }\n}\n\n/**\n * Creates an IOHandler that loads model artifacts from memory.\n *\n * When used in conjunction with `tf.loadLayersModel`, an instance of\n * `tf.LayersModel` (Keras-style) can be constructed from the loaded artifacts.\n *\n * ```js\n * const model = await tf.loadLayersModel(tf.io.fromMemory(\n * modelTopology, weightSpecs, weightData));\n * ```\n *\n * @param modelArtifacts a object containing model topology (i.e., parsed from\n * the JSON format).\n * @param weightSpecs An array of `WeightsManifestEntry` objects describing the\n * names, shapes, types, and quantization of the weight data.\n * @param weightData A single `ArrayBuffer` containing the weight data,\n *

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({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 *\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 * 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// Importing local_storage and indexed_db is necessary for the routers to be\n// registered.\nimport './indexed_db';\nimport './local_storage';\n\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 * @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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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 {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 tf.matMul(a, b)\n * ```\n * @param a First matrix in dot product operation.\n * @param b Second matrix in dot product operation.\n
* @param transposeA If true, `a` is transposed before multiplication.\n * @param transposeB If true, `b` is transposed before multiplication.\n *\n * @doc {heading: 'Operations', subheading: 'Matrices'}\n */\nfunction matMul_<T extends Tensor>(\n a: Tensor|TensorLike, b: Tensor|TensorLike, transposeA = false,\n transposeB = false): T {\n let $a = convertToTensor(a, 'a', 'matMul');\n let $b = convertToTensor(b, 'b', 'matMul');\n [$a, $b] = makeTypesMatch($a, $b);\n\n const inputs: BatchMatMulInputs = {a: $a, b: $b};\n const attrs: BatchMatMulAttrs = {transposeA, transposeB};\n\n return ENGINE.runKernel(\n BatchMatMul, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);\n}\n\nexport const matMul = op({matMul_});\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 {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 locations represented by `indices` take\n * value `onValue` (defaults to 1), while all other locations take
value\n * `offValue` (defaults to 0). If `indices` is rank `R`, the output has rank\n * `R+1` with the last axis of size `depth`.\n *\n * ```js\n * tf.oneHot(tf.tensor1d([0, 1], 'int32'), 3).print();\n * ```\n *\n * @param indices `tf.Tensor` of indices with dtype `int32`.\n * @param depth The depth of the one hot dimension.\n * @param onValue A number used to fill in the output when the index matches\n * the location.\n * @param offValue A number used to fill in the output when the index does\n * not match the location.\n *\n * @doc {heading: 'Tensors', subheading: 'Creation'}\n */\nfunction oneHot_(\n indices: Tensor|TensorLike, depth: number, onValue = 1,\n offValue = 0): 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\n const inputs: OneHotInputs = {indices: $indices};\n const attrs: OneHotAttrs = {depth, onValue, offValue};\n\n
return ENGINE.runKernel(\n OneHot, inputs as unknown as NamedTensorMap,\n attrs as unknown as NamedAttrMap);\n}\n\nexport const oneHot = op({oneHot_});\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 {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`. Permutes the
dimensions according to `perm`.\n *\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 *\n * ```js\n *
const a = tf.tensor2d([1, 2, 3, 4, 5, 6], [2, 3]);\n *\n * a.transpose().print(); // or tf.transpose(a)\n * ```\n *\n *
@param x The tensor to transpose.\n * @param perm The permutation of the dimensions of a.\n *\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 util.assert(\n $x.rank === perm.length,\n
() => `Error in transpose: rank of input ${$x.rank} ` +\n   `must match length of perm ${perm}.`);\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 * @license\n * Copyright 2018
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==========\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 *\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 * ```\n *\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 *\n * @doc {heading: 'Operations', subheading: 'Evaluation'}\n */\nexport function
confusionMatrix_(\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  util.assert(\n      $labels.rank === 1,\n      () => `Expected the rank of labels
to be 1, but got ${$labels.rank}`);\n  util.assert(\n      $predictions.rank === 1,\n      () => `Expected the rank of

predictions to be 1, ` +\n `but got ${$predictions.rank}`);\n util.assert(\n $labels.shape[0] === $predictions.shape[0],\n () => `Mismatch in the number of examples: ` +\n `${$labels.shape[0]} vs. ${$predictions.shape[0]}. ` +\n `Labels and predictions should have the same number of elements.`);\n util.assert(\n numClasses > 0 && Number.isInteger(numClasses),\n () => `numClasses is required to be a positive integer, but got ` +\n `${numClasses}`);\n // TODO(cais): In the future, if oneHot supports tensors inputs for\n // `numClasses`, `confusionMatrix` can make `numClasses` optional.\n\n const oneHotLabels = oneHot(cast($labels, 'int32'), numClasses) as Tensor2D;\n const oneHotPredictions =\n oneHot(cast($predictions, 'int32'), numClasses) as Tensor2D;\n const oneHotLabelsT: Tensor2D = transpose(oneHotLabels);\n const product: Tensor2D = matMul(oneHotLabelsT, oneHotPredictions);\n return cast(product, 'int32');\n}\n\nexport const confusionMatrix = op({confusionMatrix_});\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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==========\n */\n\n/**\n * Exports under the tf.math.* namespace.\n */\n\nimport {confusionMatrix} from './ops/confusion_matrix';\n\nexport {confusionMatrix};\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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==========\n */\n\nimport {Tensor3D} from '../tensor';\nimport {inferShape} from '../tensor_util_env';\nimport {TensorLike3D} from '../types';\nimport {DataType} from '../types';\nimport {assertNonNull} from '../util';\nimport {makeTensor} from './tensor_ops_util';\n\n/**\n * Creates rank-3 `tf.Tensor` with the provided values, shape and dtype.\n *\n * The same functionality can be achieved with `tf.tensor`, but in general\n * we recommend using `tf.tensor3d` as it makes the code more readable.\n *\n * ```js\n * // Pass a nested array.\n * tf.tensor3d([[[1],
[2]], [[3], [4]]]).print();\n * ```\n * ```js\n * // Pass a flat array and specify a shape.\n * tf.tensor3d([1, 2, 3, 4], [2, 2, 1]).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`.\n * @param shape The shape of the tensor. If not provided, it is inferred from\n * `values`.\n * @param dtype The data type.\n *\n * @doc {heading: 'Tensors', subheading: 'Creation'}\n */\nexport function tensor3d(\n values: TensorLike3D, shape?: [number, number, number],\n dtype?: DataType): Tensor3D {\n assertNonNull(values);\n if (shape != null && shape.length !== 3) {\n throw new Error('tensor3d() requires shape to have three numbers');\n }\n const inferredShape = inferShape(values, dtype);\n if (inferredShape.length !== 3 && inferredShape.length !== 1) {\n throw new Error(\n 'tensor3d() requires values to be number[][][] or flat/TypedArray');\n }\n if (inferredShape.length
=== 1 && shape == null) {\n throw new Error(\n 'tensor3d() requires shape to be provided when `values` ' +\n 'are a flat array');\n }\n return makeTensor(values, shape, inferredShape, dtype) as Tensor3D;\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

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==========================================================================\n
*/\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.');\n  }\n  if (pixels == null) {\n    throw new Error('pixels
passed to tf.browser.fromPixels() can not be null');\n  }\n  let isPixelData = false;\n  let isImageData = false;\n  let
isVideo = false;\n  let isImage = false;\n  let isCanvasLike = false;\n  let isImageBitmap = false;\n  if ((pixels as
PixelData).data instanceof Uint8Array) {\n    isPixelData = true;\n  } else if (\n      typeof (ImageData) !==
'undefined' && pixels
 instanceof ImageData) {\n    isImageData = true;\n  } else if (\n      typeof (HTMLVideoElement) !== 'undefined'
&&\n      pixels instanceof HTMLVideoElement) {\n    isVideo = true;\n  } else if (\n      typeof
(HTMLImageElement) !== 'undefined' &&\n      pixels instanceof HTMLImageElement) {\n    isImage = true;\n    //
tslint:disable-next-line: no-any\n  } else if ((pixels as any).getContext != null) {\n    isCanvasLike = true;\n  } else if
(\n      typeof (ImageBitmap) !== 'undefined' &&\n      pixels instanceof ImageBitmap) {\n    isImageBitmap =
true;\n  } else {\n    throw new Error(\n        'pixels passed to tf.browser.fromPixels() must be either an ' +\n
`HTMLVideoElement, HTMLImageElement, HTMLCanvasElement, ImageData ` +\n        `in browser, or
OffscreenCanvas, ImageData in webworker` +\n        ` or {data: Uint32Array, width: number, height: number}, ` +\n
    `but was ${(pixels as {}).constructor.name}`);\n  }\n  if (isVideo) {\n    const
HAVE_CURRENT_DATA_READY_STATE
 = 2;\n    if (isVideo &&\n        (pixels as HTMLVideoElement).readyState <\n
HAVE_CURRENT_DATA_READY_STATE) {\n      throw new Error(\n          'The video element has not loaded
data yet. Please wait for ' +\n          '`loadeddata` event on the <video> element.');\n    }\n  }\n  // If the current
backend has 'FromPixels' registered, it has a more\n  // efficient way of handling pixel uploads, so we call that.\n
const kernel = getKernel(FromPixels, ENGINE.backendName);\n  if (kernel != null) {\n    const inputs:
FromPixelsInputs = {pixels};\n    const attrs: FromPixelsAttrs = {numChannels};\n    return ENGINE.runKernel(\n
   FromPixels, inputs as {} as NamedTensorMap,\n        attrs as {} as NamedAttrMap);\n  }\n\n  const [width,
height] = isVideo ?\n      [\n        (pixels as HTMLVideoElement).videoWidth,\n        (pixels as
HTMLVideoElement).videoHeight\n      ] :\n      [pixels.width, pixels.height];\n  let vals:
Uint8ClampedArray|Uint8Array;\n\n  if (isCanvasLike)
 {\n    vals =\n        // tslint:disable-next-line:no-any\n        (pixels as any).getContext('2d').getImageData(0, 0, width,
height).data;\n  } else if (isImageData || isPixelData) {\n    vals = (pixels as PixelData | ImageData).data;\n  } else if
(isImage || isVideo || isImageBitmap) {\n    if (fromPixels2DContext == null) {\n      fromPixels2DContext =
document.createElement('canvas').getContext('2d');\n    }\n    fromPixels2DContext.canvas.width = width;\n
fromPixels2DContext.canvas.height = height;\n    fromPixels2DContext.drawImage(\n        pixels as
HTMLVideoElement, 0, 0, width, height);\n    vals = fromPixels2DContext.getImageData(0, 0, width,
```

height).data;\n }\n let values: Int32Array;\n if (numChannels === 4) {\n   values = new Int32Array(vals);\n } else {\n   const numPixels = width * height;\n   values = new Int32Array(numPixels * numChannels);\n   for (let i = 0; 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, 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 *\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 *\n * Returns a promise that resolves when the canvas has been drawn to.\n *\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, 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 *\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 ${$img.rank}.`);\n }\n const [height, width] = $img.shape.slice(0, 2);\n const depth = $img.rank === 2 ? 1 : $img.shape[2];\n\n if (depth > 4 || depth === 2) {\n   throw new Error(\n   `toPixels only supports depth of size ` +\n   `1, 3 or 4 but got ${depth}`);\n }\n\n if ($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\n const data = await $img.data();\n const multiplier = $img.dtype === 'float32' ? 255 : 1;\n const bytes = new Uint8ClampedArray(width * height * 4);\n\n for (let i = 0; i < height * width; ++i) {\n   const rgba = [0, 0, 0, 255];\n\n   for (let d = 0; d < depth; d++) {\n   const value = data[i * depth + d];\n\n   if ($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 ${value}.`);\n   }\n   }\n\n   if (depth === 1) {\n   rgba[0] = value * multiplier;\n   rgba[1] = value * multiplier;\n   rgba[2] = value * multiplier;\n
} else {\n   rgba[d] = value * multiplier;\n   }\n   }\n\n   const j = i * 4;\n   bytes[j + 0] = Math.round(rgba[0]);\n   bytes[j + 1] = Math.round(rgba[1]);\n   bytes[j + 2] = Math.round(rgba[2]);\n   bytes[j + 3] = Math.round(rgba[3]);\n }\n\n if (canvas != null) {\n   canvas.width = width;\n   canvas.height = height;\n   const ctx = canvas.getContext('2d');\n   const imageData = new ImageData(bytes, width, height);\n   ctx.putImageData(imageData, 0, 0);\n }\n if ($img !== img) {\n $img.dispose();\n }\n return bytes;\n}\n\nexport const fromPixels = op({fromPixels_});\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
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==\n
*/\nimport {TensorInfo} from '../kernel_registry';\nimport {computeStrides, sizeFromShape} from '../util';\n\n/**\n * Validate gather nd inputs.\n *\n * @param tensor The tensor contains the source values.\n * @param indices The tensor contains the indices to slice the source.\n *\n * @returns [resultShape, numUpdates, sliceSize, strides]\n */\nexport function prepareAndValidate(tensor: TensorInfo, indices: TensorInfo):\n   [number[], number, number,

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\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\n const indicesShape = indices.shape;\n const sliceRank = indicesShape[indicesShape.length - 1];\n\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\n const inputShape = tensor.shape;\n\n const resultShape = indicesShape.slice();\n resultShape.pop();\n\n let sliceSize = 1;\n for (let i = sliceRank; i < tensorRank; ++i) {\n   sliceSize *= inputShape[i];\n   resultShape.push(inputShape[i]);\n }\n\n const strides =\n   [...computeStrides(tensor.shape).map(stride => stride / sliceSize),\n   1].slice(0, sliceRank);\n\n return [resultShape, nResult, sliceSize, strides];\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 {TensorInfo} from '../kernel_registry';\nimport {Tensor} from '../tensor';\nimport {computeStrides, sizeFromShape} from '../util';\n\n/**\n * Check whether updates.shape = indices.shape[:batchDim] +\n * shape[sliceDim:]\n *\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\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   `, sliceDim: ${sliceDim}, and batchDim: ${batchDim}.`;\n\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}] (${\n              indices.shape[d]}).`);\n   }\n }\n for (let d = 0; d < updates.rank - batchDim; ++d) {\n   if (updates.shape[d + batchDim] !== shape[d + sliceDim]) {\n   throw new Error(\n   shapeError +\n   ` updates.shape[${d + batchDim}] (${\n              updates.shape[d + batchDim]}) != shape[${d + batchDim}] (${\n              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

```
(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
(shape.length < 1) {\n    throw new Error(\n        `Output rank must be greater or equal to 1, but got shape:
${shape}`);\n  }\n\n  if (shape.length === 0) {\n    if (indices.size === 0) {\n      throw new Error(`Indices specified
for empty output. indices shape: ${\n          indices.shape}`);\n    }\n    if (updates.size === 0) {\n      throw new
Error(`Updates specified for empty output. updates shape: ${\n          updates.shape}`);\n    }\n  }\n\n
validateUpdateShape(shape, indices, updates);\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
update values.\n * @param shape The shape of the output tensor.\n *\n * @returns ScatterShapeInfo\n */\nexport
function calculateShapes(\n    updates: TensorInfo, indices: TensorInfo,\n    shape:
 number[]): ScatterShapeInfo {\n  // Calculate the number of dimensions in indices\n  const indicesRank =
indices.shape.length;\n  const sliceRank = (indicesRank > 1) ? indices.shape[indicesRank - 1] : 1;\n\n  // Calculate
the number of elements that make up each slice of our updated\n  // tensor. This allows us to work with flattened
tensors and copy over whole\n  // slices at a time.\n  const totalNd = shape.length;\n\n  let sliceSize = 1;\n  for (let i =
sliceRank; i < totalNd; ++i) {\n    sliceSize *= shape[i];\n  }\n\n  const safeSliceDim = (sliceRank < 1) ? 1 :
sliceRank;\n  const numUpdates = sizeFromShape(indices.shape) / safeSliceDim;\n\n  const strides =
[...computeStrides(shape.slice(0, sliceRank)), 1];\n  const outputSize = sizeFromShape(shape);\n  return {sliceRank,
numUpdates, sliceSize, strides, outputSize};\n}\n","/**\n * @license\n * Copyright 2017 Google LLC. All Rights
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governing permissions and\n * limitations under the License.\n *
==========================================================================\n
*/\n\nimport {TensorInfo} from '../kernel_registry';\nimport * as util from '../util';\n\nexport type SliceInfo = {\n
nonStrided: boolean,\n  $begin: number[],\n  $end: number[],\n  $strides: number[],\n  size: number[],\n  newShape:
number[],\n  outShape: number[]\n};\n\nexport function assertParamsValid(\n    input: TensorInfo, begin: number[],
size: number[]): void {\n  const inputRank = input.shape.length;\n  util.assert(\n
   inputRank === begin.length,\n      () => `Error in slice${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
slice${inputRank}D: Length of size ${size} must ` +\n          `match the rank of the array (${inputRank}).`);\n\n  for
(let i = 0; i < inputRank; ++i) {\n    util.assert(\n        begin[i] + size[i] <= input.shape[i],\n        () => `Error in
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/** Converts a binary mask to an array of axes. Used in stridedSlice().
*/\nexport function maskToAxes(mask: number): number[] {\n  const axes = [];\n  let axis = 0;\n  while (mask > 0)
{\n    if (mask & 1) {\n      axes.push(axis);\n    }\n    mask /= 2;\n    axis++;\n  }\n  return axes;\n}\n\n/** Computes
the output shape given the strided
 slice params. */\nexport function computeOutShape(\n    begin: number[], end: number[], strides: number[]):
number[] {\n  const size = [];\n  for (let axis = 0; axis < begin.length; axis++) {\n    size[axis] = Math.ceil((end[axis]
- begin[axis]) / strides[axis]);\n  }\n  return size;\n}\n\n// Creates full selection at the elided dimensions. If the
dimension matches\n// the ellipsis mask, override the current stride value. Otherwise, insert.\nexport function
stridesWithElidedDims(\n    strides: number[], ellipsisInsertionIndex: number, numElidedAxes: number,\n
inputShape: number[]): number[] {\n  const newStrides = [...strides];\n  for (let i = newStrides.length; i <
inputShape.length; i++) {\n    newStrides.push(1);\n  }\n  for (let i = 0; i < numElidedAxes; i++) {\n    if (i === 0)
{\n      newStrides[ellipsisInsertionIndex] = 1;\n    } else {\n      newStrides.splice(\n          ellipsisInsertionIndex, 0 /*
num elements to delete */,\n          1 /* element to add */);\n      newStrides.pop();\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 return normalizedAxis - (numElidedAxes - 1);\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// Normalize the start, end and strides.\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\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,\n axis, ellipsisMask);\n }\n }\n\n return {\n begin: normalizedBegin,\n end: normalizedEnd,\n strides: normalizedStrides\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.\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\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]\n = originalValue;\n }\n }\n return newIndices;\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.\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\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 for (let i = 0; i < newIndices.length; i++) {\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 return newIndices;\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\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\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\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 continous set of elements in the\n * 'flat' space.\n */\nexport function isSliceContinous(\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    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, $begin,
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$end, $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 Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {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 */\nexport declare type ConfigDictValue =\n boolean | number | string | null | ConfigDictArray | ConfigDict;\nexport declare interface ConfigDict {\n [key: string]: ConfigDictValue;\n}\nexport declare interface ConfigDictArray extends Array<ConfigDictValue> {}\n\n/**\n * Type to represent the class-type of Serializable objects.\n *\n * Ie 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 */\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};\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 */\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 getClassName(): string {\n return (this.constructor as SerializableConstructor<Serializable>)\n .className;\n }\n\n /**\n * Return all the non-weight state needed to serialize this object.\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 */\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 *\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 */\nexport 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\n SerializationMap.register(cls);\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 {ENGINE} from './engine';\nimport {inferShape} from './tensor_util_env';\nimport {RecursiveArray, TensorLike,  TypedArray} from './types';\nimport {arraysEqual, encodeString, flatten, isString, isTypedArray} from './util';\n\nconst TEST_EPSILON_FLOAT32 = 1e-3;\nexport const TEST_EPSILON_FLOAT16 = 1e-1;\n\nexport 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\nexport function testEpsilon() {\n  return ENGINE.backend.floatPrecision() === 32 ? TEST_EPSILON_FLOAT32 :\n                                                  TEST_EPSILON_FLOAT16;\n}\n\nfunction 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\n    if (aType !== bType) {\n      throw new Error(\n          `Arrays are of different type. Actual: ${aType}. ` +\n          `Expected: ${bType}`);\n    }\n  }\n\n  if (Array.isArray(actual) && Array.isArray(expected)) {\n    const actualShape = inferShape(actual);\n    const expectedShape = inferShape(expected);\n    if (!arraysEqual(actualShape, expectedShape)) {\n      throw new Error(\n          `Arrays have different shapes. ` +\n          `Actual: [${actualShape}]. Expected: [${expectedShape}]`);\n    }\n  }\n\n  const actualFlat =\n      isTypedArray(actual) ? actual : flatten(actual as RecursiveArray<number>);\n  const expectedFlat = isTypedArray(expected) ?\n      expected :\n      flatten(expected as RecursiveArray<number>);\n\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\n    if
```

(!predicate(a, e)) {\n throw new Error(\n `Arrays differ: actual[${i}] = ${a}, expected[${i}] = ${e}.\\n` +\n `Actual: ${actualFlat}.\\n` +\n `Expected: ${expectedFlat}.`);\n }\n }\n}\n\nexport interface DoneFn {\n (): void;\n fail: (message?: Error|string) => void;\n}\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' ||\n 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 === ${e}`);\n }\n}\n\nfunction areClose(a: number, e: number, epsilon: number): boolean {\n if (!isFinite(a) && !isFinite(e)) {\n return true;\n }\n if (isNaN(a) || isNaN(e) || Math.abs(a - e) > epsilon) {\n return false;\n }\n return true;\n}\n\nexport function expectValuesInRange(\n actual: TypedArray|number[], low: number,\n high: number) {\n for (let i = 0; i < actual.length; i++) {\n if (actual[i] < low || actual[i] > high) {\n throw new Error(\n `Value out of range:${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\n // 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<{}>):\n RecursiveArray<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","/** @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 * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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';\n\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\n * 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\n * download the result of every operation to the CPU. This should not be used in\n * production. Debug mode does not affect the timing information of the kernel\n * 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 console.warn(`TensorFlow.js deprecation warnings have been disabled.`);\n}\n\n/** Warn users about deprecated functionality. */\nexport function deprecationWarn(msg: string) {\n if

(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 * - `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 *\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>, 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

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 *\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 *\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 * console.log('y:');\n * y.print();\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 * - `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 * - On `WebGL` The following additional properties exist:\n * - `uploadWaitMs`: CPU blocking time on texture uploads.\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 *\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 */\nexport function findBackend(name: string): KernelBackend {\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 */\nexport function findBackendFactory(name: string): () =>\n 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 *
 @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, true\n * if not.\n *\n * @doc {heading: 'Backends'}\n */\nexport function registerBackend(\n name: string, 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 highest\n * priority backend has async initialization, in which case, you should call\n * 'await tf.ready()' before

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 * @param platform A platform implementation.\n */\nexport function setPlatform(platformName: string, platform: Platform) {\n env().setPlatform(platformName, platform);\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 {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';\n\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 * @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 *
==========\n */\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';\n\nimport {op} from './operation';\n\n/**\n * Divides two `tf.Tensor`s element-wise, A / B. Supports broadcasting.\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 * @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,

software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {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 * ```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.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\n * `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, $b);\n\n if ($a.dtype === 'int32' && $b.dtype === 'int32') {\n   return floorDiv($a, $b);\n }\n\n const inputs: RealDivInputs = {a: $a, b: $b};\n const attrs = {};\n\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 * ```js\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 * @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\n const inputs: MultiplyInputs = {a: $a, b: $b};\n\n return ENGINE.runKernel(Multiply, inputs as {} as NamedTensorMap);\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   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 * @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 {Acos, AcosInputs} 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 acos of the input `tf.Tensor` element-wise: `acos(x)`\n *\n * ```js\n * const x = tf.tensor1d([0, 1, -1, .7]);\n *\n * x.acos().print(); // or tf.acos(x)\n * ```\n * @param x The input tensor.\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n */\nfunction acos_<T extends Tensor>(x: T|TensorLike): T {\n const $x = convertToTensor(x, 'x', 'acos');\n const inputs:
AcosInputs = {x: $x};\n\n return ENGINE.runKernel(Acos, inputs as {} as NamedTensorMap);\n}\nexport const acos = op({acos_});\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 {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: $x};\n\n return ENGINE.runKernel(Acosh, inputs as {} as NamedTensorMap);\n}\nexport const acosh = op({acosh_});\n","/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n
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the License.\n *
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*/\nimport {ENGINE} from '../engine';\nimport {AddN, AddNInputs} from '../kernel_names';\nimport {Tensor}
from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {convertToTensor} from
'../tensor_util_env';\nimport {TensorLike} from '../types';\nimport * as util from '../util';\n\nimport {op} from
'./operation';\n\n/**\n * Adds a list of `tf.Tensor`s element-wise, each with the same shape and dtype.\n *\n * ```js\n
* const a = tf.tensor1d([1, 2]);\n * const b = tf.tensor1d([3, 4]);\n * const c = tf.tensor1d([5, 6]);\n *\n * tf.addN([a,
b, c]).print();\n * ```\n * @param tensors A list of tensors with the same shape and dtype.\n * @doc {heading:
'Operations', subheading: 'Arithmetic'}\n */\nfunction addN_<T extends Tensor>(tensors: Array<T|TensorLike>): T
{\n util.assert(\n   Array.isArray(tensors),\n   () => 'The argument passed to tf.addN() must be a list of
tensors');\n util.assert(\n   tensors.length >= 1,\n   () => `Must pass at least one tensor to tf.addN(), but got ` +\n
`${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
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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 {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 * ```js\n * const x = tf.tensor1d([1, 1, 1], 'bool');\n *\n * x.all().print(); // or tf.all(x)\n *
```\n *\n * ```js\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
* @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 *\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
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*/\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 * ```js\n * const x = tf.tensor1d([1, 1, 1], 'bool');\n *\n * x.any().print(); // or tf.any(x)\n *
```\n *\n * ```js\n * const x = tf.tensor2d([1, 1, 0, 0], [2, 2], 'bool');\n *\n * const axis = 1;\n * x.any(axis).print(); //
or tf.any(x, axis)\n * ```\n *\n * @param x The input tensor. Must be of dtype bool.\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 *\n * @doc {heading: 'Operations', subheading: 'Reduction'}\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,
attrs as {} as NamedAttrMap);\n}\n\n// tslint:disable-next-line:variable-name\nexport const any =
op({any_});\n","/**\n * @license\n * Copyright 2020 Google Inc. All Rights Reserved.\n * Licensed under the
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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 * ```js\n * const x = tf.tensor1d([1, 2, 3]);\n *\n * x.argMax().print(); // or
tf.argMax(x)\n * ```\n *\n * ```js\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 * @param axis The
dimension to reduce. Defaults to 0 (outer-most dimension).\n *\n * @doc {heading: 'Operations', subheading:
'Reduction'}\n */\nfunction argMax_<T extends Tensor>(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\nexport const argMax = op({argMax_});\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\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`\n * removed.\n *\n * ```js\n * const x = tf.tensor1d([1, 2, 3]);\n *\n * x.argMin().print(); // or tf.argMin(x)\n * ```\n *\n * ```js\n * const x = tf.tensor2d([1, 2, 4, 3], [2, 2]);\n *\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\n const inputs: ArgMinInputs = {x: $x};\n const attrs: ArgMinAttrs = {axis};\n\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {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 *\n * x.asin().print(); // or tf.asin(x)\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\n return ENGINE.runKernel(Asin, inputs as {} as NamedTensorMap);\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
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 * @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\n const inputs: AsinhInputs = {x: $x};\n\n return ENGINE.runKernel(Asinh, inputs as {} as NamedTensorMap);\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {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 * ```js\n * const x = tf.tensor1d([0, 1, -1, .7]);\n *\n * x.atan().print(); // or tf.atan(x)\n * ```\n * @param x The input tensor.\n *\n * @doc {heading: 'Operations', subheading: 'Basic math'}\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}\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 */\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 * Supports broadcasting.\n *\n * ```js\n * const a = tf.tensor1d([1.0, 1.0, -1.0, .7]);\n * const b = tf.tensor1d([2.0, 13.0, 3.5, .21]);\n *\n * tf.atan2(a, b).print()\n * ```\n *\n * @param a The first tensor.\n * @param b The second tensor. Must have the same dtype as `a`.\n *\n * @doc {heading: 'Operations', subheading: 'Basic math'}\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 * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {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 * `atanh(x)`\n *\n * ```js\n * const x = tf.tensor1d([0, .1, -.1, .7]);\n *\n * x.atanh().print(); // or tf.atanh(x)\n * ```\n * @param x The input tensor.\n *\n * @doc {heading: 'Operations', subheading: 'Basic math'}\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}\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

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under the License.\n *
==========\n */\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 *\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], strides: number|[number, number],\n pad: 'same'|'valid'|number,
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, strides: number|[number, number],\n dilations: number|[number, number], 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 ===

'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],\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];\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],\n outShape: [number, number, number, number, number],\n filterShape: [number, number, number, number, number]\n};\n\n/**\n * Computes the information\n for a forward pass of a 3D convolution/pooling\n * operation.\n */\nexport function computeConv3DInfo(\n inShape: [number, number, number, number, number],\n filterShape: [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];\n  if (dataFormat === 'channelsFirst') {\n    outShape = [batchSize, outChannels,
outDepth, outHeight, outWidth];\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  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  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  if
(param.length === 2) {\n    return [param[0], param[1], 1];\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 upsampled\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
*/\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\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' :\n        '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,
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\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\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 * @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';\n\nimport {op} from './operation';\n\n/**\n * Reshapes a `tf.Tensor` to a given shape.\n *\n * Given an input tensor, returns a new tensor with the same values as the\n * input tensor with shape `shape`.\n *\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 *\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 * ```js\n * const x = tf.tensor1d([1, 2, 3, 4]);\n * x.reshape([2, 2]).print();\n * ```\n *\n * @param x The input tensor to be reshaped.\n * @param shape An array of integers defining the output tensor shape.\n *\n * @doc {heading: 'Tensors', subheading: 'Transformations'}\n */\nfunction reshape_<R extends Rank>(\n    x: Tensor|TensorLike, shape: ShapeMap[R]): Tensor<R> {\n  const $x = convertToTensor(x, 'x', 'reshape', 'string_or_numeric');\n\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}\nexport const reshape = op({reshape_});\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 *\n * @param x The input tensor, of rank 4
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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 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 avgPool_<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', '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\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {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\n *     `[batch, depth, height, width, inChannels]`.\n * @param filterSize The filter size:\n *     `[filterDepth, filterHeight, filterWidth]`.\n *     If `filterSize` is a single number,\n *     then `filterDepth == filterHeight == filterWidth`.\n * @param strides The strides of the pooling:\n *     `[strideDepth, strideHeight, strideWidth]`.\n *     If `strides` is a single number,\n *     then `strideDepth == 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 dimRoundingMode A string from:
```

'ceil', 'round', 'floor'. If none is\n * provided, it will default to truncate.\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 avgPool3d_<T extends Tensor4D|Tensor5D>(\n x: T|TensorLike, filterSize: [number, number, number]|number,\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', 'avgPool3d', 'float32');\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 avgPool3d: x must be rank 5 but got rank ${x5D.rank}.`);\n util.assert(\n dataFormat === 'NDHWC',\n () => `Error in avgPool3d: Only NDHWC is currently supported, ` +\n `but got dataFormat of ${dataFormat}`);\n\n if (dimRoundingMode != null) {\n util.assert(\n util.isInt(pad as number),\n () => `Error in avgPool3d: pad must be an integer when using, ` +\n `dimRoundingMode ${dimRoundingMode} but got pad ${pad}.`);\n }\n\n const inputs: AvgPool3DInputs = {x: x5D};\n\n const attrs:\n AvgPool3DAttrs = {filterSize, strides, pad, dimRoundingMode, dataFormat};\n\n // tslint:disable-next-line: no-unnecessary-type-assertion\n let res = ENGINE.runKernel(\n AvgPool3D, inputs as {} as NamedTensorMap,\n attrs as {} as NamedAttrMap) as T;\n\n res = cast(res, x5D.dtype);\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 avgPool3d = op({avgPool3d_});\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 {Concat, ConcatAttrs, ConcatInputs} from '../kernel_names';\nimport {NamedAttrMap} from '../kernel_registry';\nimport {Tensor} from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {convertToTensorArray} from '../tensor_util_env';\nimport {TensorLike} from '../types';\nimport {assert} from '../util';\n\nimport {clone} from './clone';\nimport {op} from './operation';\n\n/**\n * Concatenates a list of `tf.Tensor`s along a given axis.\n *\n * The tensors ranks and types must match, and their sizes must match in all\n * dimensions except `axis`.\n *\n * Also available are stricter rank-specific methods that assert that\n * `tensors` are of the given rank:\n * - `tf.concat1d`\n * - `tf.concat2d`\n * - `tf.concat3d`\n * - `tf.concat4d`\n *\n * Except `tf.concat1d` (which does not have axis param), all methods have\n * same signature as this method.\n *\n * ```js\n * const a = tf.tensor1d([1, 2]);\n * const b = tf.tensor1d([3, 4]);\n * a.concat(b).print(); // or a.concat(b)\n * ```\n *\n * ```js\n * const a = tf.tensor1d([1, 2]);\n * const b = tf.tensor1d([3, 4]);\n * const c = tf.tensor1d([5, 6]);\n * tf.concat([a, b, c]).print();\n * ```\n *\n * ```js\n * const a = tf.tensor2d([[1, 2], [10, 20]]);\n * const b = tf.tensor2d([[3, 4], [30, 40]]);\n * const axis = 1;\n * tf.concat([a, b], axis).print();\n * ```\n * @param tensors A list of tensors to concatenate.\n * @param axis The axis to concate along. Defaults to 0 (the first dim).\n *\n * @doc {heading: 'Tensors', subheading: 'Slicing and Joining'}\n */\nfunction concat_<T extends Tensor>(tensors: Array<T|TensorLike>, axis = 0): T {\n assert(tensors.length >= 1, () => 'Pass at least one tensor to concat');\n\n const $tensors =\n convertToTensorArray(tensors, 'tensors', 'concat', 'string_or_numeric');\n\n if ($tensors[0].dtype === 'complex64') {\n $tensors.forEach(tensor => {\n if (tensor.dtype !== 'complex64') {\n throw new Error(`Cannot concatenate complex64 tensors with a tensor\n with dtype ${tensor.dtype}. `);\n }\n });\n }\n\n 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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {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\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 */\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,\n 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 */\nfunction slice_<R extends Rank, T extends Tensor<R>>(\n   x: T|TensorLike, begin: number|number[], size?: number|number[]): T {\n const $x = convertToTensor(x,\n 'x', 'slice', 'string_or_numeric');\n\n if ($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\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 *

Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {Tanh, TanhInputs} 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 tangent of the input `tf.Tensor` element-wise: `tanh(x)`\n *\n * ```js\n * const x = tf.tensor1d([0, 1, -1, 70]);\n *\n * x.tanh().print(); // or tf.tanh(x)\n * ```\n * @param x The input tensor.\n *\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n */\nfunction tanh_<T extends Tensor>(x: T|TensorLike): T {\n const $x = convertToTensor(x, 'x', 'tanh');\n\n const inputs: TanhInputs = {x: $x};\n\n return ENGINE.runKernel(Tanh, inputs as {} as NamedTensorMap);\n}\nexport const tanh = op({tanh_});\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 */\n\nimport {Scalar, Tensor1D, Tensor2D} from '../tensor';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from '../types';\n\nimport {add} from './add';\nimport {concat} from './concat';\nimport {matMul} from './mat_mul';\nimport {mul} from './mul';\nimport {op} from './operation';\nimport {sigmoid} from './sigmoid';\nimport
 {slice} from './slice';\nimport {tanh} from './tanh';\n\n/**\n * Computes the next state and output of a 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 */\nfunction basicLSTMCell_(\n forgetBias: Scalar|TensorLike, lstmKernel: Tensor2D|TensorLike,\n   lstmBias: Tensor1D|TensorLike, data: Tensor2D|TensorLike,\n   c: Tensor2D|TensorLike, h: Tensor2D|TensorLike): [Tensor2D, Tensor2D] {\n const $forgetBias =\n   convertToTensor(forgetBias, 'forgetBias', 'basicLSTMCell');\n const $lstmKernel =\n convertToTensor(lstmKernel, 'lstmKernel', 'basicLSTMCell');\n const $lstmBias = convertToTensor(lstmBias, 'lstmBias',
 'basicLSTMCell');\n const $data = convertToTensor(data, 'data', 'basicLSTMCell');\n const $c = convertToTensor(c, 'c', 'basicLSTMCell');\n const $h = convertToTensor(h, 'h', 'basicLSTMCell');\n\n const combined = concat([$data, $h], 1);\n const weighted = matMul(combined, $lstmKernel);\n const res: Tensor2D = add(weighted, $lstmBias);\n\n // i = input_gate, j = new_input, f = forget_gate, o = output_gate\n const batchSize = res.shape[0];\n const sliceCols = res.shape[1] / 4;\n const sliceSize: [number, number] = [batchSize, sliceCols];\n const i = slice(res, [0, 0], sliceSize);\n const j = slice(res, [0, sliceCols], sliceSize);\n const f = slice(res, [0, sliceCols * 2], sliceSize);\n const o = slice(res, [0, sliceCols * 3], sliceSize);\n\n const newC: Tensor2D =\n add(mul(sigmoid(i), tanh(j)),\n   mul($c, sigmoid(add($forgetBias, f)) as Tensor2D));\n const newH: Tensor2D = mul(tanh(newC), sigmoid(o));\n return [newC, newH];\n}\n\nexport const basicLSTMCell
 = op({basicLSTMCell_});\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 {BatchToSpaceND, BatchToSpaceNDAttrs, BatchToSpaceNDInputs} 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 * This operation reshapes the \"batch\" dimension 0 into `M + 1` dimensions 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 intermediate\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], [4, 1, 1, 1]);\n * const blockShape = [2, 2];\n * const crops = [[0, 0], [0, 0]];\n *\n * x.batchToSpaceND(blockShape, crops).print();\n * ```\n *\n * @param x A `tf.Tensor`. N-D with `x.shape` = `[batch] + spatialShape +\n * remainingShape`, where spatialShape has `M` dimensions.\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 `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], ...,\n * blockShape[M-1], batch / prod(blockShape), x.shape[1], ...,\n * x.shape[N-1]]`\n *\n * 2. Permute dimensions of `reshaped`to produce `permuted` of shape `[batch /\n * prod(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] *\n * blockShape[M-1],x.shape[M+1],
..., 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] -\n * crops[M-1,1],x.shape[M+1], ..., x.shape[N-1]]`\n *\n * @doc {heading: 'Tensors', subheading: 'Transformations'}\n */\nfunction batchToSpaceND_<T extends Tensor>(\n x: T|TensorLike, blockShape: number[], crops: number[][]): T {\n const $x = convertToTensor(x, 'x', 'batchToSpaceND');\n const prod = blockShape.reduce((a, b) => a * b);\n\n util.assert(\n $x.rank >= 1 + blockShape.length,\n () => `input rank is ${$x.rank} but should be > than blockShape.length ${\n blockShape.length}`);\n\n util.assert(\n crops.length === blockShape.length,\n () => `crops.length is ${\n crops.length} but should be equal to blockShape.length ${\n blockShape.length}`);\n\n
util.assert(\n $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\n const inputs: BatchToSpaceNDInputs = {x: $x};\n const attrs: BatchToSpaceNDAttrs = {blockShape, crops};\n\n return ENGINE.runKernel(\n BatchToSpaceND, inputs as {} as NamedTensorMap,\n attrs as {} as NamedAttrMap);\n}\n\nexport const batchToSpaceND = op({batchToSpaceND_});\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, Tensor4D} from '../tensor';\nimport {Rank} from '../types';\nimport {reshape} from './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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {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 *\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\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 === $scale.rank,\n   () => 'Batch normalization gradient requires mean and scale to have ' +\n   'equal ranks.');\n\n const x4D: Tensor4D = xAs4D($x);\n\n const inputs: FusedBatchNormInputs = {\n   x: x4D,\n   scale: $scale,\n   offset: $offset,\n   mean: $mean,\n   variance: $variance\n };\n\n const attrs: FusedBatchNormAttrs = {varianceEpsilon};\n\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\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, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF 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 {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\n return batchNorm($x, $mean, $variance, $offset,
$scale, varianceEpsilon);\n}\n\nexport const batchNorm2d = op({batchNorm2d_});\n","/**\n * @license\n *
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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 {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

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 ==\n */\nimport {Tensor1D, Tensor4D} 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 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 */\nfunction 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 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 ==\n */\n\nimport {ENGINE} from '../engine';\nimport {Bincount, BincountAttrs, BincountInputs} from '../kernel_names';\nimport {NamedAttrMap} from '../kernel_registry';\nimport {Tensor1D}

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 *\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 *\n * Values in `x` outside of the range [0, size) are ignored.\n *\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 *\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\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\n const inputs: BincountInputs = {x: $x, weights: $weights};\n const attrs: BincountAttrs = {size};\n\n return ENGINE.runKernel(\n Bincount, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);\n}\n\nexport const bincount = op({bincount_});\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 {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';\n\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 *\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 is 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 *\n * @param input The tensor that is to be broadcasted.\n * @param shape The input is to be broadcast to this shape.\n *\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\n if (shape.some(d => !(d > 0) || d % 1 !== 0)) {\n throw new Error(`broadcastTo(): Invalid broadcast shape [${shape}].`);\n }\n\n if (shape.length < input.rank) {\n throw new Error(`broadcastTo(): shape.length=${shape.length} < input.rank=${\n input.rank}.`);\n }\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\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 (input.shape[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\n if (axes.length === 0) {\n return clone(input) as Tensor<R>;\n }\n\n // TODO call broadcastTo kernel directly once backends implement broadcstTo\n const inputs: TileInputs = {x:

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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {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 * ```js\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}\nexport const ceil = op({ceil_});\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\n the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {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';\nimport * as util from '../util';\n\nimport {op} from './operation';\n\n/**\n * Clips values element-wise. `max(min(x, clipValueMax), clipValueMin)`\n *\n * ```js\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}\nexport const clipByValue = op({clipByValue_});\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';\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 *\n * ==\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 *\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 *\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 * ==\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 *\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 *\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 * ==\n */\nimport {Tensor4D} from '../tensor';\nimport {TensorLike} from '../types';\n\nimport {concat} from

'./concat';\nimport {op} from './operation';\n\n/**\n * Concatenates a list of `tf.Tensor4D`s along an axis.\n * See `concat` for details.\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 concat4d_(\n tensors: Array<Tensor4D|TensorLike>, axis: number): Tensor4D {\n return concat(tensors, axis);\n}\n\nexport const concat4d = op({concat4d_});\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 {Conv2D, Conv2DAttrs, Conv2DInputs} 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 * as conv_util from './conv_util';\nimport {op} from './operation';\nimport {reshape} from './reshape';\n\n/**\n * Computes a 2D convolution over the input x.\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, 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.\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 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 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 *\n * @doc {heading: 'Operations', subheading: 'Convolution'}\n */\nfunction conv2d_<T extends Tensor3D|Tensor4D>(\n x: T|TensorLike, filter: Tensor4D|TensorLike,\n strides: [number, number]|number,\n pad: 'valid'|'same'|number|conv_util.ExplicitPadding,\n dataFormat: 'NHWC'|'NCHW' = 'NHWC',\n dilations: [number, number]|number = [1, 1],\n dimRoundingMode?: 'floor'|'round'|'ceil'): T {\n const $x = convertToTensor(x, 'x', 'conv2d');\n const $filter = convertToTensor(filter, 'filter', 'conv2d');\n\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 x4D.rank === 4,\n () => `Error in conv2d: input must be rank 4, but got rank ${x4D.rank}.`);\n util.assert(\n $filter.rank === 4,\n () => `Error in conv2d: filter
must be rank 4, but got rank ` +\n `${$filter.rank}.`);\n if (dimRoundingMode != null) {\n util.assert(\n util.isInt(pad as number),\n () => `Error in conv2d: pad must be an integer when using, ` +\n `dimRoundingMode ${dimRoundingMode} but got pad ${pad}.`);\n }\n\n const inDepth = dataFormat === 'NHWC' ? x4D.shape[3] : x4D.shape[1];\n util.assert(\n inDepth === $filter.shape[2],\n () => `Error in conv2d: depth of input (${inDepth}) must match ` +\n `input depth for filter ${$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\n const inputs:

```
Conv2DInputs = {x: x4D, filter: $filter};\n  const attrs:\n      Conv2DAttrs = {strides, pad, dataFormat, dilations, dimRoundingMode};\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]]) as T;\n  }\n  return res;\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF 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 {Tensor2D, Tensor3D, Tensor4D} from '../tensor';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from '../types';\nimport * as util from '../util';\n\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 * @param filter The filter, rank 3, of shape\n *     `[filterWidth, inDepth, outDepth]`.\n * @param stride The number of entries by which the filter is moved right at\n *     each step.\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 dataFormat An optional string from \"NWC\", \"NCW\". Defaults to \"NWC\",\n *     the data is stored in the order of [batch, in_width, in_channels]. Only\n *     \"NWC\" is currently supported.\n * @param dilation The dilation rate in which we sample input values in\n *     atrous convolution. Defaults to `1`. If it is greater than 1, then\n *     stride must be `1`.\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 conv1d_<T extends Tensor2D|Tensor3D>(\n    x: T|TensorLike, filter: Tensor3D|TensorLike, stride: number,\n    pad: 'valid'|'same'|number|conv_util.ExplicitPadding,\n    dataFormat: 'NWC'|'NCW' = 'NWC', dilation = 1,\n dimRoundingMode?:
 'floor'|'round'|'ceil'): T {\n  const $x = convertToTensor(x, 'x', 'conv1d');\n  const $filter = convertToTensor(filter, 'filter', 'conv1d');\n\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\n  util.assert(\n      x3D.rank === 3,\n      () => `Error in conv1d: input must be rank 3, but got rank ${x3D.rank}.`);\n  util.assert(\n      $filter.rank === 3,\n      () => `Error in conv1d: filter must be rank 3, but got rank ` +\n          `${$filter.rank}.`);\n  if (dimRoundingMode != null) {\n    util.assert(\n        util.isInt(pad as number),\n        () => `Error in conv1d: pad must be an integer when using, ` +\n            `dimRoundingMode ${dimRoundingMode} but got pad ${pad}.`);\n  }\n\n  util.assert(\n      x3D.shape[2] === $filter.shape[1],\n      () => `Error in conv1d: depth of input (${x3D.shape[2]}) must match ` +\n          `input depth for filter
 ${$filter.shape[1]}.`);\n  util.assert(\n      conv_util.eitherStridesOrDilationsAreOne(stride, dilation),\n      () => 'Error in conv1D: Either stride or dilation must be 1. ' +\n          `Got stride ${stride} and dilation '${dilation}'`);\n  util.assert(\n      dataFormat === 'NWC',\n      () => `Error in conv1d: got dataFormat of ${\n          dataFormat} but only NWC is currently supported.`);\n\n  const filter4D = reshape(\n      $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\n  const conv2dDataFormat = 'NHWC';\n\n  const res = conv2d(\n      (input4D as Tensor4D), (filter4D as Tensor4D), strides, pad,\n      conv2dDataFormat, dilations, dimRoundingMode);\n\n  if (reshapedTo3D) {\n    return reshape(res, [res.shape[2],
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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 *
==========================================================================\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';\n\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 *\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 (${dy.rank}) must match`);\n\n  let xShape4D = xShape as [number, number, number,
 number];\n  let dy4D = dy as Tensor4D;\n  let reshapedTo4D = false;\n  if (dy.rank === 3) {\n    reshapedTo4D = true;\n    dy4D = reshape(dy, [1, dy.shape[0], dy.shape[1], dy.shape[2]]);\n    xShape4D = [1, xShape[0], xShape[1], xShape[2]];\n  }\n\n  util.assert(\n      xShape4D.length === 4,\n      () =>\n          `Error in conv2dDerInput: inShape must be length 4, but got length ` +\n          `${xShape4D.length}.`);\n  util.assert(\n      dy4D.rank === 4,\n      () => `Error in conv2dDerInput: dy must be rank 4, but got ` +\n          `rank ${dy4D.rank}`);\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\n  const attrs: Conv2DBackpropInputAttrs =\n      {strides, pad, dataFormat, dimRoundingMode, 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 ==\n */\nimport {Tensor3D, Tensor4D} from '../tensor';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from '../types';\n\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 * @param filter The filter, rank 4, of shape\n *   `[filterHeight, filterWidth, outDepth, inDepth]`.\n *   `inDepth` must match `inDepth` in `x`.\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 * @param strides The strides of the original convolution:\n *   `[strideHeight, strideWidth]`.\n * @param pad The type of padding algorithm used in the non-transpose version\n *   of the op.\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\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
 on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {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';\n\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 * @param filter The filter, rank 5, of shape\n *   `[filterDepth, filterHeight, filterWidth, inChannels, outChannels]`.\n *   inChannels must match between input and filter.\n * @param strides The strides of the convolution: `[strideDepth, 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 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 * @param dilations The dilation rates: `[dilationDepth, dilationHeight,\n *     dilationWidth]` in which we sample input values across the height\n *   and width dimensions in atrous convolution. Defaults to `[1, 1, 1]`.\n *   If `dilations` is a single number, then\n * `dilationDepth == dilationHeight == dilationWidth`. If it is greater\n *   than 1, then all values of `strides` must be 1.\n *\n * @doc {heading: 'Operations', subheading: 'Convolution'}\n */\nfunction conv3d_<T extends Tensor4D|Tensor5D>(\n   x: T|TensorLike, filter: Tensor5D|TensorLike,\n   strides: [number, number, number]|number, pad: 'valid'|'same',\n   dataFormat: 'NDHWC'|'NCDHW' = 'NDHWC',\n   dilations: [number, number, number]|number = [1, 1, 1]): T {\n const $x = convertToTensor(x, 'x', 'conv3d');\n const $filter = convertToTensor(filter, 'filter', 'conv3d');\n\n let x5D = $x as Tensor5D;\n let reshapedTo5D = false;\n\n if ($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 util.assert(\n   x5D.rank === 5,\n   () => `Error in conv3d: input must be rank 5, but got rank ${x5D.rank}.`);\n util.assert(\n $filter.rank === 5,\n   () => `Error in conv3d: filter must be rank 5, but got rank ` +\n `${$filter.rank}.`);\n util.assert(\n   x5D.shape[4] === $filter.shape[3],\n   () => `Error in conv3d: depth of input (${x5D.shape[4]}) must match ` +\n   `input depth for filter ${$filter.shape[3]}.`);\n util.assert(\n eitherStridesOrDilationsAreOne(strides, dilations),\n   () => 'Error in conv3D: Either strides or dilations must be 1. ' +\n   `Got strides ${strides} and dilations '${dilations}'`);\n util.assert(\n   dataFormat === 'NDHWC',\n () => `Error in conv3d: got dataFormat of ${\n          dataFormat} but only NDHWC is currently supported.`);\n\n const inputs: Conv3DInputs = {x: x5D, filter:
 $filter};\n\n const attrs: Conv3DAttrs = {strides, pad, dataFormat, dilations};\n\n // tslint:disable-next-line: no-unnecessary-type-assertion\n const res = ENGINE.runKernel(\n   Conv3D, 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 return res;\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 on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF 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 {Conv3DBackpropInputV2, Conv3DBackpropInputV2Attrs, Conv3DBackpropInputV2Inputs} from '../kernel_names';\nimport {NamedAttrMap} from '../kernel_registry';\nimport {Tensor4D, Tensor5D} from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport * as util from '../util';\n\nimport {op} from './operation';\nimport {reshape} from './reshape';\n\n/**\n * Computes the derivative of the input of a 3D convolution.\n *\n * @param xShape The shape of the input: [batch, depth, height, width,\n * in_channels]. If length of 4, batch of 1 is assumed.\n * @param dy The derivative of the output, of rank 5 or rank 4 of shape\n *   `[batch, outDepth, outHeight, outWidth, in_channels]`.\n * If rank 4, batch of 1 is assumed.\n
 * @param filter The filter, rank 5, of shape\n *   `[filterDepth, filterHeight, filterWidth, inDepth, outDepth]`.\n * @param strides The strides of the convolution: `[strideDepth, 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 */\nfunction conv3DBackpropInput_<T extends Tensor4D|Tensor5D>(\n   xShape:\n   [number, number, number, number,\n   number]|[number, number, number, number],\n   dy: T, filter: Tensor5D, strides: [number, number, number]|number,\n   pad: 'valid'|'same'): T {\n util.assert(\n   xShape.length === dy.rank,\n   () => `Length of

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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 {} 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 * @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, Tensor5D} from '../tensor';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from '../types';\n\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 * @param filter The filter, rank 4, of shape\n *     `[depth, filterHeight, filterWidth, outDepth, inDepth]`.\n *     `inDepth` must match `inDepth` in `x`.\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 * @param strides The strides of the original convolution:\n *     `[strideDepth, strideHeight, strideWidth]`.\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,\n         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 * @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 {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 */\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}\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 *\n ==\n */\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 */\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}\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 License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {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 */\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\nexport const cumsum = op({cumsum_});\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 {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`.\n *\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 *\n * Values in `x` outside of the range [0, size) are ignored.\n *\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\n * 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\n * or number of occurrences. Defaults to False.\n *\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 util.assert(size >= 0, () => `size must be non-negative, but got ${size}.`);\n util.assert(\n $weights.size === $x.size || $weights.size === 0,\n () =>\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 * @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 {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`\n * 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\n * moved.\n *\n * - Chunks of data of size `blockSize * blockSize` from depth are rearranged\n * into non-overlapping blocks of size `blockSize x blockSize`\n *\n * - The width the output tensor is `inputWidth * blockSize`, whereas the\n * height is `inputHeight * blockSize`\n *\n * - The Y, X coordinates within each block of the output image are determined\n * by the high order component of the input channel index\n *\n * - The depth of the input tensor must

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 *\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\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 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\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\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\n const inputs: DepthToSpaceInputs = {x: $x};\n const attrs: DepthToSpaceAttrs = {blockSize, dataFormat};\n\n return ENGINE.runKernel(\n DepthToSpace, inputs as {} as NamedTensorMap,\n attrs as {} as NamedAttrMap);\n}\n\nexport const depthToSpace = op({depthToSpace_});\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 {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';\n\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 * 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` 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 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\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 return res;\n}\n\nexport const depthwiseConv2d = op({depthwiseConv2d_});\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 {Diag, DiagInputs} from '../kernel_names';\nimport {Tensor} from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {convertToTensor} from '../tensor_util_env';\n\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 * ```js\n * const x = tf.tensor1d([1, 2, 3, 4]);\n *\n * tf.diag(x).print()\n * ```\n * ```js\n * const x = tf.tensor1d([1, 2, 3, 4, 5, 6, 6, 8], [4, 2])\n *\n * 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 * @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 {Dilation2D, Dilation2DAttrs,
Dilation2DInputs} 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 * Computes the grayscale dilation over the input `x`.\n *\n * @param x The input tensor, rank 3 or rank 4 of shape\n * `[batch, height, width, inChannels]`. If rank 3, batch 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, 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 Specify the data format of the input and output data.\n * Defaults to 'NHWC'. Only 'NHWC' is currently supported. With the\n * default format \"NHWC\", the data is stored in the order of: [batch,\n * height, width, channels].\n * @param dilations The dilation rates: `[dilationHeight, dilationWidth]`\n * in which we sample input values across the height and width dimensions\n * for atrous morphological dilation. Defaults to `[1, 1]`. If `dilations`\n * is a single number, then `dilationHeight == dilationWidth`. If it is\n * greater than 1, then all values of `strides` must be 1.\n *\n * @doc
{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 = convertToTensor(x, 'x', 'dilation2d');\n const $filter = convertToTensor(filter, 'filter', 'dilation2d');\n\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 $filter.rank === 3,\n () => `Error in dilation2d: filter must be rank 3, but got rank ` +\n `${$filter.rank}.`);\n util.assert(\n dataFormat === 'NHWC',\n () => `Error in dilation2d: Only NHWC is currently supported, ` +\n `but got dataFormat of ${dataFormat}`);\n\n let x4D = $x as Tensor4D;\n let reshapedTo4D = false;\n\n if ($x.rank === 3) {\n
x4D = reshape($x, [1, $x.shape[0], $x.shape[1], $x.shape[2]]);\n reshapedTo4D = true;\n }\n\n const inputs: 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, 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 dilation2d = op({dilation2d_});\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/**\n * Returns the dimensions in the input shape that are broadcasted to\n * produce the provided output shape.\n *\n * The returned dimensions are 0-indexed and sorted. An example:\n * inShape = [4, 1, 3]\n * outShape

= [5, 4, 3, 3]\n * result = [1]. Dimension 1 (2nd dimension of input) gets broadcasted 1 => 3.\n */\nexport function getBroadcastDims(\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 = inShape[dim] || 1;\n const b = outShape[outShape.length - 1 - i] || 1;\n if (b > 1 && a === 1) {\n dims.unshift(dim);\n }\n }\n return dims;\n}\n\n/**\n * Returns the axes in the output space that should be reduced to produce\n * the input space.\n */\nexport function getReductionAxes(\n inShape: number[], outShape: number[]): number[] {\n const result: number[] = [];\n for (let i = 0; i < outShape.length; i++) {\n const inDim = inShape[inShape.length - i - 1];\n const outAxis = outShape.length - i - 1;\n const outDim = outShape[outAxis];\n if (inDim == null || (inDim === 1 && outDim > 1)) {\n result.unshift(outAxis);\n }\n }\n return result;\n}\n\nexport function assertAndGetBroadcastShape(\n shapeA: number[], shapeB: number[]): number[] {\n const result: number[] = [];\n const l = Math.max(shapeA.length, shapeB.length);\n\n for (let i = 0; i < l; i++) {\n let a = shapeA[shapeA.length - i - 1];\n if (a == null) {\n a = 1;\n }\n let b = shapeB[shapeB.length - i - 1];\n if (b == null) {\n b = 1;\n }\n if (a === 1) {\n result.unshift(b);\n } else if (b === 1) {\n result.unshift(a);\n } else if (a !== b) {\n const errMsg = `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 * @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 {Equal, EqualInputs} 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.equal(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 equal_<T extends Tensor>(\n a: Tensor|TensorLike, b: Tensor|TensorLike): T {\n let $a = convertToTensor(a, 'a', 'equal');\n let $b = convertToTensor(b, 'b', 'equal');\n [$a, $b] = makeTypesMatch($a, $b);\n\n assertAndGetBroadcastShape($a.shape, $b.shape);\n\n const inputs: EqualInputs = {a: $a, b: $b};\n\n return ENGINE.runKernel(Equal, inputs as {} as NamedTensorMap);\n}\n\nexport const equal = op({equal_});\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 {Select, SelectInputs} from '../kernel_names';\nimport {Tensor} from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from '../types';\nimport {assert, assertShapesMatch} from '../util';\n\nimport {broadcastTo} from './broadcast_to';\nimport {assertAndGetBroadcastShape} from './broadcast_util';\nimport {op} from './operation';\n\n/**\n * Returns the elements, either `a` or `b` depending on the `condition`.\n *\n * If the condition is true, select from `a`, otherwise select from `b`.\n *\n * ```js\n * const cond =

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 * @param a If `condition` is rank 1, `a` may have a higher rank but\n * its first dimension
must match the size of `condition`.\n * @param b A tensor with the same dtype as `a` and with shape that is\n * compatible with `a`.\n * @return A tensor with same dtype as `a` and `b`, and shape that is\n * broadcastable from `a` and `b`.\n *\n * @doc {heading: 'Operations', subheading: 'Logical'}\n */\nfunction where_<T extends Tensor>(\n condition: Tensor|TensorLike, a: T|TensorLike, b: T|TensorLike): T {\n const $a = convertToTensor(a, 'a', 'where');\n const $b = convertToTensor(b, 'b', 'where');\n const $condition = convertToTensor(condition, 'condition', 'where', 'bool');\n // TODO: move this logic to forward function when the broadcastTo op is\n // implemented in WASM.\n // Find the broadcastable shape for $a and $b.\n const broadcastShape = assertAndGetBroadcastShape($a.shape, $b.shape);\n const $broadcastedA = broadcastTo($a, broadcastShape);\n const $broadcastedB = broadcastTo($b, broadcastShape);\n if ($condition.rank === 1) {\n // If condition rank is
1, then the first dimension must match the size of\n // condition.\n assert(\n $condition.shape[0] === $a.shape[0],\n () => 'The first dimension of `a` must match the size of `condition`.');\n }\n\n if ($condition.rank !== 1) {\n // A must have the same shape as condition.\n assertShapesMatch(\n $condition.shape, $broadcastedB.shape, 'Error in where: ');\n }\n\n const inputs: SelectInputs = {\n condition: $condition,\n t: $broadcastedA,\n e: $broadcastedB\n };\n return ENGINE.runKernel(Select, inputs as unknown as NamedTensorMap);\n}\n\nexport const where = op({where_});\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 {ZerosLike, ZerosLikeInputs} 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 * Creates a `tf.Tensor` with all elements set to 0 with the same shape as the\n * given tensor.\n *\n * ```js\n * const x = tf.tensor([1, 2]);\n * tf.zerosLike(x).print();\n * ```\n *\n * @param x The tensor of required shape.\n *\n * @doc {heading: 'Tensors', subheading: 'Creation'}\n */\nfunction zerosLike_<T extends Tensor>(x:
T|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}\nexport const zerosLike = op({zerosLike_});\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
{makeTypesMatch} from '../tensor_util';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from '../types';\n\nimport {div} from './div';\nimport {equal} from './equal';\nimport {op} from './operation';\nimport {where} from './where';\nimport {zerosLike} from './zeros_like';\n\n/**\n * Divides two `tf.Tensor`s element-wise, A / B. Supports broadcasting. Return 0\n * if denominator is 0.\n *\n *\n * ```js\n * const 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 *

a.divNoNan(b).print(); // or tf.divNoNan(a, b)\n * a.divNoNan(c).print(); // or tf.divNoNan(a, c)\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 * 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, $b);\n const zeros = zerosLike(divResult);\n const bEqualsZero = equal($b, zeros);\n return where(bEqualsZero, zeros, divResult) as T;\n}\n\nexport const divNoNan = op({divNoNan_});\n","/**\n * @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';\nimport * as util from '../util';\n\nimport {matMul} from './mat_mul';\nimport {op} from './operation';\nimport {reshape} from './reshape';\n\n/**\n * Computes the dot product of two matrices and/or vectors, `t1` and `t2`.\n *\n * ```js\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 *
 @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($t2, [$t2.shape[0], $t2.shape[1]]);\n   const t1t2 = matMul(t12D, t22D);\n   return reshape(t1t2, [t1t2.size]);\n } else if ($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\nexport const dot = op({dot_});\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 {Elu, EluInputs} 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 linear element-wise: `x > 0 ? e ^ x - 1 : 0`.\n *\n * ```js\n * const x = tf.tensor1d([-1, 1, -3, 2]);\n *\n * x.elu().print(); // or tf.elu(x)\n * ```\n * @param x The input tensor.\n *\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\n const inputs: EluInputs = {x: $x};\n\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {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 gause error function of the input `tf.Tensor` element-wise:\n * `erf(x)`\n *\n * ```js\n * const x = tf.tensor1d([0, .1, -.1, .7]);\n *\n * x.erf().print(); // or tf.erf(x);\n * ```\n * @param x The input tensor.\n *\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(\n $x.dtype === 'int32' || $x.dtype === 'float32',\n   () => 'Input dtype must be `int32` or `float32`.');\n\n if ($x.dtype === 'int32') {\n $x = cast($x, 'float32');\n }\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {Exp, ExpInputs} 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` element-wise. `e ^ x`\n *\n * ```js\n * const x = tf.tensor1d([1, 2, -3]);\n *\n * x.exp().print(); // or tf.exp(x)\n * ```\n * @param x The input tensor.\n *\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\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS 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 {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\n  util.assert(axis <= $x.rank, () => 'Axis must be <= rank of the tensor');\n\n
const inputs: ExpandDimsInputs = {input: $x};\n  const attrs: ExpandDimsAttrs = {dim: axis};\n\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
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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 {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 * `e ^ x - 1`\n *\n * ```js\n * const x = tf.tensor1d([1,
2, -3]);\n *\n * x.expm1().print();  // or tf.expm1(x)\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\n  const inputs: Expm1Inputs = {x: $x};\n  return ENGINE.runKernel(Expm1, inputs as {} as
NamedTensorMap);\n}\nexport const expm1 = op({expm1_});\n","/**\n * @license\n * Copyright 2020 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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OR CONDITIONS OF ANY 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 {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 *\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 *\n * a.tile([1, 2]).print();  // or a.tile([1, 2])\n * ```\n * @param x The
```

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\n const inputs: TileInputs = {x: $x};\n const attrs: TileAttrs = {reps};\n\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';\n\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 batchShape 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 batchShape?:\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 *
==\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',

subheading: 'Creation'}\n */\nfunction fill<R extends Rank>(\n shape: ShapeMap[R], value: number|string, dtype?: DataType): Tensor<R> {\n const attrs: FillAttrs = {shape, value, dtype};\n\n return ENGINE.runKernel(Fill, {}, attrs as {} as NamedAttrMap);\n}\n\nexport {fill};\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 {Floor, FloorInputs} 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 floor of input `tf.Tensor` element-wise: `floor(x)`.\n *\n * ```js\n * const x = tf.tensor1d([.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', subheading: 'Basic math'}\n */\nfunction floor_<T extends Tensor>(x: T|TensorLike): T {\n const $x = convertToTensor(x, 'x', 'floor');\n\n const inputs: FloorInputs = {x: $x};\n return ENGINE.runKernel(Floor, inputs as {} as NamedTensorMap);\n}\nexport const floor = op({floor_});\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 {ENGINE} from '../engine';\nimport {GatherV2, GatherV2Attrs, GatherV2Inputs} 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 * Gather slices from tensor `x`'s axis `axis` according
 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 *\n * ```js\n * const x = tf.tensor2d([1, 2, 3, 4], [2, 2]);\n * const indices = tf.tensor1d([1, 1, 0], 'int32');\n *\n * x.gather(indices).print();\n * ```\n * @param x The input tensor whose slices to be gathered.\n * @param indices The indices of the values to extract.\n * @param axis The axis over which to select values. Defaults to 0.\n * @param batchDims Optional. The number of batch dimensions. It must be less\n *   than or equal to rank(indices). Defaults to 0.\n *   The output tensor will have shape of\n *   `x.shape[:axis] + indices.shape[batchDims:] + x.shape[axis + 1:]`\n *\n * @doc {heading: 'Tensors', subheading: 'Slicing and Joining'}\n */\nfunction gather_<T extends Tensor>(\n   x: T|TensorLike, indices: Tensor|TensorLike, axis = 0, batchDims = 0): T {\n const $x = convertToTensor(x, 'x',
 'gather');\n const $indices = convertToTensor(indices, 'indices', 'gather', 'int32');\n\n const inputs: GatherV2Inputs = {x: $x, indices: $indices};\n const attrs: GatherV2Attrs = {axis, batchDims};\n\n return ENGINE.runKernel(\n   GatherV2, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);\n}\n\nexport const gather = op({gather_});\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 {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 * ```js\n * const a = tf.tensor1d([1, 2, 3]);\n * const b = tf.tensor1d([2, 2, 2]);\n *\n * a.greater(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 greater_<T extends Tensor>(\n a: Tensor|TensorLike, b: Tensor|TensorLike): T {\n let $a = convertToTensor(a,
'a', 'greater');\n let $b = convertToTensor(b, 'b', 'greater');\n [$a, $b] = makeTypesMatch($a, $b);\n\n assertAndGetBroadcastShape($a.shape, $b.shape);\n\n const inputs: GreaterInputs = {a: $a, b: $b};\n\n return ENGINE.runKernel(Greater, inputs as {} as NamedTensorMap);\n}\n\nexport const greater = op({greater_});\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 {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 * ```js\n * const a = tf.tensor1d([1, 2, 3]);\n * const b = tf.tensor1d([2, 2, 2]);\n *\n * a.greaterEqual(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 greaterEqual_<T extends Tensor>(\n a: Tensor|TensorLike, b: Tensor|TensorLike): T {\n let $a = convertToTensor(a, 'a',
'greaterEqual');\n let $b = convertToTensor(b, 'b', 'greaterEqual');\n [$a, $b] = makeTypesMatch($a, $b);\n\n assertAndGetBroadcastShape($a.shape, $b.shape);\n\n const inputs: GreaterEqualInputs = {a: $a, b: $b};\n\n return ENGINE.runKernel(GreaterEqual, inputs as {} as NamedTensorMap);\n}\n\nexport const greaterEqual = op({greaterEqual_});\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 {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 * 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 * If input is real, a tensor

of all zeros is returned.\n *\n * ```js\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 return
 ENGINE.runKernel(Imag, inputs as {} as NamedTensorMap);\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 *
==========\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 * ```js\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 ENGINE.runKernel(IsFinite, inputs as {} as NamedTensorMap);\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
 required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {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 * ```js\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 ENGINE.runKernel(IsInf, inputs as {} as NamedTensorMap);\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 *
==========\n */\n\nimport {ENGINE}
 from '../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 * RReturns which elements of x are NaN.\n

*\n * ```js\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}\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 *\n ==\n */\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 * ```js\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 ==\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.\n *\n * Supports broadcasting.\n *\n * ```js\n * const a = tf.tensor1d([1, 2, 3]);\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

WARRANTIES OR CONDITIONS OF ANY 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 {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 *\n ==========\n */\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 * @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 */\nexport function 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\n return ENGINE.runKernel(LinSpace, {}, 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 *\n ==========\n */\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';\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:

'Normalization'}\n */\nfunction localResponseNormalization_<T extends Tensor3D|Tensor4D>(\n x: T|TensorLike, depthRadius = 5, bias = 1, alpha = 1, beta = 0.5): T {\n const $x = convertToTensor(x, 'x', 'localResponseNormalization');\n util.assert(\n $x.rank === 4 || $x.rank === 3,\n () => `Error in 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 `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 LRN, 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 } else {\n return res;\n }\n}\n\nexport const localResponseNormalization = op({localResponseNormalization_});\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 {ENGINE} from '../engine';\nimport {Log, LogInputs} 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 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 */\nfunction log_<T extends Tensor>(x: T|TensorLike): T {\n const $x = convertToTensor(x, 'x', 'log');\n\n const inputs: LogInputs = {x: $x};\n return ENGINE.runKernel(Log, inputs as {} as NamedTensorMap);\n}\nexport 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 * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {Log1p, Log1pInputs} 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 natural logarithm of the input `tf.Tensor` plus one\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 */\nfunction 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}\nexport const log1p = 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 * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {CustomGradientFunc, ENGINE} from './engine';\nimport {Scalar, Tensor, Variable} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor, convertToTensorArray} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from './util';\n\n/**\n * Provided `f(x)`, returns another function `g(x, dy?)`, which gives the\n * gradient of `f(x)` with respect to `x`.\n *\n * If `dy` is provided, the gradient of `f(x).mul(dy).sum()` with respect to\n * `x` is computed instead. `f(x)` must take a single tensor `x` and return a\n * single tensor `y`. If `f()` takes multiple inputs, use `tf.grads` instead.\n *\n * ```js\n * // f(x) = x ^ 2\n * const f = x => x.square();\n * // f'(x) = 2x\n * const g = tf.grad(f);\n *\n * const x = tf.tensor1d([2, 3]);\n
 * g(x).print();\n * ```\n *\n * ```js\n * // f(x) = x ^ 3\n * const f = x => x.pow(tf.scalar(3, 'int32'));\n * // f'(x) = 3x ^ 2\n * const g = tf.grad(f);\n * // f''(x) = 6x\n * const gg = tf.grad(g);\n *\n * const x = tf.tensor1d([2, 3]);\n * gg(x).print();\n * ```\n *\n * @param f The function f(x), to compute gradient for.\n *\n * @doc {heading: 'Training', subheading: 'Gradients'}\n */\nfunction grad(f: (x: Tensor) => Tensor): (\n    x: TensorLike|Tensor, dy?: TensorLike|Tensor) => Tensor {\n  util.assert(\n      util.isFunction(f), () => 'The f passed in grad(f) must be a function');\n  return (x: TensorLike|Tensor, dy?: TensorLike|Tensor): Tensor => {\n    // x can be of any dtype, thus null as the last argument.\n    const $x = convertToTensor(x, 'x', 'tf.grad', 'string_or_numeric');\n    const $dy: Tensor =\n        (dy != null) ? convertToTensor(dy, 'dy', 'tf.grad') : null;\n    return ENGINE.tidy(() => {\n      const {value, grads} = ENGINE.gradients(() => f($x), [$x], $dy);\n
      if ($dy != null) {\n        util.assertShapesMatch(\n            value.shape, $dy.shape,\n            'The shape of dy passed in grad(f)(x, dy) must match the shape ' +\n                'returned by f(x)');\n      }\n      checkGrads(grads);\n      return grads[0];\n    });\n  };\n}\n\n/**\n * Provided `f(x1, x2,...)`, returns another function `g([x1, x2,...], dy?)`,\n * which gives an array of gradients of `f()` with respect to each input\n * [`x1`,`x2`,...].\n *\n * If `dy` is passed when calling `g()`, the gradient of\n * `f(x1,...).mul(dy).sum()` with respect to each input is computed instead.\n * The provided `f` must take one or more tensors and return a single tensor\n * `y`. If `f()` takes a single input, we recommend using `tf.grad` instead.\n *\n * ```js\n * // f(a, b) = a * b\n * const f = (a, b) => a.mul(b);\n * // df / da = b, df / db = a\n * const g = tf.grads(f);\n *\n * const a = tf.tensor1d([2, 3]);\n * const b = tf.tensor1d([-2, -3]);\n * const [da, db] = g([a,
 b]);\n * console.log('da');\n * da.print();\n * console.log('db');\n * db.print();\n * ```\n *\n * @param f The function `f(x1, x2,...)` to compute gradients for.\n *\n * @doc {heading: 'Training', subheading: 'Gradients'}\n */\nfunction grads(f: (...args: Tensor[]) => Tensor): (\n    args: Array<Tensor|TensorLike>, dy?: Tensor|TensorLike) => Tensor[] {\n  util.assert(\n      util.isFunction(f), () => 'The f passed in grads(f) must be a function');\n  return (args: Array<Tensor|TensorLike>, dy?: Tensor|TensorLike): Tensor[] => {\n    util.assert(\n        Array.isArray(args),\n        () => 'The args passed in grads(f)(args) must be an array ' +\n            'of `Tensor`s or `TensorLike`s');\n    // args can be of any dtype, thus null as the last argument.\n    const $args =\n        convertToTensorArray(args, 'args', 'tf.grads', 'string_or_numeric');\n    const $dy: Tensor =\n        (dy != null) ? convertToTensor(dy, 'dy', 'tf.grads') : null;\n    return ENGINE.tidy(() => {\n
   const {value, grads} = ENGINE.gradients(() => f(...$args), $args, $dy);\n      if ($dy != null) {\n        util.assertShapesMatch(\n            value.shape, $dy.shape,\n            'The shape of dy passed in grads(f)([x1,...], dy) must ' +\n                'match the shape returned by f([x1,...])');\n      }\n      checkGrads(grads);\n      return grads;\n    });\n  };\n}\n\n/**\n * Like `tf.grad`, but also returns the value of `f()`. Useful when `f()`\n * returns a metric you want to show.\n *\n * The result is a rich object with the following properties:\n * - grad: The gradient of `f(x)` w.r.t `x` (result of `tf.grad`).\n * - value: The value returned by `f(x)`.\n *\n * ```js\n * // f(x) = x ^ 2\n * const f = x => x.square();\n * // f'(x) = 2x\n * const g = tf.valueAndGrad(f);\n *\n * const x = tf.tensor1d([2, 3]);\n * const {value, grad} = g(x);\n *\n * console.log('value');\n * value.print();\n * console.log('grad');\n * grad.print();\n * ```\n *\n * @doc {heading: 'Training', subheading:
 'Gradients'}\n */\nfunction valueAndGrad<I extends Tensor, O extends Tensor>(f: (x: I) => O): (\n    x: I, dy?: O) => {\n  value: O;\n  grad: I;\n} {\n  util.assert(\n      util.isFunction(f),\n      () => 'The f passed in valueAndGrad(f)
```

must be a function');\n return (x: I, dy?: O) => {\n   util.assert(\n   x instanceof Tensor,\n   () => 'The x passed in valueAndGrad(f)(x) must be a tensor');\n   util.assert(\n   dy == null || dy instanceof Tensor,\n   () => 'The dy passed in valueAndGrad(f)(x, dy) must be a tensor');\n   const {grads, value} = ENGINE.gradients(() => f(x), [x], dy);\n   checkGrads(grads);\n   return {grad: grads[0] as I, value};\n };\n}\n\n/**\n * Like `tf.grads`, but returns also the value of `f()`. Useful when `f()`\n * returns a metric you want to show.\n *\n * The result is a rich object with the following properties:\n * - grads: The gradients of `f()` w.r.t each input (result of `tf.grads`).\n * - value: The value returned
 by `f(x)`.\n *\n * ```js\n * // f(a, b) = a * b\n * const f = (a, b) => a.mul(b);\n * // df/da = b, df/db = a\n * const g = tf.valueAndGrads(f);\n *\n * const a = tf.tensor1d([2, 3]);\n * const b = tf.tensor1d([-2, -3]);\n * const {value, grads} = g([a, b]);\n *\n * const [da, db] = grads;\n *\n * console.log('value');\n * value.print();\n *\n * console.log('da');\n * da.print();\n * console.log('db');\n * db.print();\n * ```\n *\n * @doc {heading: 'Training', subheading: 'Gradients'}\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) must be a function');\n return (args: Tensor[], dy?: O) => {\n   util.assert(\n   Array.isArray(args) && args.every(arg => arg instanceof Tensor),\n   () => 'The args passed in valueAndGrads(f)(args) must be array of ' +\n   'tensors');\n   util.assert(\n   dy == null || dy instanceof Tensor,\n   () => 'The dy passed in valueAndGrads(f)(args, dy) must be a 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 valueAndGrads(f)([x1,...], dy) must ' +\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 the list of\n * trainable variables provided by `varList`. If no list is provided, it\n * defaults to all trainable variables.\n *\n * ```js\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 *\n * // f(a, b) = a * x ^ 2 + b * x\n * const f = () => a.mul(x.square()).add(b.mul(x)).sum();\n * // df/da = x ^ 2, df/db = x\n * const {value, grads} = tf.variableGrads(f);\n
 *\n * Object.keys(grads).forEach(varName => grads[varName].print());\n * ```\n *\n * @param f The function to 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 `varList` argument is provided explicitly and contains a subset of\n *   non-trainable variables, this map in the return value will contain keys\n *   that map the names of the non-trainable variables to `null`.\n *\n * @doc {heading: 'Training', subheading: 'Gradients'}\n */\nfunction variableGrads(f: () => Scalar, varList?: Variable[]):\n   {value: Scalar, grads: NamedTensorMap} {\n util.assert(\n   util.isFunction(f),\n   () => 'The f passed in 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   'of variables');\n\n const specifiedVarList = varList != null;\n if (!specifiedVarList) {\n   // Get all of the trainable variables.\n   varList = [];\n   for (const varName in ENGINE.registeredVariables) {\n   varList.push(ENGINE.registeredVariables[varName]);\n   }\n }\n\n const specifiedNonTrainable: Variable[] =\n   specifiedVarList ? varList.filter(variable => !variable.trainable) : null;\n\n // Prune non-trainable variables.\n const 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, but none of the ${originalVarCount} variables is ` +\n   `trainable.`);\n\n const allowNoGradients = true;\n const {value, grads} = ENGINE.gradients(f, varList, null, allowNoGradients);\n\n util.assert(\n   grads.some(g => g != null),\n   () => 'Cannot find a connection between any variable and the result of ' +\n   'the loss function y=f(x). Please make sure the operations that ' +\n   'use variables are inside the function f passed to minimize().');\n util.assert(\n   value.rank === 0,\n   () => `The f passed in variableGrads(f)

must return a scalar, but it ` +\n `returned a rank-${value.rank} tensor`);\n\n const namedGrads: NamedTensorMap = {};\n varList.forEach((v, i) => {\n if (grads[i] != null) {\n namedGrads[v.name] = grads[i];\n }\n });\n if (specifiedNonTrainable != null) {\n // If varList is explicitly provided and contains non-trainable values,\n // add them to the returned gradients with `null` values.\n specifiedNonTrainable.forEach(v => namedGrads[v.name] = null);\n }\n return {value, grads: namedGrads};\n}\n\n/**\n * Overrides the gradient computation of a function `f`.\n *\n * Takes a function\n * `f(...inputs, save) => {value: Tensor, gradFunc: (dy, saved) => Tensor[]}`\n * and returns another function `g(...inputs)` which takes the same inputs as\n * `f`. When called, `g` returns `f().value`. In backward mode, custom gradients\n * with respect to each input of `f` are computed using `f().gradFunc`.\n *\n * The `save` function passsed to `f` should be used for saving tensors needed\n * in the gradient. And the `saved` passed to the `gradFunc` is a\n * `NamedTensorMap`, which contains those saved tensor.\n *\n * ```js\n * const customOp = tf.customGrad((x, save) => {\n * // Save x to make sure it's available later for the gradient.\n * save([x]);\n * // Override gradient of our custom x ^ 2 op to be dy * abs(x);\n * return {\n * value: x.square(),\n * // Note `saved.x` which points to the `x` we saved earlier.\n * gradFunc: (dy, saved) => [dy.mul(saved[0].abs())]\n * };\n * });\n *\n * const x = tf.tensor1d([-1, -2, 3]);\n * const dx = tf.grad(x => customOp(x));\n *\n * console.log(`f(x):`);\n * customOp(x).print();\n * console.log(`f'(x):`);\n * dx(x).print();\n * ```\n *\n * @param f The function to evaluate in forward mode, which should return\n * `{value: Tensor, gradFunc: (dy, saved) => Tensor[]}`, where `gradFunc`\n * returns the custom gradients of `f` with respect to its inputs.\n *\n * @doc {heading: 'Training', subheading: 'Gradients'}\n */\nfunction customGrad<T extends Tensor>(f: CustomGradientFunc<T>):\n (...args: Tensor[]) => T {\n return ENGINE.customGrad(f);\n}\n\nfunction checkGrads(grads: Tensor[]) {\n const numNullGradients = grads.filter(g => g == null).length;\n if (numNullGradients > 0) {\n throw new Error(\n `Cannot compute gradient of y=f(x) with respect to x. Make sure that\n the f you passed encloses all operations that lead from x to y.`);\n }\n}\n\nexport {\n customGrad,\n variableGrads,\n valueAndGrad,\n valueAndGrads,\n grad,\n grads,\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 {ENGINE} from '../engine';\nimport {Neg, NegInputs} 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 `-1 * x` element-wise.\n *\n * ```js\n * const x = tf.tensor2d([1, 2, -2, 0], [2, 2]);\n *\n * x.neg().print(); // or tf.neg(x)\n * ```\n *\n * @param x The input tensor.\n *\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n */\nfunction neg_<T extends Tensor>(x: T|TensorLike): T {\n const $x = convertToTensor(x, 'x', 'neg');\n\n const inputs: NegInputs = {x: $x};\n return ENGINE.runKernel(Neg, inputs as {} as NamedTensorMap);\n}\nexport const neg = op({neg_});\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 {ENGINE} from '../engine';\nimport {Softplus, SoftplusInputs} 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 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}\nexport const softplus = op({softplus_});\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 {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 $x = convertToTensor(x, 'x', 'logSigmoid');\n\n // Use a custom gradient to maintain previous implementation.\n // There is no LogSigmoid kernel in TF so we can't use engine.runKernel\n // directly\n const customOp = customGrad((x: Tensor) => {\n   // TODO(yassogba) we can remove the chained softplus call here only\n   // after backends have modualrized softplus at which point we can call\n   // engine runKernel(..., Sotfplus, ...) directly.\n   const value = neg(softplus(neg(x)));\n\n   const gradFunc = (dy: T) => {\n   const derX = mul(dy, sigmoid(neg(x)));\n   return derX;\n   };\n   return {value, gradFunc};\n });\n\n return customOp($x) as T;\n}\nexport const logSigmoid = op({logSigmoid_});\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 {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 * @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 *\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\n const inputs: MaxInputs = {x: $x};\n const attrs: MaxAttrs = {reductionIndices: axis, keepDims};\n\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 ==\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 *\n * a.sub(b).print(); // or tf.sub(a, b)\n * ```\n *\n * ```js\n * // Broadcast subtract a with b.\n * const a = tf.tensor1d([10, 20, 30, 40]);\n * const b = tf.scalar(5);\n *\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 *\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\n const inputs: SubInputs = {a: $a, b: $b};\n\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 ==\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 *\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 *\n * ```js\n * const x = tf.tensor1d([1, 2, 3]);\n *\n * x.sum().print(); // or tf.sum(x)\n * ```\n *\n * ```js\n * const x = tf.tensor2d([1, 2, 3, 4], [2, 2]);\n *\n * const axis = 1;\n * x.sum(axis).print(); // or tf.sum(x, axis)\n * ```\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 *\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\n const inputs: SumInputs = {x: $x};\n const attrs: SumAttrs = {axis, keepDims};\n\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 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY 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';\n\nimport {Tensor} from '../tensor';\nimport {GradSaveFunc} from '../tensor_types';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from '../types';\n\nimport {cast} from './cast';\nimport {exp} from './exp';\nimport {log} from './log';\nimport {max} from './max';\nimport {mul} from './mul';\nimport {op} from './operation';\nimport {sub} from './sub';\nimport {sum} from './sum';\n\n/**\n * Computes the log softmax.\n *\n * ```js\n * const a = tf.tensor1d([1, 2, 3]);\n *\n * a.logSoftmax().print(); // or tf.logSoftmax(a)\n * ```\n *\n * ```js\n * const a = tf.tensor2d([2, 4, 6, 1, 2, 3], [2, 3]);\n *\n * a.logSoftmax().print(); // or tf.logSoftmax(a)\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 */\nfunction logSoftmax_<T extends Tensor>(logits: T|TensorLike, axis = -1): T {\n const $logits = convertToTensor(logits, 'logits', 'logSoftmax');\n\n if (axis === -1) {\n   axis = $logits.rank - 1;\n }\n if (axis !== $logits.rank - 1) {\n   throw Error(\n   'Log Softmax along a non-last dimension is not yet supported. ' +\n   `Logits was rank ${$logits.rank} and axis was ${axis}`);\n }\n\n // const forward: ForwardFunc<Tensor> = (backend, save) => {\n //   const keepDims = true;\n //   const xMax = max(logits, axis, true);\n //   const shifted = sub(logits, xMax);\n //   const value =\n //   sub(cast(shifted, 'float32'), log(sum(exp(shifted), axis,\n //   keepDims)));\n //   save([value]);\n //   return value;\n // };\n\n // Use a
custom gradient for numerical stability.\n const customOp = customGrad((logits: Tensor, save: GradSaveFunc) => {\n   const keepDims = true;\n   const xMax = max(logits, axis, true);\n   const shifted = sub(logits, xMax);\n   const value =\n   sub(cast(shifted, 'float32'), log(sum(exp(shifted), axis, keepDims)));\n   save([value]);\n\n   const gradFunc = (dy: Tensor, saved: Tensor[]) => {\n   const [value] = saved;\n   const keepDims = true;\n   const softmax = exp(value);\n   return sub(dy, mul(sum(dy, axis, keepDims), softmax));\n   };\n   return {value, gradFunc};\n });\n\n return customOp($logits) as T;\n\n // TODO Use Engine.runKernel when CPU/WebGL/WASM backends implement this.\n // const inputs: LogSoftmaxInputs = {logits: $logits};\n // const attrs: LogSoftmaxAttrs = {axis};\n // return ENGINE.runKernel(\n //   LogSoftmax, inputs as {} as NamedTensorMap,\n //   attrs as {} as NamedAttrMap);\n}\n\nexport const logSoftmax = op({logSoftmax_});\n","/**\n
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==========\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 */\nexport function axesAreInnerMostDims(axes: number[], rank: number): boolean {\n for (let i = 0; i < axes.length; ++i) {\n   if
(axes[axes.length - i - 1] !== rank - 1 - i) {\n   return false;\n   }\n }\n return true;\n}\n\nexport function combineLocations(\n   outputLoc: number[], reduceLoc: number[], axes: number[]): number[] {\n const rank = outputLoc.length + reduceLoc.length;\n const loc = [];\n let outIdx = 0;\n let reduceIdx = 0;\n   for (let dim = 0;

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dim < rank; dim++) {\n    if (axes.indexOf(dim) === -1) {\n      loc.push(outputLoc[outIdx++]);\n    } else {\n
loc.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  const reduceSubShape = axes.map(x => 1);\n  return combineLocations(shape, reduceSubShape,
axes);\n}\n\nexport function assertAxesAreInnerMostDims(\n    msg: string, axes: number[], rank: number): void
{\n  util.assert(\n      axesAreInnerMostDims(axes, rank),\n      () => `${msg} supports only inner-most axes for now.
` +\n          `Got axes ${axes} and rank-${rank} input.`);\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):
number[]|\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/** Returns the axes permutation
 that undoes the original permutation. */\nexport function getUndoAxesPermutation(axes: number[]): number[] {\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  const res: number[] = [];\n  for (let i = rank -
numAxes; i < rank; ++i) {\n    res.push(i);\n  }\n  return res;\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
*/\n\nimport {Tensor} from '../tensor';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike}
from '../types';\nimport {parseAxisParam} from '../util';\n\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 *\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 *\n * ```js\n * const x = tf.tensor1d([1, 2, 3]);\n *\n * x.logSumExp().print();  // or
tf.logSumExp(x)\n * ```\n *\n * ```js\n * const x = tf.tensor2d([1, 2, 3, 4], [2, 2]);\n *\n * const axis = 1;\n *
x.logSumExp(axis).print();  // or tf.logSumExp(a, axis)\n * ```\n * @param x The input tensor.\n * @param axis The
dimension(s) to reduce. If null (the default),\n *     reduces all dimensions.\n * @param keepDims If true, retains
reduced dimensions with length\n *     of 1. Defaults to false.\n *\n * @doc {heading: 'Operations', subheading:
'Reduction'}\n */\nfunction logSumExp_<T extends Tensor>(\n    x: Tensor|TensorLike, axis: number|number[] =
null, keepDims = false): T {\n  const $x = convertToTensor(x, 'x', 'logSumExp');\n\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\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 *
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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 {LogicalAnd, LogicalAndInputs} from '../kernel_names';\nimport {Tensor} from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\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 AND 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 *\n * a.logicalAnd(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 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\n const inputs: LogicalAndInputs = {a: $a, b: $b};\n\n return ENGINE.runKernel(LogicalAnd, inputs as {} as NamedTensorMap);\n}\n\nexport const logicalAnd = op({logicalAnd_});\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 {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 *\n * ```js\n * const a = tf.tensor1d([false, true], 'bool');\n *\n * a.logicalNot().print();\n * ```\n *\n * @param x The input tensor. Must be of dtype 'bool'.\n *\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}\n\nexport const logicalNot = op({logicalNot_});\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 {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 *\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}\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 */\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 *\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 */\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';\n\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\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 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\n const inputs: MaxPoolInputs = {x: x4D};\n\n const attrs: MaxPoolAttrs = {filterSize, strides, pad, dimRoundingMode};\n\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\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';\nimport {MaxPool3D, MaxPool3DAttrs, MaxPool3DInputs} 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 {op} from './operation';\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 * @param filterSize The filter size:\n * `[filterDepth, filterHeight, filterWidth]`.\n * If `filterSize` is a single number,\n * then `filterDepth == filterHeight == filterWidth`.\n * @param strides The strides of the pooling:\n * `[strideDepth, strideHeight, strideWidth]`.\n * If `strides` is a single number,\n * then `strideDepth == 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 dimRoundingMode A string from: 'ceil', 'round', 'floor'. If none is\n * provided, it will default to truncate.\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 * @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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {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';\n\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 * @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 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 * @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 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, 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\n const result = ENGINE.runKernel(\n MaxPoolWithArgmax,
 inputs as {} as NamedTensorMap,\n attrs as {} as NamedAttrMap) as Tensor[];\n\n return {result: result[0], indexes: result[1]};\n}\n\nexport const maxPoolWithArgmax = op({maxPoolWithArgmax_});\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 {Maximum, MaximumInputs}
 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 max of a and b (`a > b ? a : b`) element-wise.\n * Supports broadcasting.\n *\n * We also expose `tf.maximumStrict` 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.maximum(b).print(); // or tf.maximum(a, b)\n * ```\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 *\n * a.maximum(b).print(); // or tf.maximum(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 maximum_<T extends Tensor>(\n a: Tensor|TensorLike, b: Tensor|TensorLike): T {\n let $a = convertToTensor(a, 'a', 'maximum');\n let $b = convertToTensor(b, 'b', 'maximum');\n [$a, $b] = makeTypesMatch($a, $b);\n\n if ($a.dtype === 'bool') {\n $a = cast($a, 'int32');\n $b = cast($b, 'int32');\n }\n assertAndGetBroadcastShape($a.shape, $b.shape);\n\n const inputs: MaximumInputs = {a: $a, b: $b};\n\n return ENGINE.runKernel(Maximum, inputs as {} as NamedTensorMap);\n}\n\nexport const maximum = op({maximum_});\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 {Mean, MeanAttrs, MeanInputs} 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 mean of elements across dimensions of a `tf.Tensor`.\n *\n * Reduces `x` along the dimensions given in `axis`. Unless `keepDims` is\n * true, the rank of the `tf.Tensor` 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 a `tf.Tensor` with\n * a single element is returned.\n *\n * ```js\n * const x = tf.tensor1d([1, 2, 3]);\n *\n * x.mean().print(); // or tf.mean(a)\n * ```\n *\n * ```js\n * const x = tf.tensor2d([1, 2, 3, 4], [2, 2]);\n *\n * const axis = 1;\n * x.mean(axis).print(); // or tf.mean(x, axis)\n * ```\n *\n * @param x The input tensor.\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 *\n * @doc {heading: 'Operations', subheading: 'Reduction'}\n */\nfunction mean_<T extends Tensor>(\n x: Tensor|TensorLike, axis: number|number[] = null, keepDims = false): T {\n const $x = convertToTensor(x, 'x', 'mean');\n\n const inputs: MeanInputs = {x: $x};\n

const attrs: MeanAttrs = {axis, keepDims};\n\n return ENGINE.runKernel(\n   Mean, inputs
 as {} as NamedTensorMap, attrs as {} as NamedAttrMap);\n}\n\nexport const mean = op({mean_});\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 {Min, MinAttrs, MinInputs} 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 minimum value from the input.\n *\n * Reduces the input along the dimensions given in `axes`. Unless `keepDims`\n * is true, the rank of the array is reduced by 1 for each entry in `axes`.\n * If `keepDims` is true, the reduced dimensions are retained with length 1.\n * If `axes` has no entries, all dimensions are reduced, and an array with a\n * single element is returned.\n *\n * ```js\n * const x = tf.tensor1d([1, 2, 3]);\n *\n * x.min().print(); // or tf.min(x)\n * ```\n *\n * ```js\n * const x = tf.tensor2d([1, 2, 3, 4], [2, 2]);\n *\n * const axis = 1;\n * x.min(axis).print(); // or tf.min(x, axis)\n * ```\n *\n * @param x The input Tensor.\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 *\n * @doc {heading: 'Operations', subheading: 'Reduction'}\n */\nfunction min_<T extends Tensor>(\n   x: Tensor|TensorLike, axis: number|number[] = null, keepDims = false): T {\n const $x = convertToTensor(x, 'x', 'min');\n\n const inputs: MinInputs = {x: $x};\n const attrs: MinAttrs = {axis, keepDims};\n\n // tslint:disable-next-line: no-unnecessary-type-assertion\n return ENGINE.runKernel(\n   Min, inputs as {} as NamedTensorMap,\n   attrs as {} as NamedAttrMap) as T;\n}\n\nexport const min = op({min_});\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 {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==========\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 *\n * This operation implements the `REFLECT` and `SYMMETRIC` modes of pad.\n *\n * ```js\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 * ```\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/** @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==========\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 * ```js\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 *\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 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
*/\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 * @param x The input Tensor.\n *\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
*/\n\nimport {Tensor} from '../tensor';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from '../types';\nimport {parseAxisParam} from '../util';\n\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 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 *
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*/\nimport {Tensor2D} from '../tensor';\nimport {convertToTensor, convertToTensorArray} from '../tensor_util_env';\nimport {TensorLike} from '../types';\nimport {op} from './operation';\n\n/**\n * @docalias (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
 states and outputs of a stack of LSTMCells.\n *\n * Each cell output is used as input to the next cell.\n *\n * Returns `[cellState, cellOutput]`.\n *\n * Derived from tf.contrib.rn.MultiRNNCell.\n *\n * @param lstmCells Array of 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 multiRNNCell_(\n   lstmCells: LSTMCellFunc[], data: Tensor2D|TensorLike,\n   c: Array<Tensor2D|TensorLike>,\n   h: Array<Tensor2D|TensorLike>): [Tensor2D[], Tensor2D[]] {\n const $data = convertToTensor(data, 'data', 'multiRNNCell');\n const $c = convertToTensorArray(c, 'c', 'multiRNNCell');\n const $h = convertToTensorArray(h, 'h', 'multiRNNCell');\n\n let input = $data;\n const newStates = [];\n for (let i = 0; i < lstmCells.length; i++) {\n   const output = lstmCells[i](input, $c[i], $h[i]);\n   newStates.push(output[0]);\n   newStates.push(output[1]);\n
    input = output[1];\n }\n const newC: Tensor2D[] = [];\n const newH: Tensor2D[] = [];\n for (let i = 0; i < newStates.length; i += 2) {\n   newC.push(newStates[i]);\n   newH.push(newStates[i + 1]);\n }\n return [newC, newH];\n}\nexport const multiRNNCell = op({multiRNNCell_});\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 '../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';\n\nimport {op} from './operation';\nimport {reshape} from './reshape';\n\n/**\n * Creates a `tf.Tensor` with values drawn from a multinomial distribution.\n *\n * ```js\n * const probs = tf.tensor([.75, .25]);\n * tf.multinomial(probs, 3).print();\n * ```\n *\n * @param logits 1D array with 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 number.\n * @param normalized Whether the provided `logits` are normalized true\n *   probabilities
 (sum to 1). Defaults to false.\n * @return 1D array of shape `[numSamples]`, or 2D array of shape\n * `[batchSize, numSamples]`, depending on the rank of the input.\n *\n * @doc {heading: 'Tensors', subheading: 'Random'}\n */\nfunction multinomial_(\n   logits: Tensor1D|Tensor2D|TensorLike, numSamples: number, seed?: number,\n   normalized = false): Tensor1D|Tensor2D {\n const $logits = convertToTensor(logits, 'logits', '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

${origRank}`);\n }\n // TODO(lina128): Investigate correct seed behavior. The code seems not allow\n // setting see to 0.\n seed = seed || Math.random();\n\n // The kernel only accepts (and returns) rank 2 tensors.\n const logits2D: Tensor2D =\n   origRank === 1 ? reshape($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 *\n ==\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';\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([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 *\n ==\n */\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 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

on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {makeOnesTypedArray, sizeFromShape} from '../util';\n\nimport {complex} from './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 * @param dtype The type of an element in the resulting tensor. Defaults to\n * 'float'.\n *\n * @doc {heading: 'Tensors', subheading: 'Creation'}\n */\nexport function ones<R extends Rank>(\n shape: ShapeMap[R], dtype: 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 = makeOnesTypedArray(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 on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {OnesLike, OnesLikeInputs} 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 * Creates a `tf.Tensor` with all elements set to 1 with the same shape as the\n * given tensor.\n *\n * ```js\n * const x = tf.tensor([1, 2]);\n * tf.onesLike(x).print();\n * ```\n * @param x A tensor.\n *\n * @doc {heading: 'Tensors', subheading: 'Creation'}\n */\nfunction onesLike_<T extends Tensor>(x: T|TensorLike): T {\n const $x = convertToTensor(x, 'x', 'onesLike');\n\n const inputs: OnesLikeInputs = {x: $x};\n return ENGINE.runKernel(OnesLike, inputs as {} as NamedTensorMap);\n}\n\nexport const onesLike = op({onesLike_});\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 {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 * Computes the outer product of two vectors, `v1` 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 * @param v1 The first vector in the outer product operation.\n * @param v2 The second vector in the outer product operation.\n *\n * @doc {heading: 'Operations', subheading: 'Matrices'}\n */\nfunction outerProduct_(\n v1: Tensor1D|TensorLike, v2: Tensor1D|TensorLike): Tensor2D {\n const $v1 = convertToTensor(v1, 'v1', 'outerProduct');\n const $v2 = convertToTensor(v2, 'v2', 'outerProduct');\n\n util.assert(\n $v1.rank === 1 && $v2.rank === 1,\n () => `Error in outerProduct: inputs must be rank 1, but got ranks ` +\n `${$v1.rank} and ${$v2.rank}.`);\n\n const v12D = reshape($v1, [-1, 1]);\n const v22D = reshape($v2, [1, -1]);\n return matMul(v12D, v22D);\n}\n\nexport

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 paddings.\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 `paddings` 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 * @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 * @param constantValue The pad value to use. Defaults to 0.\n *\n * @doc {heading: 'Tensors', subheading: 'Transformations'}\n */\nfunction pad_<T extends Tensor>(\n   x: T|TensorLike, paddings: 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 = {paddings, 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\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
*/\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 paddings. See `pad` for details.\n */\nfunction pad1d_(\n   x: Tensor1D|TensorLike, paddings: [number, number],\n   constantValue = 0): Tensor1D {\n assert(\n   paddings.length === 2,\n   () => 'Invalid number of paddings. Must be length of 2.');\n return pad(x, [paddings], constantValue);\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
*/\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], [number, number]],\n constantValue = 0): Tensor2D {\n assert(\n paddings.length === 2 && paddings[0].length === 2 &&\n paddings[1].length === 2,\n () => 'Invalid number of paddings. Must be length 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 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License
at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF 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';\nimport {assert} from '../util';\nimport {op} from './operation';\nimport {pad} from './pad';\n\n/**\n * Pads a `tf.Tensor3D` with a given value and paddings. See `pad` for details.\n */\nfunction pad3d_(\n x: Tensor3D|TensorLike,\n paddings: [[number, number], [number, number], [number, number]],\n constantValue = 0): Tensor3D {\n assert(\n paddings.length === 3 && paddings[0].length === 2 &&\n paddings[1].length === 2 &&
paddings[2].length === 2,\n () => 'Invalid number of paddings. Must be length of 2 each.');\n return pad(x, paddings, constantValue);\n}\n\nexport const pad3d = op({pad3d_});\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';\nimport {assert}
from '../util';\nimport {op} from './operation';\nimport {pad} from './pad';\n\n/**\n * Pads a `tf.Tensor4D` with a 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 = 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 number of paddings. Must be length of 2 each.');\n return pad(x, paddings, constantValue);\n}\n\nexport const pad4d = op({pad4d_});\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 {SpaceToBatchND, SpaceToBatchNDAttrs, SpaceToBatchNDInputs} 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 * This operation divides \"spatial\" dimensions `[1, ..., M]` of the input into\n * a grid of blocks of shape `blockShape`, and interleaves

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these blocks with\n * the \"batch\" dimension (0) such that in the output, the spatial\n * dimensions `[1, ..., M]` correspond to the position within the grid,\n * and the batch dimension combines both the position within a spatial block\n * and the original batch position. Prior to division into blocks,\n * the spatial dimensions of the input are optionally zero padded\n * according to `paddings`. See below for a precise description.\n *\n * ```js\n * const x = tf.tensor4d([1, 2, 3, 4], [1, 2, 2, 1]);\n * const blockShape = [2, 2];\n * const paddings = [[0, 0], [0, 0]];\n *\n * x.spaceToBatchND(blockShape, paddings).print();\n * ```\n *\n * @param x A `tf.Tensor`. N-D with `x.shape` = `[batch] + spatialShape +\n * remainingShape`, where spatialShape has `M` dimensions.\n * @param blockShape A 1-D array. Must have shape `[M]`, all values must\n * be >= 1.\n * @param paddings A 2-D array. Must have shape `[M, 2]`, all values must be >=\n *     0. `paddings[i] = [padStart, padEnd]` specifies
 the amount to zero-pad\n * from input dimension `i + 1`, which corresponds to spatial dimension `i`. It\n * is required that\n * `(inputShape[i + 1] + padStart + padEnd) % blockShape[i] === 0`\n *\n * This operation is equivalent to the following steps:\n *\n * 1. Zero-pad the start and end of dimensions `[1, ..., M]` of the input\n * according to `paddings` to produce `padded` of shape paddedShape.\n *\n * 2. Reshape `padded` to `reshapedPadded` of shape:\n * `[batch] + [paddedShape[1] / blockShape[0], blockShape[0], ...,\n * paddedShape[M] / blockShape[M-1], blockShape[M-1]] + remainingShape`\n *\n * 3. Permute dimensions of `reshapedPadded` to produce `permutedReshapedPadded`\n * of shape: `blockShape + [batch] + [paddedShape[1] / blockShape[0], ...,\n * paddedShape[M] / blockShape[M-1]] + remainingShape`\n *\n * 4. Reshape `permutedReshapedPadded` to flatten `blockShape` into the\n * batch dimension, producing an output tensor of shape:\n * `[batch * prod(blockShape)] + [paddedShape[1]
 / blockShape[0], ...,\n * paddedShape[M] / blockShape[M-1]] + remainingShape`\n *\n * @doc {heading: 'Tensors', subheading: 'Transformations'}\n */\nfunction spaceToBatchND_<T extends Tensor>(\n    x: T|TensorLike, blockShape: number[], paddings: number[][]): T {\n  const $x = convertToTensor(x, 'x', 'spaceToBatchND');\n\n  util.assert(\n      $x.rank >= 1 + blockShape.length,\n      () => `input rank ${$x.rank} should be > than [blockShape] ${\n          blockShape.length}`);\n\n  util.assert(\n      paddings.length === blockShape.length,\n      () => `paddings.shape[0] ${\n          paddings.length} must be equal to [blockShape] ${blockShape.length}`);\n\n  util.assert(\n      $x.shape.reduce(\n          (a, b, i) => {\n            if (i > 0 && i <= blockShape.length) {\n              return a &&\n                  ((b + paddings[i - 1][0] + paddings[i - 1][1]) %\n                       blockShape[i - 1] ===\n                   0);\n            }\n            return a;\n          },\n          true),\n      () => `input spatial dimensions ${$x.shape.slice(1)} with paddings ${\n          paddings.toString()} must be divisible by blockShapes ${\n          blockShape.toString()}`);\n\n  const inputs: SpaceToBatchNDInputs = {x: $x};\n  const attrs: SpaceToBatchNDAttrs = {blockShape, paddings};\n\n  return ENGINE.runKernel(\n      SpaceToBatchND, inputs as {} as NamedTensorMap,\n      attrs as {} as NamedAttrMap);\n}\n\nexport const spaceToBatchND = op({spaceToBatchND_});\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 {Tensor3D, Tensor4D} from '../tensor';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from '../types';\nimport * as util from '../util';\n\nimport {avgPool} from './avg_pool';\nimport {batchToSpaceND} from './batch_to_space_nd';\nimport * as conv_util from './conv_util';\nimport {maxPool} from './max_pool';\nimport {op} from './operation';\nimport {reshape} from './reshape';\nimport {spaceToBatchND} from './space_to_batch_nd';\n\n/**\n * Performs an N-D pooling operation\n *\n * @param input 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 windowShape The filter size: `[filterHeight, filterWidth]`. If\n *     `filterSize` is a single number,
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then `filterHeight == filterWidth`.\n * @param poolingType The type of pooling, either 'max' or 'avg'.\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 dilated pooling. Defaults to `[1, 1]`. If `dilationRate` 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 strides The strides of the pooling: `[strideHeight, strideWidth]`. If\n *   `strides` is
a single number, then `strideHeight == strideWidth`.\n *\n * @doc {heading: 'Operations', subheading: 'Convolution'}\n */\nfunction pool_<T extends Tensor3D|Tensor4D>(\n   input: T|TensorLike, windowShape: [number, 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 // 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// https://github.com/tensorflow/tensorflow/blob/50f6bb67dc98c9b74630b6047aae7a4f8a40fd02/tensorflow/python/ops/array_ops.py#L2184\nfunction 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// https://github.com/tensorflow/tensorflow/blob/50f6bb67dc98c9b74630b6047aae7a4f8a40fd02/tensorflow/python/ops/nn_ops.py#L524\nfunction 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\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\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF 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 {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';\n\nimport {op} from './operation';\n\n/**\n * Computes the power of one `tf.Tensor` to another. Supports broadcasting.\n *\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 * ```\n *\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 * ```\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 * @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\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';\n\nimport {op} from './operation';\n\n/**\n * Computes leaky rectified linear element-wise with parametric alphas.\n *\n * `x < 0 ? alpha * x :
 f(x) = x`\n *\n * ```js\n * const x = tf.tensor1d([-1, 2, -3, 4]);\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 * @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 {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`\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 *\n * ```js\n * const x = tf.tensor1d([1, 2, 3]);\n *\n * x.prod().print(); // or tf.prod(x)\n * ```\n *\n * ```js\n * const x = tf.tensor2d([1, 2, 3, 4], [2, 2]);\n *\n * const axis = 1;\n * x.prod(axis).print(); // or tf.prod(x, axis)\n * ```\n *\n * @param x The input tensor to compute the product 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 *\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 * @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 {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","// 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\n// Copyright (C) 2010 by Johannes Baagøe <baagoe@baagoe.org>\n//\n// Permission is hereby granted, free of charge, to any person obtaining a copy\n// of this

software and associated documentation files (the \"Software\"), to deal\n// in the Software without restriction, including without limitation the rights\n// to use, copy, modify, merge, publish, distribute, sublicense, and/or sell\n// copies of
the Software, and to permit persons to whom the Software is\n// furnished to do so, subject to the following conditions:\n// \n// The above copyright notice and this permission notice shall be included in\n// all copies or substantial portions of the Software.\n// \n// THE SOFTWARE IS PROVIDED \"AS IS\", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR\n// IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY,\n// FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE\n// AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER\n// LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM,\n// OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN\n// THE SOFTWARE.\n\n\n\n(function(global, module, define) {\n\nfunction Alea(seed) {\n var me = this, mash = Mash();\n\n me.next = function() {\n var t = 2091639 * me.s0 + me.c * 2.3283064365386963e-10; // 2^-32\n me.s0 = me.s1;\n me.s1 = me.s2;\n
return me.s2 = t - (me.c = t | 0);\n };\n\n // Apply the seeding algorithm from Baagoe.\n me.c = 1;\n me.s0 = mash(' ');\n me.s1 = mash(' ');\n me.s2 = mash(' ');\n me.s0 -= mash(seed);\n if (me.s0 < 0) { me.s0 += 1; }\n me.s1 -= mash(seed);\n if (me.s1 < 0) { me.s1 += 1; }\n me.s2 -= mash(seed);\n if (me.s2 < 0) { me.s2 += 1; }\n mash = null;\n}\n\nfunction copy(f, t) {\n t.c = f.c;\n t.s0 = f.s0;\n t.s1 = f.s1;\n t.s2 = f.s2;\n return t;\n}\n\nfunction impl(seed, opts) {\n var xg = new Alea(seed),\n state = opts && opts.state,\n prng = xg.next;\n prng.int32 = function() { return (xg.next() * 0x100000000) | 0; }\n prng.double = function() {\n return prng() + (prng() * 0x200000 | 0) * 1.1102230246251565e-16; // 2^-53\n };\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\nfunction Mash() {\n var n = 0xefc8249d;\n\n var mash = function(data)
{\n data = data.toString();\n for (var i = 0; i < data.length; i++) {\n n += data.charCodeAt(i);\n var h = 0.02519603282416938 * n;\n n = h >>> 0;\n h -= n;\n h *= n;\n n = h >>> 0;\n h -= n;\n n += h * 0x100000000; // 2^32\n }\n return (n >>> 0) * 2.3283064365386963e-10; // 2^-32\n };\n\n return mash;\n}\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.alea = 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\n","// A Javascript implementaion of the \"xor128\" prng algorithm by\n// George Marsaglia. See http://www.jstatsoft.org/v08/i14/paper\n\n(function(global, module, define) {\n\nfunction XorGen(seed) {\n var me = this, strseed = '';\n\n me.x = 0;\n me.y = 0;\n me.z = 0;\n me.w = 0;\n\n
// Set up generator function.\n me.next = function() {\n var t = me.x ^ (me.x << 11);\n me.x = me.y;\n me.y = me.z;\n me.z = me.w;\n return me.w ^= (me.w >>> 19) ^ t ^ (t >>> 8);\n };\n\n if (seed === (seed | 0)) {\n // Integer seed.\n me.x = seed;\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 + 64; k++) {\n me.x ^= strseed.charCodeAt(k) | 0;\n me.next();\n }\n}\n\nfunction copy(f, t) {\n t.x = f.x;\n t.y = f.y;\n t.z = f.z;\n t.w = f.w;\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 = 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.xor128 = 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\n","// A Javascript implementaion of the \"xorwow\" prng algorithm by\n// George Marsaglia. See http://www.jstatsoft.org/v08/i14/paper\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 t = (me.x ^ (me.x >>> 2));\n me.x = me.y; me.y = me.z; me.z = me.w; me.w = me.v;\n   return (me.d = (me.d + 362437 | 0)) +\n   (me.v = (me.v
 ^ (me.v << 4)) ^ (t ^ (t << 1))) | 0;\n };\n\n me.x = 0;\n me.y = 0;\n me.z = 0;\n me.w = 0;\n me.v = 0;\n\n if (seed === (seed | 0)) {\n   // Integer seed.\n   me.x = seed;\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 + 64; k++) {\n   me.x ^= strseed.charCodeAt(k) | 0;\n   if (k == strseed.length) {\n   me.d = me.x << 10 ^ me.x >>> 4;\n   }\n   me.next();\n }\n}\n\nfunction copy(f, t) {\n t.x = f.x;\n t.y = f.y;\n t.z = f.z;\n t.w = f.w;\n t.v = f.v;\n t.d = 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 = 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.xorwow = 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\n","// A Javascript implementaion of the \"xorshift7\" algorithm by\n// François Panneton and Pierre L'ecuyer:\n// \"On the Xorgshift Random Number Generators\"\n// http://saluc.engr.uconn.edu/refs/crypto/rng/panneton05onthexorshift.pdf\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   // Update xor generator.\n   var X = me.x, i = me.i, t,
 v, w;\n   t = X[i]; t ^= (t >>> 7); v = t ^ (t << 24);\n   t = X[(i + 1) & 7]; v ^= t ^ (t >>> 10);\n   t = X[(i + 3) & 7]; v ^= t ^ (t >>> 3);\n   t = X[(i + 4) & 7]; v ^= t ^ (t << 7);\n   t = X[(i + 7) & 7]; t = t ^ (t << 13); v ^= t ^ (t << 9);\n
  X[i] = v;\n   me.i = (i + 1) & 7;\n   return v;\n };\n\n function init(me, seed) {\n   var j, w, X = [];\n\n   if (seed === (seed | 0)) {\n   // Seed state array using a 32-bit integer.\n   w = X[0] = seed;\n   } else {\n   // Seed state using a string.\n   seed = '' + seed;\n   for (j = 0; j < seed.length; ++j) {\n   X[j & 7] = (X[j & 7] << 15) ^\n
  (seed.charCodeAt(j) + X[(j + 1) & 7] << 13);\n   }\n   }\n   // Enforce an array length of 8, not all zeroes.\n   while (X.length < 8) X.push(0);\n   for (j = 0; j < 8 && X[j] === 0; ++j);\n   if (j == 8) w = X[7] = -1; else w = X[j];\n\n   me.x = X;\n   me.i = 0;\n\n   // Discard an initial 256 values.\n   for (j = 256; j > 0; --j) {\n
      me.next();\n   }\n }\n\n init(me, seed);\n}\n\nfunction copy(f, t) {\n t.x = f.x.slice();\n t.i = f.i;\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 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 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.xorshift7 = 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\n","// A Javascript implementaion of Richard Brent's Xorgens xor4096 algorithm.\n//\n// This fast non-cryptographic random number generator is designed for\n// use in Monte-Carlo algorithms. It combines a long-period xorshift\n// generator with a Weyl generator, and it passes all common batteries\n// of stasticial tests for randomness while consuming only a few nanoseconds\n// for each prng generated. For background on the generator, see Brent's\n// paper: \"Some long-period random number generators using shifts and xors.\"\n// http://arxiv.org/pdf/1004.3115v1.pdf\n//\n// Usage:\n//\n// var xor4096 = require('xor4096');\n// random = xor4096(1);   // Seed with int32 or string.\n// assert.equal(random(), 0.1520436450538547); // (0, 1) range, 53 bits.\n// assert.equal(random.int32(), 1806534897);   // signed int32, 32 bits.\n//\n// 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 initalizing 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.charCodeAt((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  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  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  this,
          // 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  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.charCodeAt(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 =
```

```
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
= 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\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
OF\nMERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT.\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//\n// The following constants are related to IEEE 754
limits.\n//\nvar 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//\n// seedrandom()\n// This is the seedrandom function described above.\n//\nfunction seedrandom(seed,
options, callback) {\n  var key = [];\n  options = (options == true) ? { entropy: true } : (options || {});\n\n  // Flatten
the seed string or build one from local entropy if needed.\n  var shortseed = mixkey(flatten(\n    options.entropy ?
[seed, tostring(pool)] :\n    (seed == null) ? autoseed() : seed, 3), key);\n\n  // Use the seed to initialize an ARC4
generator.\n  var arc4 = new ARC4(key);\n\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),
          // Start with a numerator n < 2 ^ 48\n        d = startdenom,                 //   and denominator d = 2 ^ 48.\n        x =
0;                          //   and no
 'extra last byte'.\n    while (n < significance) {          // Fill up all significant digits by\n      n = (n + x) * width;
//   shifting numerator and\n      d *= width;                       //   denominator and generating a\n      x = arc4.g(1);
       //   new least-significant-byte.\n    }\n    while (n >= overflow) {             // To avoid rounding up, before
adding\n      n /= 2;                           //   last byte, shift everything\n      d /= 2;                           //   right using integer
math until\n      x >>>= 1;                         //   we have exactly the desired bits.\n    }\n    return (n + x) / d;                 //
Form the number within [0, 1).\n  };\n\n  prng.int32 = function() { return arc4.g(4) | 0; }\n  prng.quick = function() {
return arc4.g(4) / 0x100000000; }\n  prng.double = prng;\n\n  // Mix the randomness into accumulated entropy.\n
mixkey(tostring(arc4.S), pool);\n\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) {
copy(state, arc4); }\n          // Only provide the .state method if requested via options.state.\n          prng.state =
function() { return copy(arc4, {}); }\n        }\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) {
math[rngname] = prng; return seed; }\n\n        // Otherwise, it is a newer calling convention, so return the\n        //
```

prng directly.\n else return prng;\n })(\n prng,\n shortseed,\n 'global' in options ? options.global : (this == math),\n options.state);\n}\nmath['seed' + rngname] = seedrandom;\n\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//\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 // 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// copy()\n// Copies internal state of ARC4 to or from a plain object.\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// Converts an object tree to nested arrays of strings.\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 }\n return (result.length ? result : typ == 'string' ? obj : obj + '\\0');\n}\n\n//\n// mixkey()\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//\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// Returns an object for autoseeding, using window.crypto and Node crypto\n// module if available.\n//\nfunction autoseed() {\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//
Converts an array of charcodes to a string\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//\nmixkey(math.random(), pool);\n\n//\n// Nodejs and AMD support: export the implementation as a module using\n// either convention.\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 [], // pool: entropy pool starts empty\n Math // math: package containing
random, pow, and seedrandom\n);\n","// A library of seedable RNGs implemented in Javascript.\n//\n// Usage:\n//\n// var seedrandom = require('seedrandom');\n// var random = seedrandom(1); // or any seed.\n// var x = random(); // 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 Baagøe.\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// xorshift7, by François Panneton and Pierre L'ecuyer, takes\n// a different approach: it adds robustness by allowing more

shifts\n// than Marsaglia's original three. It is a 7-shift generator\n// with 256 bits, that passes BigCrush with no systmatic failures.\n// Period 2^256-1.\n// No systematic BigCrush failures reported.\nvar xorshift7 = require('./lib/xorshift7');\n\n// xor4096, by Richard Brent, is a 4096-bit xor-shift with a\n// very long period that also adds a Weyl generator. It also passes\n// BigCrush with no systematic failures. Its long period may\n// be useful if you have many generators and need to avoid\n// collisions.\n// Period: 2^4128-2^32.\n// No systematic BigCrush failures reported.\nvar xor4096 = require('./lib/xor4096');\n\n// Tyche-i, by Samuel Neves and Filipe Araujo, is a bit-shifting random\n// number generator derived from ChaCha, a modern stream cipher.\n// https://eden.dei.uc.pt/~sneves/pubs/2011-snfa2.pdf\n// Period: ~2^127\n// No systematic BigCrush failures reported.\nvar tychei = require('./lib/tychei');\n\n// The original ARC4-based prng included in this library.\n// Period: ~2^1600\nvar sr = require('./seedrandom');\n\nsr.alea = alea;\nsr.xor128 = xor128;\nsr.xorwow = xorwow;\nsr.xorshift7 = xorshift7;\nsr.xor4096 = xor4096;\nsr.tychei = tychei;\n\nmodule.exports = sr;\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 * as seedrandom from 'seedrandom';\n\nimport {expectNumbersClose, testEpsilon} from '../test_util';\nimport {TypedArray} from '../types';\n\nexport interface RandomBase {\n nextValue(): number;\n}\n\nexport interface RandomGamma {\n nextValue(): number;\n}\n\nexport interface RandNormalDataTypes {\n float32: Float32Array;\n int32: Int32Array;\n}\n\nexport interface RandGammaDataTypes {\n float32: Float32Array;\n int32: Int32Array;\n}\n\n// https://en.wikipedia.org/wiki/Marsaglia_polar_method\nexport class MPRandGauss implements RandomBase {\n private mean: number;\n private stdDev: number;\n private nextVal: number;\n private dtype?: keyof RandNormalDataTypes;\n private truncated?: boolean;\n private upper?: number;\n private lower?: number;\n private random: seedrandom.prng;\n\n constructor(\n   mean: number, stdDeviation: number, dtype?: keyof RandNormalDataTypes,\n   truncated?: boolean, seed?: number) {\n   this.mean = mean;\n   this.stdDev = stdDeviation;\n   this.dtype = dtype;\n   this.nextVal = NaN;\n   this.truncated = truncated;\n   if (this.truncated) {\n   this.upper = this.mean + this.stdDev * 2;\n   this.lower = this.mean - this.stdDev * 2;\n   }\n   const seedValue = seed ? seed : Math.random();\n   this.random = seedrandom.alea(seedValue.toString());\n }\n\n /** Returns next sample from a Gaussian distribution. */\n public nextValue(): number {\n   if (!isNaN(this.nextVal)) {\n   const value = this.nextVal;\n   this.nextVal = NaN;\n   return value;\n   }\n\n   let resultX: number, resultY: number;\n   let isValid = false;\n   while (!isValid) {\n   let v1: number, v2: number, s: number;\n   do {\n   v1 = 2 * this.random() - 1;\n   v2 = 2 * this.random() - 1;\n   s = v1 * v1 + v2 * v2;\n   } while (s >= 1 || s === 0);\n\n   const mul = Math.sqrt(-2.0 * Math.log(s) / s);\n   resultX = this.mean + this.stdDev * v1 * mul;\n   resultY = this.mean + this.stdDev * v2 * mul;\n\n   if (!this.truncated || this.isValidTruncated(resultX)) {\n   isValid = true;\n   }\n   }\n\n   if (!this.truncated || this.isValidTruncated(resultY)) {\n   this.nextVal = this.convertValue(resultY);\n   }\n   return this.convertValue(resultX);\n }\n\n /** Handles proper rounding for non-floating-point numbers. */\n private convertValue(value: number): number {\n   if (this.dtype == null || this.dtype === 'float32') {\n   return value;\n   }\n   return Math.round(value);\n }\n\n /** Returns true if less than 2-standard-deviations from the mean. */\n private isValidTruncated(value: number): boolean {\n   return value <= this.upper && value >= this.lower;\n }\n}\n\n// Marsaglia, George, and Wai Wan Tsang. 2000. \"A Simple Method for Generating\n// Gamma Variables.\"\nexport class RandGamma implements RandomGamma {\n private alpha: number;\n private beta: number;\n private d: number;\n private c: number;\n private dtype?: keyof RandGammaDataTypes;\n private randu: seedrandom.prng;\n private randn:

```
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 =
dtype;\n\n    const seedValue = seed ? seed : Math.random();\n    this.randu =
seedrandom.alea(seedValue.toString());\n    this.randn = new MPRandGauss(0, 1, dtype, false, this.randu());\n\n    if
(alpha < 1) {\n      this.d = alpha + (2 / 3);\n    } else {\n      this.d = alpha - (1 / 3);\n    }\n    this.c = 1 / Math.sqrt(9 *
this.d);\n  }\n\n  /** Returns next sample from a gamma distribution. */\n  public nextValue(): number {\n    let x2:
number, v0: number, v1: number, x: number, u: number, v: number;\n    while (true) {\n      do {\n        x =
this.randn.nextValue();\n        v = 1 + (this.c * x);\n      } while (v <= 0);\n      v *= v * v;\n      x2 = x * x;\n      v0 =
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    }\n    v = (1 / this.beta) * this.d *
v;\n    if (this.alpha < 1) {\n      v *= Math.pow(this.randu(), 1 / this.alpha);\n    }\n    return this.convertValue(v);\n
}\n  /** Handles proper rounding for non-floating-point numbers. */\n  private convertValue(value: number):
number {\n    if (this.dtype === 'float32') {\n      return value;\n    }\n    return Math.round(value);\n  }\n}\n\nexport
class UniformRandom implements RandomBase {\n  private min: number;\n  private range: number;\n  private
random: seedrandom.prng;\n  private dtype?: keyof RandNormalDataTypes;\n\n  constructor(\n      min = 0, max =
1, dtype?: keyof RandNormalDataTypes,\n      seed?: string|number) {\n    this.min = min;\n    this.range = max -
min;\n    this.dtype = dtype;\n    if (seed == null) {\n      seed = Math.random();\n    }\n    if (typeof seed ===
'number') {\n      seed = seed.toString();\n    }\n\n    if (!this.canReturnFloat()
    && this.range <= 1) {\n      throw new Error(\n          `The difference between ${min} - ${max} <= 1 and dtype is
not float`);\n    }\n    this.random = seedrandom.alea(seed);\n  }\n\n  /** Handles proper rounding for non floating
point numbers. */\n  private canReturnFloat = () =>\n      (this.dtype == null || this.dtype === 'float32');\n\n  private
convertValue(value: number): number {\n    if (this.canReturnFloat()) {\n      return value;\n    }\n    return
Math.round(value);\n  }\n\n  nextValue() {\n    return this.convertValue(this.min + this.range * this.random());\n
}\n}\n\nexport function jarqueBeraNormalityTest(values: TypedArray|number[]) {\n  //
https://en.wikipedia.org/wiki/Jarque%E2%80%93Bera_test\n  const n = values.length;\n  const s =
skewness(values);\n  const k = kurtosis(values);\n  const jb = n / 6 * (Math.pow(s, 2) + 0.25 * Math.pow(k - 3, 2));\n
// JB test requires 2-degress of freedom from Chi-Square @ 0.95:\n  //
http://www.itl.nist.gov/div898/handbook/eda/section3/eda3674.htm\n
  const CHI_SQUARE_2DEG = 5.991;\n  if (jb > CHI_SQUARE_2DEG) {\n    throw new Error(`Invalid p-value
for JB: ${jb}`);\n  }\n}\n\nexport function expectArrayInMeanStdRange(\n    actual: TypedArray|number[],
expectedMean: number, expectedStdDev: number,\n    epsilon?: number) {\n  if (epsilon == null) {\n    epsilon =
testEpsilon();\n  }\n  const actualMean = mean(actual);\n  expectNumbersClose(actualMean, expectedMean,
epsilon);\n  expectNumbersClose(\n      standardDeviation(actual, actualMean), expectedStdDev,
epsilon);\n}\n\nfunction mean(values: TypedArray|number[]) {\n  let sum = 0;\n  for (let i = 0; i < values.length;
i++) {\n    sum += values[i];\n  }\n  return sum / values.length;\n}\n\nfunction standardDeviation(values:
TypedArray|number[], mean: number) {\n  let squareDiffSum = 0;\n  for (let i = 0; i < values.length; i++) {\n    const
diff = values[i] - mean;\n    squareDiffSum += diff * diff;\n  }\n  return Math.sqrt(squareDiffSum
 / values.length);\n}\n\nfunction kurtosis(values: TypedArray|number[]) {\n  //
https://en.wikipedia.org/wiki/Kurtosis\n  const valuesMean = mean(values);\n  const n = values.length;\n  let sum2 =
0;\n  let sum4 = 0;\n  for (let i = 0; i < n; i++) {\n    const v = values[i] - valuesMean;\n    sum2 += Math.pow(v,
2);\n    sum4 += Math.pow(v, 4);\n  }\n  return (1 / n) * sum4 / Math.pow((1 / n) * sum2, 2);\n}\n\nfunction
skewness(values: TypedArray|number[]) {\n  // https://en.wikipedia.org/wiki/Skewness\n  const valuesMean =
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 =
values[i] - valuesMean;\n    sum2 += Math.pow(v, 2);\n    sum3 += Math.pow(v, 3);\n  }\n  return (1 / n) * sum3 /
Math.pow((1 / (n - 1)) * sum2, 3 / 2);\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
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with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {Tensor} from '../tensor';\nimport {Rank, ShapeMap} from '../types';\n\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 *\n * ```js\n * tf.randomGamma([2, 2], 1).print();\n * ```\n *\n * @param shape An array of integers defining the output tensor shape.\n * @param alpha The shape parameter of the gamma distribution.\n
* @param beta The inverse scale parameter of the gamma distribution. Defaults\n * to 1.\n * @param dtype The data type of the output. Defaults to float32.\n * @param seed The seed for the random number generator.\n *\n * @doc {heading: 'Tensors', subheading: 'Random'}\n */\nfunction randomGamma_<R extends Rank>(\n shape: ShapeMap[R], alpha: number, beta = 1,\n dtype: 'float32'|'int32' = 'float32', 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 * @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 {Tensor} from '../tensor';\nimport {DataType, Rank, ShapeMap} from '../types';\n\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 *\n * ```js\n * tf.randomNormal([2, 2]).print();\n * ```\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.\n * @param seed The seed for the random number generator.\n *\n * @doc {heading: 'Tensors', subheading: 'Random'}\n */\nfunction randomNormal_<R extends Rank>(\n shape: ShapeMap[R], mean = 0, stdDev = 1, dtype?: 'float32'|'int32',\n seed?: number): Tensor<R> {\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, 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 * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n
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*/\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 *\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\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.sv\n *\n *\n * ```js\n * tf.range(0, 9, 2).print();\n * ```\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\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 *\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

NamedTensorMap);\n}\n\nexport const real = op({real_});\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 {Reciprocal, ReciprocalInputs} 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 x element-wise: `1 / x`\n *\n * ```js\n * const x = tf.tensor1d([0, 1, 2]);\n *\n * x.reciprocal().print(); // or tf.reciprocal(x)\n * ```\n * @param x The input tensor.\n *\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n */\nfunction reciprocal_<T extends Tensor>(x: T|TensorLike): T {\n const $x
 = convertToTensor(x, 'x', 'reciprocal');\n\n const inputs: ReciprocalInputs = {x: $x};\n return
ENGINE.runKernel(Reciprocal, inputs as {} as NamedTensorMap);\n}\nexport const reciprocal = op({reciprocal_});\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 {Relu, ReluInputs} 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 rectified linear element-wise: `max(x, 0)`.\n *\n * ```js\n * const x = tf.tensor1d([-1, 2, -3, 4]);\n *\n * x.relu().print(); // or tf.relu(x)\n * ```\n * @param x The input tensor. If the dtype is `bool`, the output dtype will be\n *   `int32'.\n *\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n */\nfunction relu_<T extends Tensor>(x: T|TensorLike): T {\n const $x = convertToTensor(x, 'x', 'relu');\n\n const inputs: ReluInputs = {x: $x};\n\n return ENGINE.runKernel(Relu, inputs as {} as NamedTensorMap);\n}\n\nexport const relu = op({relu_});\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
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*/\n\nimport {ENGINE} from '../engine';\nimport {Relu6, Relu6Inputs} 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 rectified linear 6 element-wise: `min(max(x, 0), 6)`.\n *\n * ```js\n * const x = tf.tensor1d([-1, 2, -3, 8]);\n *\n * x.relu6().print();
  // or tf.relu6(x)\n * ```\n * @param x The input tensor. If the dtype is `bool`, the output dtype will be\n *
`int32'.\n *\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n */\nfunction relu6_<T extends Tensor>(x:

T|TensorLike): T {\n const $x = convertToTensor(x, 'x', 'relu6');\n\n const inputs: Relu6Inputs = {x: $x};\n\n return ENGINE.runKernel(Relu6, inputs as {} as NamedTensorMap);\n}\n\nexport const relu6 = op({relu6_});\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 {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\n * 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\n * same signature as this method.\n *\n * ```js\n * const x = tf.tensor1d([1, 2, 3, 4]);\n *\n * x.reverse().print();\n
 * ```\n *\n * ```js\n * const x = tf.tensor2d([1, 2, 3, 4], [2, 2]);\n *\n * const axis = 1;\n * x.reverse(axis).print();\n * ```\n * @param x The input tensor to be reversed.\n * @param axis The set of dimensions to reverse. Must be in the\n *   range [-rank(x), rank(x)). Defaults to all axes.\n *\n * @doc {heading: 'Tensors', subheading: 'Slicing and Joining'}\n */\nfunction reverse_<T extends Tensor>(\n   x: T|TensorLike, axis?: number|number[]): T {\n const $x = convertToTensor(x, 'x', 'reverse');\n\n const inputs: ReverseInputs = {x: $x};\n const attrs: ReverseAttrs = {dims: axis};\n\n return ENGINE.runKernel(\n   Reverse, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);\n}\n\nexport const reverse = op({reverse_});\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
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*/\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');\n util.assert(\n $x.rank === 1,\n   () => `Error in reverse1D: x must be rank 1 but got rank
 ${$x.rank}.`);\n return reverse($x, 0);\n}\n\nexport const reverse1d = op({reverse1d_});\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} 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[]): Tensor2D {\n const $x = convertToTensor(x, 'x', 'reverse');\n util.assert(\n $x.rank === 2,\n () => `Error in reverse2D: x must be rank 2 but got rank ${$x.rank}.`);\n return reverse($x, axis);\n}\n\nexport const reverse2d = op({reverse2d_});\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
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==========\n */\n\nimport {Tensor3D} 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.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 = convertToTensor(x, 'x', 'reverse');\n util.assert(\n $x.rank === 3,\n () => `Error in reverse3D: x must be rank 3 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 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {Tensor4D} 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.Tensor4D` 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 reverse4d_(x: Tensor4D|TensorLike, axis?: number|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 const 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 compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n
* distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {Round, RoundInputs} 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 round of input `tf.Tensor` element-wise: `round(x)`.\n * It implements banker's rounding.\n *\n * ```js\n * const x = tf.tensor1d([.6, 1.1, -3.3]);\n *\n * x.round().print(); // or tf.round(x)\n * ```\n * @param x The input tensor.\n *\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {Rsqrt, RsqrtInputs} 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.rsqrt().print(); // or tf.rsqrt(x)\n * ```\n * @param x The input tensor.\n *\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n */\nfunction rsqrt_<T extends Tensor>(x: T|TensorLike): T {\n const $x = convertToTensor(x, 'x', 'rsqrt');\n\n const inputs: RsqrtInputs = {x: $x};\n\n return ENGINE.runKernel(Rsqrt, inputs as {} as NamedTensorMap);\n}\nexport const rsqrt = op({rsqrt_});\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 {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 * @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 '(number|boolean|string)');\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 `Uint8Array`.');\n }\n const shape: number[] = [];\n const inferredShape: number[] = [];\n return makeTensor(value, shape, inferredShape, dtype) as Scalar;\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 {ENGINE} from '../engine';\nimport {Selu, SeluInputs} 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 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 */\nfunction 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\nexport 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 */\nimport {Tensor3D, Tensor4D} from '../tensor';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from '../types';\nimport * as util from '../util';\n\nimport {conv2d} from './conv2d';\nimport {depthwiseConv2d} from './depthwise_conv2d';\nimport {op} from './operation';\nimport {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 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 *\n * @doc {heading: 'Operations', subheading: 'Convolution'}\n */\nfunction 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   dataFormat: '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,

```
$x.shape[0], $x.shape[1], $x.shape[2]]);\n  }\n\n  if (dataFormat === 'NCHW') {\n    throw new Error(\n 'separableConv2d currently does not support dataFormat NCHW; only ' +\n        'NHWC is supported');\n  }\n\n util.assert(\n      x4D.rank === 4,\n      () => `Error in separableConv2d: input must be rank 4, but got ` +\n `rank ${x4D.rank}.`);\n  util.assert(\n      $depthwiseFilter.rank === 4,\n      () => `Error in separableConv2d: depthwise
 filter must be rank 4, but ` +\n          `got rank ${$depthwiseFilter.rank}.`);\n  util.assert(\n      $pointwiseFilter.rank === 4,\n      () => `Error in separableConv2d: pointwise filter must be rank 4, but ` +\n          `got rank ${$depthwiseFilter.rank}.`);\n  util.assert(\n      $pointwiseFilter.shape[0] === 1,\n      () =>\n          `Error in separableConv2d: the first dimension of pointwise filter ` +\n          ` must be 1, but got ${$pointwiseFilter.shape[0]}.`);\n  util.assert(\n      $pointwiseFilter.shape[1] === 1,\n      () => `Error in separableConv2d: the second dimension of pointwise ` +\n          `filter must be 1, but got ${$pointwiseFilter.shape[1]}.`);\n\n  const inChannels = $depthwiseFilter.shape[2];\n  const channelMultiplier = $depthwiseFilter.shape[3];\n  util.assert(\n      $pointwiseFilter.shape[2] === inChannels * channelMultiplier,\n      () =>\n          `Error in separableConv2d: the third dimension of pointwise filter ` +\n          `must be
 ${inChannels * channelMultiplier}, ` +\n          `but got ${$pointwiseFilter.shape[2]}.`);\n\n  const depthwise = depthwiseConv2d(\n      x4D, $depthwiseFilter, strides, pad, dataFormat, dilation);\n  const pointwiseStride = 1;\n const res =\n      conv2d(depthwise, $pointwiseFilter, pointwiseStride, 'valid', dataFormat);\n\n  if (reshapedTo4D) {\n    return reshape(res, [res.shape[1], res.shape[2], res.shape[3]]) as T;\n  }\n  return res as T;\n}\n\nexport const separableConv2d = op({separableConv2d_});\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 {Tensor, TensorBuffer} from '../tensor';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from '../types';\nimport * as util from '../util';\n\n/**\n * Computes the difference between two lists of numbers.\n *\n * Given a Tensor `x` and a Tensor `y`, this operation returns a Tensor `out`\n * that represents all values that are in `x` but not in `y`. The returned\n * Tensor `out` is sorted in the same order that the numbers appear in `x`\n * (duplicates are preserved). This operation also returns a Tensor indices that\n * represents the position of each out element in `x`. In other words:\n *\n * `out[i] = x[idx[i]] for i in [0, 1, ..., out.length - 1]`\n *\n * ```js\n * const x = [1, 2, 3, 4, 5, 6];\n * const y = [1, 3,
 5];\n *\n * const [out, indices] = await tf.setdiff1dAsync(x, y);\n * out.print(); // [2, 4, 6]\n * indices.print(); // [1, 3, 5]\n * ```\n *\n * @param x 1-D Tensor. Values to keep.\n * @param y 1-D Tensor. Must have the same type as x. Values to exclude in the\n *      output.\n * @returns Promise of Tensor tuple [out, indices].\n *  out: Tensor with the same type as x.\n *  indices: A Tensor of type int32.\n *\n * @doc {heading: 'Tensors', subheading: 'Transformations'}\n */\nasync function setdiff1dAsync_(\n    x: Tensor|TensorLike, y: Tensor|TensorLike): Promise<[Tensor, Tensor]> {\n  const $x = convertToTensor(x, 'x', 'setdiff1d');\n  const $y = convertToTensor(y, 'y', 'setdiff1d');\n\n  util.assert(\n      $x.dtype === $y.dtype,\n      () => `x and y should have the same dtype, but got x (${$x.dtype}) and y (${$y.dtype}).`);\n\n  util.assert(\n      $x.rank === 1, () => `x should be 1D tensor, but got x (${$x.shape}).`);\n\n  util.assert(\n      $y.rank === 1, () =>
 `y should be 1D tensor, but got y (${$y.shape}).`);\n\n  const xVals = await $x.data();\n  const yVals = await $y.data();\n  const ySet = new Set(yVals);\n\n  let outputSize = 0;\n  for (let i = 0; i < xVals.length; i++) {\n    if (!ySet.has(xVals[i])) {\n      outputSize++;\n    }\n  }\n\n  const buffer = new TensorBuffer([outputSize], $x.dtype);\n  const indices = new TensorBuffer([outputSize], 'int32');\n  for (let i = 0, p = 0; i < xVals.length; i++) {\n    if (!ySet.has(xVals[i])) {\n      buffer.values[p] = xVals[i];\n      indices.values[p] = i;\n      p++;\n    }\n  }\n
```

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}\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\n const inputs: SinInputs = {x: $x};\n\n return ENGINE.runKernel(Sin, inputs as {} as NamedTensorMap);\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}\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 `slice` 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}\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 `slice` for details.\n */\nfunction slice2d_(\n   x: Tensor2D|TensorLike, begin: [number, number],\n   size: [number, number]):
 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}\nexport const slice2d = op({slice2d_});\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
 {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 `slice` 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}\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

the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {Tensor4D} 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 4D slice from a 4D array starting at coordinates `begin` and\n * is of size `size`. See `slice` for details.\n */\nfunction 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}\nexport const slice4d = op({slice4d_});\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 {Softmax, SoftmaxAttrs, SoftmaxInputs} 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 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 */\nfunction 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\nexport const softmax = op({softmax_});\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 {FFT, FFTInputs} from '../../kernel_names';\nimport {Tensor} from '../../tensor';\nimport {NamedTensorMap} from '../../tensor_types';\nimport {assert} from '../../util';\nimport {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

* ```\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 * @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 {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 * ```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.ifft().print(); // tf.spectral.ifft(x).print();\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 * @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 {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 * ```js\n * const real = tf.tensor1d([1, 2, 3]);\n * const imag = tf.tensor1d([0, 0, 0]);\n * const x = tf.complex(real, imag);\n *\n * x.irfft().print();\n * ```\n * @param input The real value input to compute an irfft over.\n *\n * @doc {heading: 'Operations', subheading: 'Spectral', namespace: 'spectral'}\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],

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, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {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`\n * into `numOrSizeSplits` smaller tensors.\n * Requires that `numOrSizeSplits` evenly divides `x.shape[axis]`.\n *\n * If `numOrSizeSplits` is a number array, splits `x` into\n * `numOrSizeSplits.length` pieces. The shape of the `i`-th piece has the\n * same size as `x` except along dimension `axis` where the size is\n * `numOrSizeSplits[i]`.\n *\n * ```js\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 * @param numOrSizeSplits Either an integer indicating the number of\n * splits along the axis or an array of integers containing the sizes of\n * each output tensor along the axis. If a number then it must evenly divide\n * `x.shape[axis]`; otherwise the sum of sizes must match `x.shape[axis]`.\n * Can contain one -1 indicating that dimension is to be inferred.\n * @param axis The dimension along which to split. Defaults to 0 (the first\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 License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {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 * inner-most dimension of the real input.\n *\n * ```js\n * const real = tf.tensor1d([1, 2, 3]);\n *\n * real.rfft().print();\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 =

input.shape[input.shape.length - 1];\n const batch = input.size / innerDimensionSize;\n\n
  let adjustedInput: Tensor;\n if (fftLength != null && fftLength < innerDimensionSize) {\n   // Need to crop\n
const begin = input.shape.map(v => 0);\n   const size = input.shape.map(v => v);\n   size[input.shape.length - 1] =
fftLength;\n   adjustedInput = slice(input, begin, size);\n   innerDimensionSize = fftLength;\n } else if (fftLength
!= null && fftLength > innerDimensionSize) {\n   // Need to pad with zeros\n   const zerosShape =
input.shape.map(v => v);\n   zerosShape[input.shape.length - 1] = fftLength - innerDimensionSize;\n
adjustedInput = concat([input, zeros(zerosShape)], input.shape.length - 1);\n   innerDimensionSize = fftLength;\n }
else {\n   adjustedInput = input;\n }\n\n // Complement the input with zero imaginary numbers.\n const zerosInput
= zerosLike(adjustedInput);\n const complexInput =\n   reshape(complex(adjustedInput, zerosInput), [batch,
innerDimensionSize]);\n\n const ret = fft(complexInput);\n\n // Exclude complex conjugations.
  These conjugations are put symmetrically.\n const half = Math.floor(innerDimensionSize / 2) + 1;\n const
realValues = real(ret);\n const imagValues = imag(ret);\n const realComplexConjugate = split(\n   realValues,
[half, innerDimensionSize - half],\n   realValues.shape.length - 1);\n const imagComplexConjugate = split(\n
imagValues, [half, innerDimensionSize - half],\n   imagValues.shape.length - 1);\n\n const outputShape =
adjustedInput.shape.slice();\n outputShape[adjustedInput.shape.length - 1] = half;\n\n return reshape(\n
complex(realComplexConjugate[0], imagComplexConjugate[0]), outputShape);\n}\n\nexport const rfft =
op({rfft_});\n","/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the
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==\n
*/\n\nimport {ENGINE} from '../engine';\nimport {Sqrt, SqrtInputs} 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
square root of the input `tf.Tensor` element-wise: `y = sqrt(x)`\n *\n * ```js\n * const x = tf.tensor1d([1, 2, 4, -1]);\n
*\n * x.sqrt().print(); // or tf.sqrt(x)\n * ```\n * @param x The input tensor.\n *\n * @doc {heading: 'Operations',
subheading: 'Basic math'}\n */\nfunction
  sqrt_<T extends Tensor>(x: T|TensorLike): T {\n const $x = convertToTensor(x, 'x', 'sqrt');\n\n const inputs:
SqrtInputs = {x: $x};\n\n return ENGINE.runKernel(Sqrt, inputs as {} as NamedTensorMap);\n}\nexport const sqrt
= op({sqrt_});\n","/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
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License.\n *
==\n
*/\n\nimport {ENGINE} from '../engine';\nimport
  {SquaredDifference, SquaredDifferenceInputs} 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 (a - b) *
(a - b) element-wise.\n * Supports broadcasting.\n *\n * ```js\n * const a = tf.tensor1d([1, 4, 3, 16]);\n * const b =
tf.tensor1d([1, 2, 9, 4]);\n *\n * a.squaredDifference(b).print(); // or tf.squaredDifference(a, b)\n * ```\n *\n * ```js\n
* // Broadcast squared difference a with b.\n * const a = tf.tensor1d([2, 4, 6, 8]);\n * const b = tf.scalar(5);\n *\n *

a.squaredDifference(b).print(); // or tf.squaredDifference(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 squaredDifference_<T extends Tensor>(\n   a: Tensor|TensorLike, b: Tensor|TensorLike): T {\n let $a = convertToTensor(a, 'a', 'squaredDifference');\n let $b = convertToTensor(b, 'b', 'squaredDifference');\n [$a, $b] = makeTypesMatch($a, $b);\n\n assertAndGetBroadcastShape($a.shape, $b.shape);\n\n const inputs: SquaredDifferenceInputs = {a: $a, b: $b};\n const attrs = {};\n\n return ENGINE.runKernel(\n   SquaredDifference, inputs as unknown as NamedTensorMap, attrs);\n}\n\nexport const squaredDifference = op({squaredDifference_});\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 {Tensor} from '../tensor';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from '../types';\nimport {squeezeShape} from '../util';\n\nimport {op} from './operation';\nimport {reshape} from './reshape';\n\n/**\n * Removes dimensions of size 1 from the shape of a `tf.Tensor`.\n *\n * ```js\n * const x = tf.tensor([1, 2, 3, 4], [1, 1, 4]);\n * x.squeeze().print();\n * ```\n *\n * @param x The input tensor to be squeezed.\n * @param axis An optional list of numbers. If specified, only\n *   squeezes the dimensions listed. The dimension index starts at 0. It\n * is an error to squeeze a dimension that is not 1.\n *\n * @doc {heading: 'Tensors', subheading: 'Transformations'}\n */\nfunction squeeze_<T extends Tensor>(x: Tensor|TensorLike, axis?: number[]): T {\n const $x = convertToTensor(x, 'x', 'squeeze');\n return reshape($x, squeezeShape($x.shape, axis).newShape) as T;\n}\n\nexport const squeeze = op({squeeze_});\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 {ENGINE} from '../engine';\nimport {Pack, PackAttrs, PackInputs} from '../kernel_names';\nimport {NamedAttrMap} from '../kernel_registry';\nimport {Tensor} from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {convertToTensorArray} from '../tensor_util_env';\nimport {TensorLike} from '../types';\nimport * as util from '../util';\n\nimport {op} from './operation';\n\n/**\n * Stacks a list of rank-`R` `tf.Tensor`s into one rank-`(R+1)` `tf.Tensor`.\n *\n * ```js\n * const a = tf.tensor1d([1, 2]);\n * const b = tf.tensor1d([3, 4]);\n * const c = tf.tensor1d([5, 6]);\n * tf.stack([a, b, c]).print();\n * ```\n *\n * @param tensors A list of tensor objects with the same shape and dtype.\n * @param axis The axis to stack along. Defaults to 0 (the first dim).\n *\n * @doc {heading: 'Tensors', subheading: 'Slicing and Joining'}\n */\nfunction stack_<T extends Tensor>(\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 <= $tensors[0].rank,\n   () => 'Axis must be <= rank of the tensor');\n }\n\n const inputs: PackInputs = $tensors;\n const attrs: PackAttrs = {axis};\n\n return ENGINE.runKernel(\n   Pack, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);\n}\n\nexport const stack = op({stack_});\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 {Step, StepAttrs, StepInputs} 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 step of the input `tf.Tensor` element-wise: `x > 0 ? 1 : alpha * x`\n *\n * ```js\n * const x = tf.tensor1d([0, 2, -1, -3]);\n *\n * x.step(.5).print(); // or tf.step(x, .5)\n * ```\n * @param x The input tensor.\n * @param alpha The gradient when input is negative.\n *\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n */\nfunction step_<T extends Tensor>(x: T|TensorLike, alpha = 0.0): T {\n const $x = convertToTensor(x, 'x', 'step');\n\n const inputs: StepInputs = {x: $x};\n const attrs: StepAttrs = {alpha};\n\n return ENGINE.runKernel(\n   Step, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);\n}\nexport const step = op({step_});\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 {StridedSlice, StridedSliceAttrs, StridedSliceInputs} 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 * Extracts a strided slice of a tensor.\n *\n * Roughly speaking, this op extracts a slice of size (end-begin)/stride from\n * the given input tensor (x). Starting at the location specified by begin the\n * slice continues by adding stride to the index until all dimensions are not\n * less than end. Note that a stride can be negative, which causes a reverse\n * slice.\n *\n * ```js\n * const t = tf.tensor3d([1, 1, 1 ,2, 2, 2, 3, 3, 3, 4, 4, 4, 5, 5, 5, 6, 6, 6],\n *   [3, 2, 3]);\n * t.stridedSlice([1, 0, 0], [2, 1, 3], [1, 1, 1]).print() // [[[3, 3, 3]]]\n * t.stridedSlice([1, 0, 0], [2, 2, 3], [1, 1, 1]).print() // [[[3, 3, 3],\n *   // [4, 4, 4]]]\n * t.stridedSlice([1, -1, 0], [2, -3, 3], [1, -1, 1]).print() // [[[4, 4, 4],\n *   // [3, 3, 3]]]\n * ```\n *\n * @param x The tensor to stride slice.\n * @param begin The coordinates to start the slice from.\n * @param end: The coordinates to end the slice at.\n * @param strides: The size of the slice.\n * @param beginMask: If the ith bit of beginMask is set, begin[i] is ignored\n *   and the fullest possible range in that dimension is used instead.\n * @param endMask: If the ith bit of endMask is set, end[i] is ignored\n *   and the fullest possible range in that dimension is used instead.\n * @param shrinkAxisMask: a bitmask where bit i implies that\n * the ith specification should shrink the dimensionality. begin and end must\n * imply a slice of size 1 in the dimension.\n *\n * @doc {heading: 'Operations', subheading: 'Slicing and Joining'}\n */\nfunction stridedSlice_(\n   x: Tensor|TensorLike, begin: number[], end: number[], strides?: number[],\n   beginMask = 0, endMask = 0, ellipsisMask = 0, newAxisMask = 0,\n   shrinkAxisMask = 0): Tensor {\n const $x = convertToTensor(x, 'x', 'stridedSlice');\n\n const inputs: StridedSliceInputs = {x: $x};\n const attrs: StridedSliceAttrs = {\n   begin,\n   end,\n   strides,\n   beginMask,\n   endMask,\n   ellipsisMask,\n   newAxisMask,\n   shrinkAxisMask\n };\n\n return ENGINE.runKernel(\n   StridedSlice, inputs as {} as NamedTensorMap,\n   attrs as {} as NamedAttrMap);\n}\n\nexport const stridedSlice = op({stridedSlice_});\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 {ENGINE} from '../engine';\nimport {Tan, TanInputs} 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 tan of the input `tf.Tensor` element-wise, `tan(x)`\n *\n * ```js\n * const x = tf.tensor1d([0, Math.PI / 2, Math.PI * 3 / 4]);\n *\n * x.tan().print(); // or tf.tan(x)\n * ```\n * @param x The input tensor.\n *\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n */\nfunction tan_<T extends Tensor>(x: T|TensorLike): T {\n const $x = convertToTensor(x, 'x', 'tan');\n\n const inputs: TanInputs = {x: $x};\n\n return ENGINE.runKernel(Tan, inputs as {} as NamedTensorMap);\n}\nexport const tan = op({tan_});\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 {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 *\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 *\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 License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {inferShape} from '../tensor_util_env';\nimport {TensorLike2D} from '../types';\nimport {DataType} from '../types';\nimport {assertNonNull} from '../util';\nimport {makeTensor} from './tensor_ops_util';\n\n/**\n * Creates rank-2 `tf.Tensor` with the provided values, shape and dtype.\n *\n * The same functionality can be achieved with `tf.tensor`, but in general\n * we recommend using `tf.tensor2d` as it makes the code more readable.\n *\n * ```js\n * // Pass a nested array.\n * tf.tensor2d([[1, 2], [3, 4]]).print();\n * ```\n * ```js\n * // Pass a flat array and specify a shape.\n * tf.tensor2d([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`.\n * @param shape The shape of the tensor. If not provided, it is inferred from\n *   `values`.\n * @param dtype The data type.\n *\n * @doc {heading: 'Tensors', subheading: 'Creation'}\n */\nexport function tensor2d(\n   values: TensorLike2D, shape?: [number, number],\n   dtype?: DataType): Tensor2D {\n assertNonNull(values);\n if (shape
 != null && shape.length !== 2) {\n   throw new Error('tensor2d() requires shape to have two numbers');\n }\n const inferredShape = inferShape(values, dtype);\n if (inferredShape.length !== 2 && inferredShape.length !== 1) {\n   throw new Error(\n   'tensor2d() requires values to be number[][] or flat/TypedArray');\n }\n if (inferredShape.length === 1 && shape == null) {\n   throw new Error(\n   'tensor2d() requires shape to be provided when `values` ' +\n   'are a flat/TypedArray');\n }\n return makeTensor(values, shape, inferredShape, dtype) as Tensor2D;\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 {Tensor4D} from '../tensor';\nimport {inferShape} from '../tensor_util_env';\nimport {TensorLike4D} from '../types';\nimport {DataType} from '../types';\nimport {assertNonNull} from '../util';\nimport {makeTensor} from './tensor_ops_util';\n\n/**\n * Creates rank-4 `tf.Tensor` with the provided values, shape and dtype.\n *\n * The same functionality can be achieved with `tf.tensor`, but in general\n * we recommend using `tf.tensor4d` as it makes the code more readable.\n *\n * ```js\n * // Pass a nested array.\n * tf.tensor4d([[[[1], [2]], [[3], [4]]]]).print();\n * ```\n * ```js\n * // Pass a flat array and specify a shape.\n * tf.tensor4d([1, 2, 3, 4], [1, 2, 2,
 1]).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`.\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 */\nexport function tensor4d(\n   values: TensorLike4D, shape?: [number, number, number, number],\n   dtype?: DataType): Tensor4D {\n assertNonNull(values);\n if (shape != null && shape.length !== 4) {\n   throw new Error('tensor4d() requires shape to have four numbers');\n }\n const inferredShape = inferShape(values, dtype);\n if (inferredShape.length !== 4 && inferredShape.length !== 1) {\n   throw new Error(\n   'tensor4d() requires values to be number[][][][] or flat/TypedArray');\n }\n if (inferredShape.length === 1 && shape == null) {\n   throw new Error(\n   'tensor4d() requires shape to be provided when `values` ' +\n
        'are a flat array');\n }\n return makeTensor(values, shape, inferredShape, dtype) as Tensor4D;\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 {Tensor5D} from '../tensor';\nimport {inferShape} from '../tensor_util_env';\nimport {TensorLike5D} from '../types';\nimport {DataType} from '../types';\nimport
 {assertNonNull} from '../util';\nimport {makeTensor} from './tensor_ops_util';\n\n/**\n * Creates rank-5 `tf.Tensor` with the provided values, shape and dtype.\n *\n * The same functionality can be achieved with `tf.tensor`, but in general\n * we recommend using `tf.tensor5d` as it makes the code more readable.\n *\n * ```js\n * // Pass a nested array.\n * tf.tensor5d([[[[[1],[2]],[[3],[4]]],[[[5],[6]],[[7],[8]]]]]).print();\n * ```\n * ```js\n * // Pass a flat array and specify a shape.\n * tf.tensor5d([1, 2, 3, 4, 5, 6, 7, 8], [1, 2, 2, 2, 1]).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`.\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 */\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 * 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 {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 *\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 *\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 *\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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

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\n const inputs: TopKInputs = {x: $x};\n const attrs: TopKAttrs = {k, sorted};\n\n const [values, indices] = ENGINE.runKernel(\n TopK, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);\n\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';\n\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 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 License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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, 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, 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\n const inputs: UniqueInputs = {x: $x};\n const attrs: UniqueAttrs = {axis};\n const [values, indices] = ENGINE.runKernel(\n   Unique, inputs as {} as NamedTensorMap,\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 Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 * @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\n const inputs: UnsortedSegmentSumInputs = {x: $x, segmentIds: $segmentIds};\n const attrs: UnsortedSegmentSumAttrs = {numSegments};\n\n return ENGINE.runKernel(\n   UnsortedSegmentSum, inputs as {} as NamedTensorMap,\n   attrs as {} as NamedAttrMap);\n}\n\nexport const unsortedSegmentSum = op({unsortedSegmentSum_});\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\nimport {ENGINE} from '../engine';\nimport {Unpack, UnpackAttrs, UnpackInputs} 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 * Unstacks a `tf.Tensor` of rank-`R` into a list of rank-`(R-1)` `tf.Tensor`s.\n *\n * ```js\n * const a = tf.tensor2d([1, 2, 3, 4], [2, 2]);\n *\n * tf.unstack(a).forEach(tensor => tensor.print());\n * ```\n *\n * @param x A tensor object.\n * @param axis The axis to unstack along. Defaults to 0 (the first dim).\n *\n * @doc {heading: 'Tensors', subheading: 'Slicing and Joining'}\n */\nfunction unstack_(x: Tensor|TensorLike, axis = 0): Tensor[] {\n const $x = convertToTensor(x, 'x', 'unstack', 'string_or_numeric');\n util.assert(\n   axis >= -$x.shape.length && axis < $x.shape.length,\n   () =>\n   `Axis = ${axis} is not in [-${$x.shape.length}, ${$x.shape.length})`);\n\n const inputs: UnpackInputs = {value: $x};\n const attrs: UnpackAttrs = {axis};\n\n return ENGINE.runKernel(\n   Unpack, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);\n}\n\nexport const unstack = op({unstack_});\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
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==========\n
*/\n\nimport {ENGINE} from '../engine';\nimport {Tensor, Variable} from '../tensor';\nimport {DataType, Rank} from '../types';\n\n/**\n * Creates a new variable with the provided initial value.\n * ```js\n * const x = tf.variable(tf.tensor([1, 2, 3]));\n * x.assign(tf.tensor([4, 5, 6]));\n *\n * x.print();\n * ```\n *\n * @param initialValue Initial value for the tensor.\n * @param trainable If true, optimizers are allowed to update it.\n * @param name Name of the variable. Defaults to a unique id.\n * @param dtype If set, initialValue will be converted to the given type.\n *\n * @doc {heading: 'Tensors', subheading: 'Creation'}\n */\nexport function variable<R extends Rank>(\n   initialValue: Tensor<R>, trainable = true, name?: string,\n   dtype?: DataType): Variable<R> {\n return ENGINE.makeVariable(initialValue,
 trainable, name, dtype) as\n   Variable<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 *
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==========\n
*/\n\n/** An implementation of the Where kernel shared between cpu and webgl */\n\nimport {buffer} from '../ops/buffer';\nimport {Tensor2D} from '../tensor';\nimport {TypedArray} from '../types';\n\nexport function
 whereImpl(condShape: number[], condVals: TypedArray): Tensor2D {\n const indices = [];\n for (let i = 0; i < condVals.length; i++) {\n   if (condVals[i]) {\n   indices.push(i);\n   }\n }\n\n const inBuffer = buffer(condShape, 'int32');\n\n const out = buffer([indices.length, condShape.length], 'int32');\n for (let i = 0; i < indices.length; i++) {\n   const loc = inBuffer.indexToLoc(indices[i]);\n   const offset = i * condShape.length;\n   out.values.set(loc, offset);\n }\n return out.toTensor() as Tensor2D;\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 {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 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 */\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 * @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} 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 */\nasync function booleanMaskAsync_(\n tensor: Tensor|TensorLike, mask: Tensor|TensorLike,\n axis?: number): Promise<Tensor> {\n const $tensor = convertToTensor(tensor, 'tensor', 'boolMask');\n const $mask = convertToTensor(mask, 'mask', 'boolMask', 'bool');\n\n const axisFrom = axis == null ? 0 : axis;\n const maskDim = $mask.rank;\n const tensorShape = $tensor.shape;\n\n util.assert(maskDim > 0, () => 'mask cannot be scalar');\n util.assertShapesMatch(\n tensorShape.slice(axisFrom, axisFrom + maskDim), $mask.shape,\n `mask's shape must match the first K dimensions of tensor's shape,`);\n\n let leadingSize = 1;\n for (let i = axisFrom; i < axisFrom + maskDim; i++)
{\n leadingSize *= tensorShape[i];\n }\n const targetTensorShape =\n tensorShape.slice(0, axisFrom)\n .concat([leadingSize], tensorShape.slice(axisFrom + maskDim));\n const reshapedTensor = reshape($tensor, targetTensorShape);\n const reshapedMask = reshape($mask, [-1]);\n const positivePositions = await whereAsync(reshapedMask);\n const indices = squeeze(positivePositions, [1]);\n\n const res = gather(reshapedTensor, indices, axisFrom);\n\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 Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n
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 './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 * ```js\n * const x = tf.tensor1d([1, 2, 3, 4]);\n *\n * x.norm().print(); // or tf.norm(x)\n * ```\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)) |max(abs(x))\n * |-Infinity |min(sum(abs(x), axis=1)) |min(abs(x))\n * |1 |max(sum(abs(x), axis=0)) |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 * @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\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\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\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\n   throw new Error(`Error in norm: invalid ord value: ${p}`);\n }\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\n   throw new Error(`Error in norm: invalid ord value: ${p}`);\n }\n\n throw new Error(`Error in norm: invalid axis: ${axis}`);\n}\n\nexport const norm = op({norm_});\n","/**\n * @license\n * Copyright 2018

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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 {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`\n * where\n * `delta = (1 -
decay) * (x - v)`\n *\n * With zeroDebias (default), the `delta` term is scaled to debias the\n * effect of the (assumed) zero-initialization of `v`.\n *  `delta /= (1 - decay ^ step)`\n *\n * For more details on the zero-debiasing algorithm, see:\n *  https://arxiv.org/abs/1412.6980\n *\n * Note that this function is completely stateless and does not keep track of\n * step count. The step count needs to be maintained by the caller and passed\n * 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,\n step?: number|Scalar, zeroDebias = true): T {\n const $v = convertToTensor(v, 'v', 'movingAverage');\n const $x = convertToTensor(x, 'x', 'movingAverage');\n const $decay = convertToTensor(decay, 'decay', 'movingAverage');\n\n assertTypesMatch($v, $x);\n util.assert(\n util.arraysEqual($v.shape, $x.shape), () => 'Shape mismatch in v and x');\n\n const one = scalar(1);\n const oneMinusDecay = sub(one, $decay);\n\n let update = mul(sub($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 * @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
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==========\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';\n\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\n * values or slices within a zero tensor of the given shape tensor according to\n * indices. This operator is the inverse of the `tf.gatherND` operator which\n * extracts values or slices from a given tensor.\n *\n * ```js\n * const indices = tf.tensor2d([4, 3, 1, 7], [4, 1], 'int32');\n * const updates = tf.tensor1d([9, 10, 11, 12]);\n * const shape = [8];\n * tf.scatterND(indices, updates, shape).print() //[0, 11, 0, 10, 9, 0, 0, 12]\n * ```\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 = convertToTensor(indices, 'indices', 'scatterND', 'int32');\n const $updates = convertToTensor(updates, 'updates', 'scatterND');\n scatter_nd_util.validateInput($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 as {} as NamedTensorMap,\n attrs as {} as NamedAttrMap) as Tensor<R>;\n}\n\nexport const scatterND = op({scatterND_});\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 {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 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 number[]. Shape of the dense output tensor.\n * @param validateIndices boolean. indice validation is not supported, error\n * will be thrown if it is set.\n */\nexport function validateInput(\n sparseIndices: Tensor, sparseValues: Tensor, outputShape: number[],\n defaultValues: Tensor) {\n if (sparseIndices.dtype !== 'int32') {\n throw new Error(\n 'tf.sparseToDense() expects the indices to be int32 type,' +\n ` but the dtype was ${sparseIndices.dtype}.`);\n }\n if (sparseIndices.rank > 2) {\n throw new Error(\n 'sparseIndices should be a scalar, vector, or matrix,' +\n ` but got shape ${sparseIndices.shape}.`);\n }\n\n const numElems = sparseIndices.rank > 0 ? sparseIndices.shape[0] : 1;\n const numDims = sparseIndices.rank > 1 ? sparseIndices.shape[1] : 1;\n\n if (outputShape.length !== numDims) {\n throw new Error(\n 'outputShape has incorrect number of elements:,' +\n ` ${outputShape.length}, should be: ${numDims}.`);\n }\n\n const numValues = sparseValues.size;\n if (!(sparseValues.rank === 0 ||\n sparseValues.rank === 1 && numValues === numElems)) {\n throw new Error(\n 'sparseValues has incorrect shape ' +\n `${sparseValues.shape}, should be [] or [${numElems}]`);\n }\n\n if (sparseValues.dtype !== defaultValues.dtype) {\n throw new Error('sparseValues.dtype must match defaultValues.dtype');\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 {ENGINE} from '../engine';\nimport {SparseToDense, SparseToDenseAttrs, SparseToDenseInputs} from '../kernel_names';\nimport {NamedAttrMap} from '../kernel_registry';\nimport * as sparse_to_dense from '../ops/sparse_to_dense_util';\nimport {Scalar, Tensor} from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {convertToTensor} from '../tensor_util_env';\nimport {Rank, ScalarLike, ShapeMap, TensorLike} from '../types';\n\nimport {op} from './operation';\n\n/**\n * Converts a sparse representation into a dense tensor.\n *\n * Builds an array dense with shape outputShape such that:\n *\n * // If sparseIndices is scalar\n * dense[i] = (i == sparseIndices ? sparseValues :

defaultValue)\n *\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 * ```js\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 Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with
 the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF 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 {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 * ```js\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 may not use this file except in compliance with the License.\n * You may obtain a copy
 of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 */\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   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 except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 * ```js\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\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($noiseShape,
 0, 1, 'float32', seed), keepProb)),\n   keepProb);\n\n return mul($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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Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {tensor1d} from './tensor1d';\n\nexport function enclosingPowerOfTwo(value: number) {\n  // Return
 2**N for integer N such that 2**N >= value.\n  return Math.floor(Math.pow(2, Math.ceil(Math.log(value) / Math.log(2.0))));\n}\n\nexport function cosineWindow(\n    windowLength: number, a: number, b: number): Tensor1D {\n  const even = 1 - windowLength % 2;\n  const newValues = new Float32Array(windowLength);\n  for (let i = 0; i < windowLength; ++i) {\n    const cosArg = (2.0 * Math.PI * i) / (windowLength + even - 1);\n    newValues[i] = a - b * Math.cos(cosArg);\n  }\n  return tensor1d(newValues, 'float32');\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 {Tensor} from '../tensor';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from '../types';\nimport {assert, assertShapesMatch, getTypedArrayFromDType} from '../util';\nimport {tensor} from './tensor';\n\n/**\n * Returns whether the targets are in the top K predictions.\n *\n * ```js\n * const predictions = tf.tensor2d([[20, 10, 40, 30], [30, 50, -20, 10]]);\n * const targets = tf.tensor1d([2, 0]);\n * const precision = await tf.inTopKAsync(predictions, targets);\n * precision.print();\n * ```\n * @param predictions 2-D or higher `tf.Tensor` with last dimension being\n *     at least `k`.\n * @param targets 1-D or higher `tf.Tensor`.\n * @param k Optional Number of top elements to look at for computing precision,\n
 *     default to 1.\n *\n * @doc {heading: 'Operations', subheading: 'Evaluation'}\n */\nasync function inTopKAsync_<T extends Tensor, U extends Tensor>(\n    predictions: T|TensorLike, targets: U|TensorLike, k = 1): Promise<U> {\n  const $predictions = convertToTensor(predictions, 'predictions', 'inTopK');\n  const $targets = convertToTensor(targets, 'targets', 'inTopK');\n\n  assert(\n      $predictions.rank > 1,\n      () => 'inTopK() expects the predictions to be of rank 2 or higher, ' +\n          `but got ${$predictions.rank}`);\n  assert(\n      $predictions.rank - 1 === $targets.rank,\n      () => `predictions rank should be 1 larger than ` +\n          `targets rank, but got predictions rank ` +\n          `${$predictions.rank} and targets rank ${$targets.rank}`);\n  assertShapesMatch(\n      $predictions.shape.slice(0, $predictions.shape.length - 1),\n      $targets.shape,\n      `predictions's shape should be align with the targets' shape, ` +\n          'except the
 last dimension.');\n  const lastDim = $predictions.shape[$predictions.shape.length - 1];\n  assert(\n      k > 0 && k <= lastDim,\n      () => `'k' passed to inTopK() must be > 0 && <= the predictions last ` +\n          `dimension (${lastDim}), but got ${k}`);\n\n  const predictionsVals = await $predictions.data();\n  const targetsVals = await $targets.data();\n\n  // Reshape predictionsVals into a 2d tensor [batch, lastDim]\n  // and look up topK along lastDim.\n  const [batch, size] = [predictionsVals.length / lastDim, lastDim];\n  const precision = getTypedArrayFromDType('bool', batch);\n\n  for (let b = 0; b < batch; b++) {\n    const offset = b * size;\n    const vals = predictionsVals.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\n    precision[b] = 0;\n    for (let i = 0;
 i < k; i++) {\n      if (valAndInd[i].index === targetsVals[b]) {\n        precision[b] = 1;\n        break;\n      }\n    }\n  }\n\n  if (predictions !== $predictions) {\n    $predictions.dispose();\n  }\n  if (targets !== $targets) {\n    $targets.dispose();\n  }\n\n  // Output precision has the same shape as targets.\n  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 *
==========\n */\nimport {ENGINE} from '../engine';\nimport {Conv2DBackpropFilter, Conv2DBackpropFilterAttrs, Conv2DBackpropFilterInputs} from '../kernel_names';\nimport {NamedAttrMap} from '../kernel_registry';\nimport {Tensor3D, Tensor4D} from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport * as util from '../util';\n\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: [strideHeight,\n * 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\". 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 conv2DBackpropFilter_<T extends Tensor3D|Tensor4D>(\n   x: T, dy: T, filterShape: [number, number, number, number],\n   strides: [number, number]|number,\n   pad: 'valid'|'same'|number|conv_util.ExplicitPadding,\n   dataFormat: 'NHWC'|'NCHW' = 'NHWC',\n   dimRoundingMode?: 'floor'|'round'|'ceil'): Tensor4D {\n let x4D =
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 = 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\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
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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 {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(\n `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 =\n 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 * @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 {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 *\n * ```js\n * const inputDepth = 2;\n * const inShape = [2, 2, 2, inputDepth];\n * const outputDepth = 2;\n * const fSize = 1;\n * const pad = 0;\n * const strides = 1;\n *\n * const x = tf.tensor4d([1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15,\n * 16], inShape);\n * const w = tf.tensor4d([-1, 1, -2, 0.5], [fSize, fSize, inputDepth,\n * outputDepth]);\n *\n * tf.fused.conv2d({ x, filter: w, strides, pad, dataFormat:
'NHWC',\n * dilations: [1, 1], bias: tf.scalar(5), activation: 'relu' }).print();\n * ```\n *\n * @param obj An object with the following properties:\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, 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.\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 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,\n  filter,\n  strides,\n  pad,\n  dataFormat = 'NHWC',\n  dilations = [1, 1],\n  dimRoundingMode,\n  bias,\n  activation = 'linear',\n  preluActivationWeights,\n  leakyreluAlpha\n}: {\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\n}): T {\n  activation = activation || 'linear';\n\n  if (shouldFuse(ENGINE.state.gradientDepth, activation) === false) {\n    let result = unfusedConv2d(\n        x, filter, strides, pad, dataFormat, dilations, dimRoundingMode);\n    if (bias !=
 null) {\n      result = add(result, bias);\n    }\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\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], $x.shape[2]]);\n  }\n  util.assert(\n      x4D.rank === 4,\n      () => `Error in fused conv2d: input must be rank 4, but got rank ` +\n
 `${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 ${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
`input depth for filter ${$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 ${\n
dataFormat} but only NHWC is currently supported.`);\n\n  const convInfo = conv_util.computeConv2DInfo(\n      x4D.shape, $filter.shape, strides, dilations,
pad, dimRoundingMode);\n\n  let $bias: Tensor;\n  if (bias != null) {\n    $bias = convertToTensor(bias, 'bias', 'fused
conv2d');\n    [$bias] = makeTypesMatch($bias, $x);\n\n
broadcast_util.assertAndGetBroadcastShape(convInfo.outShape, $bias.shape);\n  }\n\n  let
$preluActivationWeights: Tensor;\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 `dilation rates greater than 1 ` +\n `are not yet supported in gradients. Got dilations '${dilations}'`);\n\n const xDer =\n conv2DBackpropInput(x4D.shape, dyActivation, $filter, strides, pad);\n const filterDer =\n conv2DBackpropFilter(x4D, dyActivation, $filter.shape, strides, pad);\n const der: Tensor[] = [xDer, filterDer];\n\n if ($bias != null) {\n const biasDer = getFusedBiasGradient($bias, dyActivation);\n der.push(biasDer);\n }\n return der;\n };\n\n const inputs: FusedConv2DInputs = {\n x: x4D,\n filter: $filter,\n bias: $bias,\n preluActivationWeights: $preluActivationWeights\n };\n\n const attrs: FusedConv2DAttrs = {\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 let res: Tensor4D|Tensor3D =\n // tslint:disable-next-line: no-unnecessary-type-assertion\n ENGINE.runKernel(\n FusedConv2D, inputs as {} as NamedTensorMap,\n attrs as {} as NamedAttrMap);\n\n save([filter, x4D, res]);\n\n if (reshapedTo4D) {\n // tslint:disable-next-line:\n 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 let res: Tensor4D|Tensor3D = ENGINE.runKernel(\n FusedConv2D, 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\n return customOpWithBias(x4D, $filter, $bias) as T;\n }\n}\nexport const conv2d = op({fusedConv2d_});\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 {DepthwiseConv2dNativeBackpropFilter, DepthwiseConv2dNativeBackpropFilterAttrs, DepthwiseConv2dNativeBackpropFilterInputs} 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 depthwiseConv2dNativeBackpropFilter_<T extends Tensor3D|Tensor4D>(\n x: T, dy: T, filterShape: [number, number, number, number],\n strides: [number, number]|number, pad: 'valid'|'same'|number,\n dilations: [number, number]|number = [1, 1],\n dimRoundingMode?: 'floor'|'round'|'ceil'): Tensor4D {\n let x4D = 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 = dy as Tensor4D;\n if (dy4D.rank === 3) {\n dy4D = reshape(dy, [1, dy.shape[0], dy.shape[1], dy.shape[2]]);\n }\n\n const inputs: DepthwiseConv2dNativeBackpropFilterInputs = {x: x4D, dy: dy4D};\n const attrs: DepthwiseConv2dNativeBackpropFilterAttrs =\n {strides, pad, dimRoundingMode, dilations, filterShape};\n\n // tslint:disable-next-line: no-unnecessary-type-assertion\n return ENGINE.runKernel(\n DepthwiseConv2dNativeBackpropFilter,\n inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap) as\n Tensor4D;\n}\n\nexport const depthwiseConv2dNativeBackpropFilter =\n op({depthwiseConv2dNativeBackpropFilter_});\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 {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 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 return res;\n}\n\nexport const depthwiseConv2dNativeBackpropInput =\n   op({depthwiseConv2dNativeBackpropInput_});\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 {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

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 * See\n * [https://www.tensorflow.org/api_docs/python/tf/nn/depthwise_conv2d](\n *
https://www.tensorflow.org/api_docs/python/tf/nn/depthwise_conv2d)\n * for more details.\n *\n * @param obj An
object with the following properties:\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` 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 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 * @param bias Tensor to be added to the result.\n *
@param activation Name of activation kernel (defaults to `linear`).\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 fusedDepthwiseConv2d_<T extends Tensor3D|Tensor4D>({\n  x,\n  filter,\n
strides,\n  pad,\n  dataFormat = 'NHWC',\n  dilations = [1, 1],\n  dimRoundingMode,\n  bias,\n  activation =
'linear',\n  preluActivationWeights,\n  leakyreluAlpha\n}: {\n  x: T|TensorLike,\n  filter: Tensor4D|TensorLike,\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  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 = unfusedDepthwiseConv2d(\n
x,
 filter, strides, pad, dataFormat, dilations, dimRoundingMode);\n    if (bias != null) {\n      result = add(result,
bias);\n    }\n\n    return applyActivation(\n                result, activation, preluActivationWeights, leakyreluAlpha) as
T;\n  }\n\n  const $x = convertToTensor(x, 'x', 'depthwiseConv2d');\n  const $filter = convertToTensor(filter, 'filter',
'depthwiseConv2d');\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  util.assert(\n
x4D.rank === 4,\n      () => `Error in fused depthwiseConv2d: input must be rank 4, but got ` +\n          `rank
${x4D.rank}.`);\n  util.assert(\n      $filter.rank === 4,\n      () => `Error in fused depthwiseConv2d: filter must be
rank 4, ` +\n          `but got rank ${$filter.rank}.`);\n  util.assert(\n      x4D.shape[3] === $filter.shape[2],\n      () =>
`Error in fused depthwiseConv2d: number of input channels
 ` +\n          `(${x4D.shape[3]}) must match the inChannels dimension in ` +\n          `filter ${$filter.shape[2]}.`);\n
if (dilations == null) {\n    dilations = [1, 1];\n  }\n  util.assert(\n
conv_util.eitherStridesOrDilationsAreOne(strides, dilations),\n      () =>\n          'Error in fused depthwiseConv2d:
Either strides or dilations must ' +\n          `be 1. Got strides ${strides} and dilations '${dilations}'`);\n\n  if
(dimRoundingMode != null) {\n    util.assert(\n        util.isInt(pad as number),\n        () => `Error in fused
depthwiseConv2d: pad must be an integer when ` +\n            `using dimRoundingMode ${dimRoundingMode} but
got pad ${pad}.`);\n  }\n\n  const convInfo = conv_util.computeConv2DInfo(\n      x4D.shape, $filter.shape, strides,
dilations, pad, dimRoundingMode,\n      true /* depthwise */);\n\n  let $bias: Tensor;\n  if (bias != null) {\n    $bias =
convertToTensor(bias, 'bias', 'fused conv2d');\n    [$bias] = makeTypesMatch($bias, $x);\n\n
  broadcast_util.assertAndGetBroadcastShape(convInfo.outShape, $bias.shape);\n  }\n\n  let
$preluActivationWeights: Tensor;\n  if (preluActivationWeights != null) {\n    $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 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\n return customOpWithBias(x4D, $filter, $bias) as T;\n }\n}\nexport const depthwiseConv2d = op({fusedDepthwiseConv2d_});\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 {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';\n\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\n return applyActivation(\n result, activation, preluActivationWeights, leakyreluAlpha) as\n T;\n }\n\n let $a = convertToTensor(a, 'a', 'fused matMul');\n let $b = convertToTensor(b, 'b', 'fused matMul');\n [$a, $b] = makeTypesMatch($a, $b);\n\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\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\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\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 ` +\n `least 2, got ranks ${$a.rank} and ${$b.rank}.`);\n\n util.assert(\n util.arraysEqual(outerDimsA, outerDimsB),\n () => `Error in fused matMul: outer dimensions (${outerDimsA}) and (` +\n `${outerDimsB}) of Tensors with shapes ${$a.shape} and ` +\n `${$b.shape} must match.`);\n\n util.assert(\n innerShapeA === innerShapeB,\n () => `Error in fused 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 outShape = $a.shape.slice(0, -2).concat([outerShapeA, outerShapeB]);\n\n const a3D: Tensor3D = transposeA ?\n reshape($a, [batchDimA, innerShapeA, outerShapeA]) :\n reshape($a, [batchDimA, outerShapeA, innerShapeA]);\n const b3D: Tensor3D = transposeB ?\n reshape($b, [batchDimB, outerShapeB, innerShapeB]) :\n reshape($b, [batchDimB, innerShapeB, outerShapeB]);\n\n let $bias: Tensor;\n if (bias != null) {\n $bias = convertToTensor(bias, 'bias', 'fused matMul');\n [$bias] = makeTypesMatch($bias, $a);\n\n broadcast_util.assertAndGetBroadcastShape(outShape, $bias.shape);\n }\n\n let $preluActivationWeights: Tensor;\n if (preluActivationWeights != null) {\n $preluActivationWeights = convertToTensor(\n preluActivationWeights, 'prelu weights', 'fused matMul');\n }\n\n const grad = (dy: Tensor3D, saved: Tensor[]) => {\n const [a3D, b3D,
y, $bias] = saved;\n // we reshape dy because the result of the forward is not\n // necessarily going to be a 3d tensor due to a reshape done at the end of\n // the customOp.\n const dyActivation =\n getFusedDyActivation(reshape(dy, y.shape), y, activation);\n let aDer: Tensor;\n let bDer: Tensor;\n\n if (!transposeA && !transposeB) {\n aDer = unfusedMatMul(dyActivation, b3D, false, true);\n bDer = unfusedMatMul(a3D, dyActivation, true, false);\n } else if (!transposeA && transposeB) {\n aDer = unfusedMatMul(dyActivation, b3D, false, false);\n bDer = unfusedMatMul(dyActivation, a3D, true, false);\n } else if (transposeA && !transposeB) {\n aDer = unfusedMatMul(b3D, dyActivation, false, true);\n bDer = unfusedMatMul(a3D, dyActivation, false, false);\n } else {\n aDer = unfusedMatMul(b3D, dyActivation, true, true);\n bDer = unfusedMatMul(dyActivation, a3D, true, true);\n
}\n\n if (bias != null) {\n const biasDer = getFusedBiasGradient($bias, dyActivation);\n return [aDer, bDer, biasDer];\n } else {\n return [aDer, bDer];\n }\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\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\n   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\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {op} from '../operation';\nimport {cosineWindow} from '../signal_ops_util';\n\n/**\n * Generate a hamming window.\n *\n * See: https://en.wikipedia.org/wiki/Window_function#Hann_and_Hamming_windows\n *\n * ```js\n * tf.signal.hammingWindow(10).print();\n * ```\n * @param The length of window\n *\n * @doc {heading: 'Operations', subheading: 'Signal', namespace: 'signal'}\n */\nfunction hammingWindow_(windowLength: number): Tensor1D {\n return cosineWindow(windowLength, 0.54, 0.46);\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {op} from '../operation';\nimport {cosineWindow} from '../signal_ops_util';\n\n/**\n * Generate a Hann window.\n *\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 *\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {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\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\n if (output.length === 0) {\n   return tensor2d([], [0, frameLength]);\n }\n\n return reshape(concat(output), [output.length, frameLength]);\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 *\n ==\n */\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';\n\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 return concat(output);\n}\nexport const stft = op({stft_});\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 {CropAndResize, CropAndResizeAttrs, CropAndResizeInputs} from '../../kernel_names';\nimport {NamedAttrMap} from '../../kernel_registry';\nimport {Tensor1D, Tensor2D, 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 * 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 cropSize.\n *\n * @param image 4d tensor of shape `[batch,imageHeight,imageWidth, depth]`,\n *   where imageHeight and imageWidth must be positive, specifying the\n *   batch of images from which to take crops\n * @param boxes 2d float32 tensor of shape `[numBoxes, 4]`. Each entry is\n *   `[y1, x1, y2, x2]`, where `(y1, x1)` and `(y2, x2)` are the normalized\n *   coordinates of the box in the boxInd[i]'th image in the batch\n * @param boxInd 1d int32 tensor of shape `[numBoxes]` with values in range\n *   `[0, batch)`
that specifies the image that the `i`-th box refers to.\n * @param cropSize 1d int32 tensor of 2 elements `[cropHeigh, cropWidth]`\n *   specifying the size to which all crops are resized to.\n * @param method Optional string from ``bilinear' | 'nearest'`,\n *      defaults to bilinear, which specifies the sampling method for resizing\n * @param extrapolationValue A threshold for deciding when to remove boxes based\n *      on score. Defaults to 0.\n * @return A 4D tensor of the shape `[numBoxes,cropHeight,cropWidth,depth]`\n *\n * @doc {heading: 'Operations', 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: 'bilinear'|'nearest' = 'bilinear',\n   extrapolationValue = 0,\n   ): Tensor4D {\n const $image = convertToTensor(image, 'image', 'cropAndResize');\n const $boxes = convertToTensor(boxes, 'boxes', 'cropAndResize',
'float32');\n const $boxInd = convertToTensor(boxInd, 'boxInd', 'cropAndResize', 'int32');\n\n const numBoxes = $boxes.shape[0];\n\n util.assert(\n $image.rank === 4,\n   () => 'Error in cropAndResize: image must be rank 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 ${$boxes.shape}.`);\n util.assert(\n $boxInd.rank === 1 && $boxInd.shape[0] === numBoxes,\n   () => `Error in cropAndResize: boxInd must be have size [${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   () => `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 ${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 Tensor4D;\n}\n\nexport const cropAndResize = op({cropAndResize_});\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 {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\n util.assert(\n $image.rank === 4,\n   () => 'Error in flipLeftRight: image must be rank 4,' +\n
`but got rank ${$image.rank}.`);\n\n const inputs: FlipLeftRightInputs = {image: $image};\n const res =\n ENGINE.runKernel(FlipLeftRight, inputs as {} as NamedTensorMap, {});\n return res as Tensor4D;\n}\n\nexport const flipLeftRight = op({flipLeftRight_});\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 {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 * @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'}\n */\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\n util.assert(\n $image.rank === 4,\n   () => 'Error in rotateWithOffset: image must be rank 4,' +\n   `but got rank ${$image.rank}.`);\n\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 * @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, 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 () =>\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\nexport {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 *
==========\n
*/\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 * @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 */\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\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\nexport 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\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 */\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_\n * 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 */\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 */\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\n return found ? left : -left - 1;\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 {TypedArray} from '../types';\nimport {binaryInsert} from './non_max_suppression_util';\n\n/**\n * Implementation of the NonMaxSuppression kernel shared between webgl and cpu.\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, 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,

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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,\n    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\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\n  candidates.sort(ascendingComparator);\n\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\n  const selectedIndices: number[] = [];\n  const selectedScores: number[] = [];\n\n  while (selectedIndices.length < maxOutputSize && candidates.length > 0) {\n    const candidate = candidates.pop();\n    const {score: originalScore, boxIndex, suppressBeginIndex} = candidate;\n\n    if (originalScore < scoreThreshold) {\n      break;\n    }\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\n      if (iou >= iouThreshold) {\n        ignoreCandidate = true;\n        break;\n      }\n\n      candidate.score =\n          candidate.score * suppressWeight(iouThreshold, scale, iou);\n\n      if (candidate.score <= scoreThreshold) {\n        break;\n      }\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\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\n  // NonMaxSuppressionV4 feature: padding output to maxOutputSize.\n  const validOutputs = selectedIndices.length;\n  const elemsToPad = maxOutputSize - validOutputs;\n\n  if (padToMaxOutputSize && elemsToPad > 0) {\n    selectedIndices.push(...new Array(elemsToPad).fill(0));\n    selectedScores.push(...new Array(elemsToPad).fill(0.0));\n  }\n\n  const result: NonMaxSuppressionResult = {selectedIndices};\n\n  if (returnScoresTensor) {\n    result['selectedScores'] = selectedScores;\n  }\n\n  if (returnValidOutputs) {\n    result['validOutputs'] = validOutputs;\n  }\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 =
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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) *\n Math.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 * @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 {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 *\n * This is the async version of `nonMaxSuppression`\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 * @return A 1D tensor with the selected box indices.\n *\n * @doc {heading: 'Operations', subheading: 'Images', namespace: 'image'}\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 * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {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 {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 * 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 = nonMaxSuppSanityCheck(\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 * @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 {nonMaxSuppressionV5Impl} from '../../backends/non_max_suppression_impl';\nimport {Tensor1D, Tensor2D} from '../../tensor';\nimport {NamedTensorMap} from '../../tensor_types';\nimport {convertToTensor} from '../../tensor_util_env';\nimport {TensorLike} from '../../types';\nimport {nonMaxSuppSanityCheck} from '../nonmax_util';\nimport {tensor1d} from '../tensor1d';\n\n/**\n * Asynchronously 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 */\nasync function nonMaxSuppressionWithScoreAsync_(\n   boxes: Tensor2D|TensorLike, scores: Tensor1D|TensorLike,\n maxOutputSize: number, iouThreshold = 0.5,\n   scoreThreshold = Number.NEGATIVE_INFINITY,\n softNmsSigma = 0.0): Promise<NamedTensorMap> {\n const $boxes = convertToTensor(boxes, 'boxes', 'nonMaxSuppressionAsync');\n const $scores = convertToTensor(scores, 'scores', 'nonMaxSuppressionAsync');\n\n const params = nonMaxSuppSanityCheck(\n $boxes, $scores, maxOutputSize, iouThreshold, scoreThreshold,\n softNmsSigma);\n maxOutputSize = params.maxOutputSize;\n iouThreshold = params.iouThreshold;\n scoreThreshold = params.scoreThreshold;\n softNmsSigma = params.softNmsSigma;\n\n const boxesAndScores = await Promise.all([$boxes.data(), $scores.data()]);\n const boxesVals = boxesAndScores[0];\n const scoresVals = boxesAndScores[1];\n\n // We call a cpu based impl directly with the typedarray data here rather\n // than a kernel because all kernels are synchronous (and thus cannot await\n // .data()).\n const {selectedIndices, selectedScores} = nonMaxSuppressionV5Impl(\n   boxesVals, scoresVals, maxOutputSize, iouThreshold, scoreThreshold,\n   softNmsSigma);\n\n if ($boxes !== boxes) {\n $boxes.dispose();\n }\n if ($scores !== scores) {\n $scores.dispose();\n }\n\n return {\n   selectedIndices: tensor1d(selectedIndices, 'int32'),\n   selectedScores: tensor1d(selectedScores)\n };\n}\n\nexport const nonMaxSuppressionWithScoreAsync = nonMaxSuppressionWithScoreAsync_;\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 {ENGINE} from '../../engine';\nimport {NonMaxSuppressionV4, NonMaxSuppressionV4Attrs, NonMaxSuppressionV4Inputs} 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 {nonMaxSuppSanityCheck} from '../nonmax_util';\nimport {op} from '../operation';\n\n/**\n

* Asynchronously performs
non maximum suppression of bounding boxes based on\n * iou (intersection over union), with an option to pad results.\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 padToMaxOutputSize Defalts to false. If true, size of output\n * `selectedIndices` is padded to maxOutputSize.\n * @return A map with the following properties:\n * - selectedIndices: A 1D
tensor with the selected box indices.\n * - validOutputs: A scalar denoting how many elements in `selectedIndices`\n * are valid. Valid elements occur first, then padding.\n *\n * @doc {heading: 'Operations', subheading: 'Images', namespace: 'image'}\n */\nfunction nonMaxSuppressionPadded_(\n boxes: Tensor2D|TensorLike, scores: Tensor1D|TensorLike,\n maxOutputSize: number, iouThreshold = 0.5,\n scoreThreshold = Number.NEGATIVE_INFINITY,\n padToMaxOutputSize = false): NamedTensorMap {\n const $boxes = convertToTensor(boxes, 'boxes', 'nonMaxSuppression');\n const $scores = convertToTensor(scores, 'scores', 'nonMaxSuppression');\n\n const params = nonMaxSuppSanityCheck(\n $boxes, $scores, maxOutputSize, iouThreshold, scoreThreshold,\n null /* softNmsSigma */);\n const $maxOutputSize = params.maxOutputSize;\n const $iouThreshold = params.iouThreshold;\n const $scoreThreshold = params.scoreThreshold;\n\n const inputs: NonMaxSuppressionV4Inputs = {boxes:
$boxes, scores: $scores};\n const attrs: NonMaxSuppressionV4Attrs = {\n maxOutputSize: $maxOutputSize,\n iouThreshold: $iouThreshold,\n scoreThreshold: $scoreThreshold,\n padToMaxOutputSize\n };\n\n // tslint:disable-next-line: no-unnecessary-type-assertion\n const result = ENGINE.runKernel(\n NonMaxSuppressionV4, inputs as {} as NamedTensorMap,\n attrs as {} as NamedAttrMap) as Tensor[];\n\n return {selectedIndices: result[0], validOutputs: result[1]};\n}\n\nexport const nonMaxSuppressionPadded = op({nonMaxSuppressionPadded_});\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 {nonMaxSuppressionV4Impl} from '../../backends/non_max_suppression_impl';\nimport {Tensor1D, Tensor2D} from '../../tensor';\nimport {NamedTensorMap} from '../../tensor_types';\nimport {convertToTensor} from '../../tensor_util_env';\nimport {TensorLike} from '../../types';\nimport {nonMaxSuppSanityCheck} from '../nonmax_util';\nimport {scalar} from '../scalar';\nimport {tensor1d} from '../tensor1d';\n\n/**\n * Asynchronously performs non maximum suppression of bounding boxes based on\n * iou (intersection over union), with an option to pad results.\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 padToMaxOutputSize Defalts to false. If true, size of output\n * `selectedIndices` is padded to maxOutputSize.\n * @return A map with the following properties:\n * - selectedIndices: A 1D tensor with the

selected box indices.\n *   - validOutputs: A scalar denoting how many elements in `selectedIndices`\n *   are valid. Valid elements occur first, then padding.\n *\n * @doc {heading: 'Operations', subheading: 'Images',
 namespace: 'image'}\n */\nasync function nonMaxSuppressionPaddedAsync_(\n   boxes: Tensor2D|TensorLike,
scores: Tensor1D|TensorLike,\n   maxOutputSize: number, iouThreshold = 0.5,\n   scoreThreshold =
Number.NEGATIVE_INFINITY,\n   padToMaxOutputSize = false): Promise<NamedTensorMap> {\n const
$boxes = convertToTensor(boxes, 'boxes', 'nonMaxSuppressionAsync');\n const $scores = convertToTensor(scores,
'scores', 'nonMaxSuppressionAsync');\n\n const params = nonMaxSuppSanityCheck(\n $boxes, $scores,
maxOutputSize, iouThreshold, scoreThreshold,\n   null /* softNmsSigma */);\n const $maxOutputSize =
params.maxOutputSize;\n const $iouThreshold = params.iouThreshold;\n const $scoreThreshold =
params.scoreThreshold;\n\n const [boxesVals, scoresVals] =\n   await Promise.all([$boxes.data(),
$scores.data()]);\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, validOutputs} = nonMaxSuppressionV4Impl(\n   boxesVals, scoresVals,
$maxOutputSize, $iouThreshold, $scoreThreshold,\n   padToMaxOutputSize);\n\n if ($boxes !== boxes) {\n
$boxes.dispose();\n }\n if ($scores !== scores) {\n $scores.dispose();\n }\n\n return {\n   selectedIndices:
tensor1d(selectedIndices, 'int32'),\n   validOutputs: scalar(validOutputs, 'int32')\n };\n}\n\nexport const
nonMaxSuppressionPaddedAsync = nonMaxSuppressionPaddedAsync_;\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 {ResizeBilinear, ResizeBilinearAttrs, ResizeBilinearInputs}
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 * Bilinear resize a single 3D image or 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 * @param size The new shape `[newHeight,
 newWidth]` to resize the\n *   images to. Each channel is resized individually.\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`. Treat similarly the width dimension.\n *
@param halfPixelCenters Defaults to `false`. Whether to assume pixel centers\n *   are at 0.5, which would make
the floating point coordinates of the top\n *   left pixel 0.5, 0.5.\n *\n * @doc {heading: 'Operations', subheading:
'Images', namespace: 'image'}\n */\nfunction resizeBilinear_<T extends Tensor3D|Tensor4D>(\n   images:
T|TensorLike, size: [number, number], alignCorners = false,\n   halfPixelCenters = false): T {\n const $images =
convertToTensor(images, 'images', 'resizeBilinear');\n\n util.assert(\n $images.rank === 3 || $images.rank ===
4,\n   () => `Error in resizeBilinear: x must be rank 3 or 4,
 but got ` +\n          `rank ${$images.rank}.`);\n  util.assert(\n      size.length === 2,\n      () => `Error in
resizeBilinear: new shape must 2D, but got shape ` +\n          `${size}.`);\n util.assert(\n   halfPixelCenters ===
false || alignCorners === false,\n   () => `Error in resizeBilinear: If halfPixelCenters is true, ` +\n
`alignCorners must be false.`);\n\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\n const [] = size;\n\n const inputs: ResizeBilinearInputs = {images:
batchImages};\n const attrs: ResizeBilinearAttrs = {alignCorners, halfPixelCenters, size};\n\n // tslint:disable-next-

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 * @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 {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 * @param size The new shape `[newHeight, newWidth]` to resize the\n * images to. Each channel is resized individually.\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`.
 Treat similarly the width dimension.\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 * @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';\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 * ```js\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 *
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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 {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 * ```js\n * const x = tf.tensor2d([[1, 2], [3, 4]]);\n * let y = tf.linalg.gramSchmidt(x);\n * y.print();\n *
console.log('Othogonalized:');\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]);
```

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// should be nearly 2.\n * ```\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 *\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; 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. ${dim})`);\n    }\n  } else {\n    inputIsTensor2D = true;\n    xs = split(xs, xs.shape[0], 0).map(x => squeeze(x, [0]));\n  }\n\n  assert(\n      xs.length <= xs[0].shape[0],\n      () => `Gram-Schmidt: Number of vectors (${\n          (xs as Tensor1D[]).length}) exceeds ` +\n          `number of dimensions (${(xs as Tensor1D[])[0].shape[0]}).`);\n\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\n  if (inputIsTensor2D) {\n    return stack(ys, 0) as Tensor2D;\n  } else {\n    return ys;\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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} 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 * (http://www.cs.cornell.edu/~bindel/class/cs6210-f09/lec18.pdf)\n *\n * ```js\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 * @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 * @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,
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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 */\nfunction 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\nfunction 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]]) 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 tawTimesWT: 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), tawTimesWT));\n      } else {\n
      const qTimesTau: Tensor2D =\n              sub(qAllJEnd, matMul(matMul(qAllJEnd, w), tawTimesWT));\n q = concat([slice(q, [0, 0], [m, j]), qTimesTau], 1);\n        }\n        return [w, r, q];\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\nexport const qr = op({qr_});\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\nexport enum Reduction {\n  NONE,\n  MEAN,\n  SUM,\n  SUM_BY_NONZERO_WEIGHTS\n}\n","/**\n *
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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 * @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_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, $predictions.shape, 'Error in absoluteDifference: ');\n\n const losses = abs(sub($labels, $predictions));\n return computeWeightedLoss(losses, $weights, reduction);\n}\n\nexport const absoluteDifference = op({absoluteDifference_});\n","/**\n * @license\n * Copyright 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 {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`\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 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, $predictions.shape, 'Error in cosineDistance: ');\n\n const one = scalar(1);\n const losses = sub(one, sum(mul($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 under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF 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 {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'.\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 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}\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 *\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 {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,\n   quadratic);\n\n const losses =\n   add(mul(scalar(0.5), square(quadratic)), mul(deltaScalar, linear));\n return computeWeightedLoss(losses, $weights, reduction);\n}\nexport const huberLoss = op({huberLoss_});\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 {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

'../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, $predictions.shape, 'Error in logLoss: ');\n\n const one = scalar(1);\n const epsilonScalar = scalar(epsilon);\n\n const l1 = neg(mul($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,
$weights, reduction);\n}\nexport const logLoss = op({logLoss_});\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';\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, $predictions.shape, 'Error in meanSquaredError: ');\n\n const losses = squaredDifference($labels, $predictions);\n return computeWeightedLoss(losses, $weights, reduction);\n}\nexport const meanSquaredError = op({meanSquaredError_});\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

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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 {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 {exp} from '../exp';\nimport {log1p} from '../log1p';\nimport {Reduction} from '../loss_ops_utils';\nimport {mul} from '../mul';\nimport {neg} from '../neg';\nimport {op} from '../operation';\nimport {relu} from '../relu';\nimport {scalar} from '../scalar';\nimport {sub} from '../sub';\n\nimport {computeWeightedLoss} from './compute_weighted_loss';\n\nfunction sigmoidCrossEntropyWithLogits_<T extends Tensor, O extends Tensor>(\n
 labels: T|TensorLike, logits: T|TensorLike): O {\n  const $labels =\n      convertToTensor(labels, 'labels', 'sigmoidCrossEntropyWithLogits');\n  const $logits =\n      convertToTensor(logits, 'logits', 'sigmoidCrossEntropyWithLogits');\n  assertShapesMatch(\n      $labels.shape, $logits.shape, 'Error in sigmoidCrossEntropyWithLogits: ');\n\n  /**\n   * Implementation Details:\n   *\n   * For brevity, let `x = logits`, `z = labels`.  The logistic loss is\n   *     z * -log(sigmoid(x)) + (1 - z) * -log(1 - sigmoid(x))\n   *   = z * -log(1 / (1 + exp(-x))) + (1 - z) * -log(exp(-x) / (1 + exp(-x)))\n   *   = z * log(1 + exp(-x)) + (1 - z) * (-log(exp(-x)) + log(1 + exp(-x)))\n   *   = z * log(1 + exp(-x)) + (1 - z) * (x + log(1 + exp(-x))\n   *   = (1 - z) * x + log(1 + exp(-x))\n   *   = x - x * z + log(1 + exp(-x))\n   *\n   *   For x < 0, to avoid overflow in exp(-x), we reformulate the above\n   *     x - x * z + log(1 + exp(-x))\n   *   = log(exp(x)) - x * z + log(1 + exp(-x))\n   *
   = - x * z + log(1 + exp(x))\n   *\n   * Hence, to ensure stability and avoid overflow, the implementation uses\n   * this equivalent formulation:\n   *     max(x, 0) - x * z + log(1 + exp(-abs(x)))\n   */\n  const maxOutput = relu($logits);\n  const outputXTarget = mul($logits, $labels);\n  const sigmoidOutput = log1p(exp(neg(abs($logits))));\n\n  return add(sub(maxOutput, outputXTarget), sigmoidOutput);\n}\n\n/**\n * Computes the sigmoid cross entropy loss between two tensors.\n *\n * If labelSmoothing is nonzero, smooth the labels towards 1/2:\n *\n *   newMulticlassLabels = multiclassLabels * (1 - labelSmoothing)\n *                         + 0.5 * labelSmoothing\n *\n * @param multiClassLabels The ground truth output tensor of shape\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 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 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 sigmoidCrossEntropy_<T extends Tensor, O extends Tensor>(\n    multiClassLabels: T|TensorLike, logits: T|TensorLike,\n    weights?: Tensor|TensorLike, labelSmoothing = 0,\n    reduction = Reduction.SUM_BY_NONZERO_WEIGHTS): O {\n  let $multiClassLabels = convertToTensor(\n      multiClassLabels, 'multiClassLabels', 'sigmoidCrossEntropy');\n  const $logits = convertToTensor(logits, 'logits', 'sigmoidCrossEntropy');\n  let $weights: Tensor = null;\n  if (weights != null) {\n    $weights = convertToTensor(weights, 'weights', 'sigmoidCrossEntropy');\n  }\n  assertShapesMatch(\n      $multiClassLabels.shape, $logits.shape, 'Error in sigmoidCrossEntropy: ');\n\n  if (labelSmoothing > 0) {\n    const labelSmoothingScalar = scalar(labelSmoothing);\n    const one = scalar(1);\n    const half = scalar(0.5);\n\n    $multiClassLabels =\n        add(mul($multiClassLabels, sub(one, labelSmoothingScalar)),\n            mul(half, labelSmoothingScalar));\n  }\n  const losses = sigmoidCrossEntropyWithLogits_($multiClassLabels, $logits);\n\n  return computeWeightedLoss(losses, $weights, reduction);\n}\n\nexport 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 \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or
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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 {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 // 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,

'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 $onehotLabels =\n add(mul($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\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\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

'./max_pool_with_argmax';\nexport {maximum} from './maximum';\nexport {mean} from './mean';\nexport {min} from './min';\nexport {minimum} from './minimum';\nexport {mirrorPad} from './mirror_pad';\nexport {mod} from './mod';\nexport {moments} from './moments';\nexport {mul} from './mul';\nexport {LSTMCellFunc, multiRNNCell} from './multi_rnn_cell';\nexport
{multinomial} from './multinomial';\nexport {neg} from './neg';\nexport {notEqual} from './not_equal';\nexport {oneHot} from './one_hot';\nexport {ones} from './ones';\nexport {onesLike} from './ones_like';\nexport {outerProduct} from './outer_product';\nexport {pad} from './pad';\nexport {pad1d} from './pad1d';\nexport {pad2d} from './pad2d';\nexport {pad3d} from './pad3d';\nexport {pad4d} from './pad4d';\nexport {pool} from './pool';\nexport {pow} from './pow';\nexport {prelu} from './prelu';\nexport {print} from './print';\nexport {prod} from './prod';\nexport {rand} from './rand';\nexport {randomGamma} from './random_gamma';\nexport {randomNormal} from './random_normal';\nexport {randomUniform} from './random_uniform';\nexport {range} from './range';\nexport {real} from './real';\nexport {reciprocal} from './reciprocal';\nexport {relu} from './relu';\nexport {relu6} from './relu6';\nexport {reshape} from './reshape';\nexport {reverse} from './reverse';\nexport {reverse1d} from './reverse_1d';\nexport
{reverse2d} from './reverse_2d';\nexport {reverse3d} from './reverse_3d';\nexport {reverse4d} from './reverse_4d';\nexport {round} from './round';\nexport {rsqrt} from './rsqrt';\nexport {scalar} from './scalar';\nexport {selu} from './selu';\nexport {separableConv2d} from './separable_conv2d';\nexport {setdiff1dAsync} from './setdiff1d_async';\nexport {sigmoid} from './sigmoid';\nexport {sign} from './sign';\nexport {sin} from './sin';\nexport {sinh} from './sinh';\nexport {slice} from './slice';\nexport {slice1d} from './slice1d';\nexport {slice2d} from './slice2d';\nexport {slice3d} from './slice3d';\nexport {slice4d} from './slice4d';\nexport {softmax} from './softmax';\nexport {softplus} from './softplus';\nexport {spaceToBatchND} from './space_to_batch_nd';\nexport {fft} from './spectral/fft';\nexport {ifft} from './spectral/ifft';\nexport {irfft} from './spectral/irfft';\nexport {rfft} from './spectral/rfft';\nexport {split} from './split';\nexport {sqrt} from
'./sqrt';\nexport {square} from './square';\nexport {squaredDifference} from './squared_difference';\nexport {squeeze} from './squeeze';\nexport {stack} from './stack';\nexport {step} from './step';\nexport {stridedSlice} from './strided_slice';\nexport {sub} from './sub';\nexport {sum} from './sum';\nexport {tan} from './tan';\nexport {tanh} from './tanh';\nexport {tensor} from './tensor';\nexport {tensor1d} from './tensor1d';\nexport {tensor2d} from './tensor2d';\nexport {tensor3d} from './tensor3d';\nexport {tensor4d} from './tensor4d';\nexport {tensor5d} from './tensor5d';\nexport {tensor6d} from './tensor6d';\nexport {tile} from './tile';\nexport {topk} from './topk';\nexport {truncatedNormal} from './truncated_normal';\nexport {unique} from './unique';\nexport {unsortedSegmentSum} from './unsorted_segment_sum';\nexport {unstack} from './unstack';\nexport {variable} from './variable';\nexport {where} from './where';\nexport {whereAsync} from './where_async';\nexport {zeros} from
'./zeros';\nexport {zerosLike} from './zeros_like';\n\nexport * from './boolean_mask';\nexport * from './transpose';\nexport * from './norm';\nexport * from './moving_average';\nexport * from './scatter_nd';\nexport * from './sparse_to_dense';\nexport * from './gather_nd';\nexport * from './dropout';\nexport * from './signal_ops_util';\nexport * 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

{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 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 {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 */\nexport interface OptimizerVariable {\n originalName: string;\n variable: Variable;\n}\n\n/** @doc {heading: 'Training', subheading: 'Classes', namespace: 'train'} */\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 * @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 minimize(f: () => Scalar, returnCost = false, varList?: Variable[]): Scalar\n |null {\n const {value, grads} = this.computeGradients(f, varList);\n\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\n * list is provided, it defaults to all trainable variables.\n *\n * @param f The function to execute and whose output to use for computing\n * gradients with respect to variables.\n * @param varList An optional list of variables to compute gradients with\n * respect to. If specified, only the trainable variables in varList will have\n
* gradients computed with respect to. Defaults to all trainable variables.\n *\n * @doc {heading: 'Training', subheading: 'Optimizers'}\n */\n computeGradients(f: () => Scalar, varList?: Variable[]):\n {value: Scalar, grads: NamedTensorMap} {\n return variableGrads(f, varList);\n }\n\n /**\n * Updates variables by using the computed gradients.\n *\n * @param variableGradients A mapping of variable name to its gradient value.\n *\n * @doc {heading: 'Training', subheading: 'Optimizers'}\n */\n abstract applyGradients(variableGradients: NamedTensorMap|\n NamedTensor[]): void;\n\n /**\n * Dispose the variables (if any) owned by this optimizer instance.\n */\n dispose(): void {\n if (this.iterations_ != null) {\n dispose(this.iterations_);\n }\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.\n // TODO(cais): Use 'int64' type when available.\n tensor: scalar(this.iterations_, 'int32')\n };\n }\n\n async getWeights(): Promise<NamedTensor[]> {\n throw new Error('getWeights() is not implemented for this optimizer yet.');\n }\n\n async setWeights(weightValues: NamedTensor[]): Promise<void> {\n throw new Error(\n `setWeights() is not implemented for this optimizer class ` +\n `${this.getClassName()}`);\n }\n\n /**\n * Extract the first element of the weight values and set it\n * as the iterations counter variable of this instance of optimizer.\n *\n * @param weightValues\n * @returns Weight values with the first element consumed and excluded.\n */\n protected async extractIterations(weightValues: NamedTensor[]):\n Promise<NamedTensor[]> {\n this.iterations_ = (await weightValues[0].tensor.data())[0];\n return weightValues.slice(1);\n }\n}\n\nObject.defineProperty(Optimizer, Symbol.hasInstance,
{\n value: (instance: Optimizer) => {\n return instance.minimize != null && instance.computeGradients != null &&\n instance.applyGradients != null;\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 {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/ops';\nimport {square} from '../ops/square';\nimport {zerosLike} from '../ops/zeros_like';\nimport {ConfigDict, registerClass, Serializable, SerializableConstructor} from '../serialization';\nimport {NamedTensor, NamedVariableMap} from '../tensor_types';\n\nimport {Optimizer, OptimizerVariable} from './optimizer';\n\n/** @doclink Optimizer */\nexport class AdadeltaOptimizer extends Optimizer {\n /** @nocollapse */\n static className = 'Adadelta'; // Name matters for Python compatibility.\n private accumulatedGrads: OptimizerVariable[] = [];\n private accumulatedUpdates: OptimizerVariable[] = [];\n\n constructor(\n protected learningRate: number, protected rho: number,\n protected epsilon: number = null) {\n super();\n\n if (epsilon == null) {\n this.epsilon = ENGINE.backend.epsilon();\n }\n }\n\n applyGradients(variableGradients: NamedVariableMap|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.accumulatedGrads[i] == null) {\n this.accumulatedGrads[i] = {\n originalName: `${name}/accum_grad`,\n variable: tidy(() => zerosLike(value).variable(trainable))\n };\n }\n if (this.accumulatedUpdates[i] == null) {\n this.accumulatedUpdates[i] = {\n originalName: `${name}/accum_var`,\n variable: tidy(() =>

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zerosLike(value).variable(trainable))\n      };\n    }\n\n    const gradient = Array.isArray(variableGradients) ?\n      variableGradients[i].tensor :\n      variableGradients[name];\n    if (gradient == null) {\n      return;\n    }\n\n    const accumulatedGrad = this.accumulatedGrads[i].variable;\n
    const accumulatedUpdate = this.accumulatedUpdates[i].variable;\n\n    tidy(() => {\n      const newAccumulatedGrad =\n          add(mul(accumulatedGrad, this.rho),\n              mul(square(gradient), 1 - this.rho));\n\n      const updates =\n          mul(div(sqrt(add(accumulatedUpdate, this.epsilon)),\n                  sqrt(add(accumulatedGrad, this.epsilon))),\n              gradient);\n\n      const newAccumulatedUpdate =\n          add(mul(accumulatedUpdate, this.rho),\n              mul(square(updates), 1 - this.rho));\n\n      accumulatedGrad.assign(newAccumulatedGrad);\n      accumulatedUpdate.assign(newAccumulatedUpdate);\n\n      const newValue = add(mul(updates, -this.learningRate), value);\n      value.assign(newValue);\n    });\n  });\n  this.incrementIterations();\n  }\n\n  dispose(): void {\n    if (this.accumulatedUpdates != null) {\n      dispose(this.accumulatedGrads.map(v => v.variable));\n      dispose(this.accumulatedUpdates.map(v => v.variable));\n    }\n  }\n\n  async getWeights(): Promise<NamedTensor[]> {\n    // Order matters for Python compatibility.\n    const variables: OptimizerVariable[] =\n        [...this.accumulatedGrads, ...this.accumulatedUpdates];\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    const variableCount = weightValues.length / 2;\n    const trainable = false;\n    this.accumulatedGrads =\n        weightValues.slice(0, variableCount).map(v => ({\n                                                   originalName: v.name,\n                                                   variable: v.tensor.variable(\n                                                       trainable)\n                                                 }));\n    this.accumulatedUpdates =\n        weightValues.slice(variableCount, variableCount * 2)\n            .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      'rho': this.rho,\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(config['learningRate'], config['rho'], config['epsilon']);\n  }\n}\nregisterClass(AdadeltaOptimizer);\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 {fill} from '../ops/fill';\nimport {mul} from '../ops/mul';\nimport {sqrt} from '../ops/sqrt';\nimport {square} from '../ops/square';\nimport {ConfigDict, registerClass, Serializable, SerializableConstructor} from '../serialization';\nimport {NamedTensor, NamedVariableMap} from '../tensor_types';\n\nimport {Optimizer, OptimizerVariable} from './optimizer';\n\n/** @doclink Optimizer */\nexport class AdagradOptimizer extends Optimizer {\n  /** @nocollapse */\n  static className = 'Adagrad';\n  // Note: Name matters for Python compatibility.\n\n  private accumulatedGrads: OptimizerVariable[] = [];\n\n  constructor(\n      protected learningRate: number, private initialAccumulatorValue = 0.1) {\n    super();\n  }\n\n  applyGradients(variableGradients: NamedVariableMap|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      if (this.accumulatedGrads[i] == null) {\n        const trainable = false;\n        this.accumulatedGrads[i] = {\n          originalName: `${name}/accumulator`,\n          variable: tidy(\n              () => fill(value.shape, this.initialAccumulatorValue)\n                        .variable(trainable))\n        };\n      }\n\n      const const
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gradient = Array.isArray(variableGradients) ?\n variableGradients[i].tensor :\n variableGradients[name];\n
if (gradient == null) {\n return;\n }\n\n const accumulatedGrad = this.accumulatedGrads[i].variable;\n\n tidy(() => {\n const newAccumulatedGrad = add(accumulatedGrad, square(gradient));\n accumulatedGrad.assign(newAccumulatedGrad);\n\n const newValue = add(\n mul(div(gradient,\n sqrt(add(newAccumulatedGrad, ENGINE.backend.epsilon()))),\n -this.learningRate),\n value);\n value.assign(newValue);\n });\n });\n this.incrementIterations();\n }\n\n dispose(): void {\n if (this.accumulatedGrads != null) {\n dispose(this.accumulatedGrads.map(v => v.variable));\n }\n }\n\n async getWeights(): Promise<NamedTensor[]> {\n // Order matters for Python compatibility.\n return [await this.saveIterations()].concat(this.accumulatedGrads.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.accumulatedGrads = weightValues.map(\n v => ({originalName: v.name, variable: v.tensor.variable(trainable)}));\n }\n\n getConfig(): ConfigDict {\n return {\n 'learningRate': this.learningRate,\n 'initialAccumulatorValue': this.initialAccumulatorValue,\n };\n }\n\n /** @nocollapse */\n static fromConfig<T extends Serializable>(\n cls: SerializableConstructor<T>, config: ConfigDict): T {\n return new cls(config['learningRate'], config['initialAccumulatorValue']);\n }\n}\nregisterClass(AdagradOptimizer);\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 {pow} from '../ops/pow';\nimport {scalar} from '../ops/scalar';\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 {Variable} from '../tensor';\nimport {NamedTensor, NamedVariableMap} from '../tensor_types';\n\nimport {Optimizer, OptimizerVariable} from './optimizer';\n\nexport class AdamOptimizer extends Optimizer {\n /** @nocollapse */\n static className = 'Adam'; // Note: Name matters for Python compatibility.\n private accBeta1: Variable;\n private accBeta2: Variable;\n\n private accumulatedFirstMoment: OptimizerVariable[] = [];\n private accumulatedSecondMoment: OptimizerVariable[] = [];\n\n constructor(\n protected learningRate: number, protected beta1: number,\n protected beta2: number, protected epsilon: number = null) {\n super();\n tidy(() => {\n // accB* will be updated by batch.\n this.accBeta1 = scalar(beta1).variable();\n this.accBeta2 = scalar(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 = Array.isArray(variableGradients) ?\n variableGradients.map(v => v.name) :\n Object.keys(variableGradients);\n tidy(() => {\n const oneMinusAccBeta1 = sub(1, this.accBeta1);\n const oneMinusAccBeta2 = sub(1, this.accBeta2);\n\n varNames.forEach((name, i) => {\n const value = ENGINE.registeredVariables[name];\n const trainable = false;\n if (this.accumulatedFirstMoment[i] == null) {\n this.accumulatedFirstMoment[i] = {\n originalName: `${name}/m`,\n variable: tidy(() => zerosLike(value).variable(trainable))\n };\n }\n if (this.accumulatedSecondMoment[i] == null) {\n this.accumulatedSecondMoment[i] = {\n originalName: `${name}/v`,\n variable: tidy(() => zerosLike(value).variable(trainable))\n };\n }\n\n const gradient = Array.isArray(variableGradients) ?\n variableGradients[i].tensor :\n variableGradients[name];\n if (gradient == null) {\n

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return;\n      }\n\n
    const firstMoment = this.accumulatedFirstMoment[i].variable;\n      const secondMoment =
this.accumulatedSecondMoment[i].variable;\n\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\n      const biasCorrectedFirstMoment =
div(newFirstMoment, oneMinusAccBeta1);\n      const biasCorrectedSecondMoment =\n
div(newSecondMoment, oneMinusAccBeta2);\n\n      firstMoment.assign(newFirstMoment);\n
secondMoment.assign(newSecondMoment);\n\n      const newValue =\n
add(mul(div(biasCorrectedFirstMoment,\n                  add(sqrt(biasCorrectedSecondMoment), this.epsilon)),\n
        -this.learningRate),\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\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
    this.accBeta2.assign(pow(this.beta2, this.iterations_ + 1));\n  });\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)\n          .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}\nregisterClass(AdamOptimizer);\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 {abs} from '../ops/abs';\nimport
{add} from '../ops/add';\nimport {div} from '../ops/div';\nimport {maximum} from '../ops/maximum';\nimport {mul}
from '../ops/mul';\nimport {scalar} from '../ops/scalar';\nimport {sub} from '../ops/sub';\nimport {zerosLike} from
'../ops/zeros_like';\nimport {ConfigDict, registerClass, Serializable, SerializableConstructor} from
'../serialization';\nimport {Variable} from '../tensor';\nimport {NamedTensor, NamedVariableMap} from
'../tensor_types';\n\nimport {Optimizer, OptimizerVariable} from './optimizer';\n\nexport class AdamaxOptimizer
extends Optimizer {\n  /** @nocollapse */\n  static className = 'Adamax';  // Note: Name matters for Python
compatbility.\n  private accBeta1: Variable;\n  private iteration: Variable;\n\n  private accumulatedFirstMoment:
```

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OptimizerVariable[] = [];\n  private accumulatedWeightedInfNorm: OptimizerVariable[] = [];\n\n  constructor(\n protected
 learningRate: number, protected beta1: number,\n      protected beta2: number, protected epsilon: number = null,\n
 protected decay = 0.0) {\n    super();\n\n    tidy(() => {\n      this.iteration = scalar(0).variable();\n      this.accBeta1 =
scalar(beta1).variable();\n    });\n\n    if (epsilon == null) {\n      this.epsilon = ENGINE.backend.epsilon();\n    }\n
}\n\n  applyGradients(variableGradients: NamedVariableMap|NamedTensor[]) {\n    const variableNames =
Array.isArray(variableGradients) ?\n        variableGradients.map(item => item.name) :\n
Object.keys(variableGradients);\n\n    tidy(() => {\n      const oneMinusAccBeta1 = sub(1, this.accBeta1);\n      const
lr =\n          div(-this.learningRate, add(mul(this.iteration, this.decay), 1));\n\n      variableNames.forEach((name, i)
=> {\n        const value = ENGINE.registeredVariables[name];\n        const trainable = false;\n        if
(this.accumulatedFirstMoment[i] == null) {\n          this.accumulatedFirstMoment[i]
 = {\n            originalName: `${name}/m`,\n            variable: zerosLike(value).variable(trainable)\n          };\n
}\n        if (this.accumulatedWeightedInfNorm[i] == null) {\n          this.accumulatedWeightedInfNorm[i] = {\n
 originalName: `${name}/v`,\n            variable: zerosLike(value).variable(trainable)\n          };\n        }\n\n        const
gradient = Array.isArray(variableGradients) ?\n            variableGradients[i].tensor :\n
variableGradients[name];\n        if (gradient == null) {\n          return;\n        }\n\n        const firstMoment =
this.accumulatedFirstMoment[i].variable;\n        const weightedInfNorm =
this.accumulatedWeightedInfNorm[i].variable;\n\n        const newFirstMoment =\n            add(mul(firstMoment,
this.beta1), mul(gradient, 1 - this.beta1));\n\n        const ut0 = mul(weightedInfNorm, this.beta2);\n        const ut1 =
abs(gradient);\n\n        const newWeightedInfNorm = maximum(ut0, ut1);\n\n
      firstMoment.assign(newFirstMoment);\n        weightedInfNorm.assign(newWeightedInfNorm);\n\n        const
newValue =\n            add(mul(div(lr, oneMinusAccBeta1),\n                    div(newFirstMoment,
add(newWeightedInfNorm, this.epsilon))),\n                value);\n\n        value.assign(newValue);\n      });\n\n
this.iteration.assign(add(this.iteration, 1));\n      this.accBeta1.assign(mul(this.accBeta1, this.beta1));\n    });\n
this.incrementIterations();\n  }\n\n  dispose(): void {\n    this.accBeta1.dispose();\n    this.iteration.dispose();\n\n    if
(this.accumulatedFirstMoment != null) {\n      dispose(this.accumulatedFirstMoment.map(v => v.variable));\n    }\n
if (this.accumulatedWeightedInfNorm != null) {\n      dispose(this.accumulatedWeightedInfNorm.map(v =>
v.variable));\n    }\n  }\n\n  async getWeights(): Promise<NamedTensor[]> {\n    throw new Error('getWeights() is
not implemented for Adamax yet.');\n  }\n\n  async setWeights(weightValues: NamedTensor[]):
 Promise<void> {\n    throw new Error('setWeights() is not implemented for Adamax yet.');\n  }\n\n  getConfig():
ConfigDict {\n    return {\n      'learningRate': this.learningRate,\n      'beta1': this.beta1,\n      'beta2': this.beta2,\n
'epsilon': this.epsilon,\n      'decay': this.decay\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'], config['decay']);\n
}\n}\nregisterClass(AdamaxOptimizer);\n","/**\n * @license\n * Copyright 2018 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 *
==========================================================================\n
*/\n\nimport {ENGINE} from '../engine';\nimport {keep, tidy} from '../globals';\nimport {add} from
'../ops/add';\nimport {mul} from '../ops/mul';\nimport {scalar} from '../ops/scalar';\nimport {ConfigDict,
registerClass, Serializable, SerializableConstructor} from '../serialization';\nimport {Scalar} from '../tensor';\nimport
{NamedTensor, NamedTensorMap} from '../tensor_types';\n\nimport {Optimizer} from './optimizer';\n\n/**
@doclink Optimizer */\nexport class SGDOptimizer extends Optimizer {\n  /** @nocollapse */\n  static className
= 'SGD';  // Note: Name matters for Python compatibility.\n  protected c: Scalar;\n\n  constructor(protected
```

learningRate: number) {\n super();\n this.setLearningRate(learningRate);\n }\n\n applyGradients(variableGradients: NamedTensorMap|NamedTensor[]) {\n const varNames = Array.isArray(variableGradients) ?\n variableGradients.map(v => v.name) :\n Object.keys(variableGradients);\n varNames.forEach((name, i) => {\n const gradient = Array.isArray(variableGradients) ?\n variableGradients[i].tensor :\n variableGradients[name];\n if (gradient == null) {\n return;\n }\n const value = ENGINE.registeredVariables[name];\n tidy(() => {\n const newValue = add(mul(this.c, gradient), value);\n value.assign(newValue);\n });\n });\n this.incrementIterations();\n }\n\n /**\n * Sets the learning rate of the optimizer.\n */\n setLearningRate(learningRate: number) {\n this.learningRate = learningRate;\n if (this.c != null) {\n this.c.dispose();\n }\n this.c = keep(scalar(-learningRate));\n }\n\n dispose() {\n this.c.dispose();\n }\n\n async getWeights(): Promise<NamedTensor[]> {\n return [await this.saveIterations()];\n }\n\n async setWeights(weightValues: NamedTensor[]): Promise<void> {\n weightValues = await this.extractIterations(weightValues);\n if (weightValues.length !== 0) {\n throw new Error('SGD optimizer does not have settable weights.');\n }\n }\n\n getConfig(): ConfigDict {\n return {'learningRate': this.learningRate};\n }\n\n /** @nocollapse */\n static fromConfig<T extends Serializable>(\n cls: SerializableConstructor<T>, config: ConfigDict): T {\n return new cls(config['learningRate']);\n }\n}\nregisterClass(SGDOptimizer);\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 {ENGINE} from '../engine';\nimport {dispose, tidy} from '../globals';\nimport {add} from '../ops/add';\nimport {mul} from '../ops/mul';\nimport {scalar} from '../ops/scalar';\nimport {zerosLike} from '../ops/zeros_like';\nimport {ConfigDict, registerClass, Serializable, SerializableConstructor} from '../serialization';\nimport {Scalar, Tensor} from '../tensor';\nimport {NamedTensor, NamedVariableMap} from '../tensor_types';\n\nimport {OptimizerVariable} from './optimizer';\nimport {SGDOptimizer} from './sgd_optimizer';\n\n/** @doclink Optimizer */\nexport class MomentumOptimizer extends SGDOptimizer {\n /** @nocollapse */\n static className = 'Momentum'; // Name matters for Python compatibility.\n private m: Scalar;\n private accumulations: OptimizerVariable[] = [];\n\n constructor(\n protected learningRate: number, private momentum: number,\n private useNesterov = false) {\n super(learningRate);\n this.m = scalar(this.momentum);\n }\n\n applyGradients(variableGradients: NamedVariableMap|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 if (this.accumulations[i] == null) {\n const trainable = false;\n this.accumulations[i] = {\n originalName: `${name}/momentum`,\n variable: tidy(() => zerosLike(value).variable(trainable))\n };\n }\n const accumulation = this.accumulations[i].variable;\n const gradient = Array.isArray(variableGradients) ?\n variableGradients[i].tensor :\n variableGradients[name];\n if (gradient == null) {\n return;\n }\n\n tidy(() => {\n let newValue: Tensor;\n const newAccumulation = add(mul(this.m, accumulation), gradient);\n if (this.useNesterov) {\n newValue = add(\n mul(this.c, add(gradient, mul(newAccumulation, this.m))), value);\n } else {\n newValue = add(mul(this.c, newAccumulation), value);\n }\n accumulation.assign(newAccumulation);\n value.assign(newValue);\n });\n });\n this.incrementIterations();\n }\n\n dispose(): void {\n this.m.dispose();\n if (this.accumulations != null) {\n dispose(this.accumulations.map(v => v.variable));\n }\n }\n\n /**\n * Sets the momentum of the optimizer.\n

```
*\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}\nregisterClass(MomentumOptimizer);\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 {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';\n\nimport {Optimizer, OptimizerVariable} from './optimizer';\n\n/**
@doclink Optimizer */\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    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: `${name}/rms`,\n          variable: tidy(() =>
zerosLike(value).variable(trainable))\n        };\n      }\n      if (this.accumulatedMoments[i] == null) {\n
this.accumulatedMoments[i] = {\n          originalName: `${name}/momentum`,\n          variable: tidy(() =>
zerosLike(value).variable(trainable))\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      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              add(mul(accumulatedMeanGrad, this.decay),\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
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                                        originalName: v.name,\n
                    variable: v.tensor.variable(\n                                        trainable)\n
            }));\n    this.accumulatedMoments =\n        weightValues.slice(variableCount, variableCount * 2)\n
.map(v => ({\n
        originalName: v.name,\n                variable: v.tensor.variable(trainable)\n              }));\n    if
(this.centered) {\n      this.accumulatedMeanGrads =\n          weightValues.slice(variableCount * 2, variableCount *
3)\n            .map(v => ({\n                originalName: v.name,\n                variable:
v.tensor.variable(trainable)\n              }));\n    }\n  }\n\n  getConfig(): ConfigDict {\n    return {\n
'learningRate': this.learningRate,\n      'decay': this.decay,\n      'momentum': this.momentum,\n      'epsilon':
this.epsilon,\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
config['learningRate'], config['decay'], config['momentum'],\n        config['epsilon'], config['centered']);\n
}\n}\nregisterClass(RMSPropOptimizer);\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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OR CONDITIONS OF ANY 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 {AdadeltaOptimizer} from './adadelta_optimizer';\nimport {AdagradOptimizer} from
'./adagrad_optimizer';\nimport {AdamOptimizer} from './adam_optimizer';\nimport {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()}, 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\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 * @param decay The learning rate decay over each update.\n *\n * @doc {heading: 'Training', subheading: 'Optimizers', namespace: 'train'}\n */\n static adamax(\n learningRate = 0.002, beta1 = 0.9, beta2 = 0.999, epsilon: number = null,\n decay = 0.0): AdamaxOptimizer {\n return new AdamaxOptimizer(learningRate, beta1, beta2, epsilon, decay);\n }\n\n /**\n * Constructs a `tf.AdagradOptimizer` that uses the Adagrad algorithm.\n * See\n * [http://www.jmlr.org/papers/volume12/duchi11a/duchi11a.pdf](\n * http://www.jmlr.org/papers/volume12/duchi11a/duchi11a.pdf)\n * or\n * [http://ruder.io/optimizing-gradient-descent/index.html#adagrad](\n * http://ruder.io/optimizing-gradient-descent/index.html#adagrad)\n *\n * @param learningRate The learning
rate to use for the Adagrad gradient\n * descent algorithm.\n * @param initialAccumulatorValue Starting value for the accumulators, must be\n * positive.\n *\n * @doc {heading: 'Training', subheading: 'Optimizers', namespace: 'train'}\n */\n static adagrad(learningRate: number, initialAccumulatorValue = 0.1):\n AdagradOptimizer {\n return new AdagradOptimizer(learningRate, initialAccumulatorValue);\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// So typings can propagate.\nimport {AdadeltaOptimizer} from './optimizers/adadelta_optimizer';\nimport {AdagradOptimizer} from './optimizers/adagrad_optimizer';\nimport {AdamOptimizer} from './optimizers/adam_optimizer';\nimport {AdamaxOptimizer} from './optimizers/adamax_optimizer';\nimport {MomentumOptimizer} from './optimizers/momentum_optimizer';\nimport {OptimizerConstructors} from './optimizers/optimizer_constructors';\nimport {RMSPropOptimizer} from './optimizers/rmsprop_optimizer';\nimport {SGDOptimizer} from './optimizers/sgd_optimizer';\n\n// tslint:disable-next-line:no-unused-expression\n[MomentumOptimizer, SGDOptimizer, AdadeltaOptimizer, AdagradOptimizer,\n RMSPropOptimizer, AdamaxOptimizer, AdamOptimizer];\n\nexport const train = {\n sgd: OptimizerConstructors.sgd,\n momentum: OptimizerConstructors.momentum,\n
adadelta: OptimizerConstructors.adadelta,\n adagrad: OptimizerConstructors.adagrad,\n rmsprop: OptimizerConstructors.rmsprop,\n adamax: OptimizerConstructors.adamax,\n adam: OptimizerConstructors.adam\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\nconst delayCallback: Function = (() => {\n if (typeof requestAnimationFrame
!== 'undefined') {\n return requestAnimationFrame;\n } else if (typeof setImmediate !== 'undefined') {\n return setImmediate;\n }\n return (f: Function) => f(); // no delays\n})();\n\n/**\n * Returns a promise that resolve when a requestAnimationFrame has completed.\n *\n * On Node.js this uses setImmediate instead of requestAnimationFrame.\n *\n * This is simply a sugar method so that users can do the following:\n * `await tf.nextFrame();`\n *\n * @doc {heading: 'Performance', subheading: 'Timing'}\n */\nfunction nextFrame():

Promise<void> {\n return new Promise<void>(resolve => delayCallback(() => resolve()));\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 (${rank})`);\n });\n\n util.assert(\n   axis >= 0 && axis < rank,\n   () => `Error in concat${rank}D: axis must be between 0 and ${rank - 1}.`);\n\n const firstShape = shapes[0];\n shapes.forEach((shape, i) => {\n   for (let r = 0; r < rank; r++) {\n   util.assert(\n   (r === axis) || (shape[r] === firstShape[r]),\n   () => `Error in concat${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 */\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   return inSize;\n }\n return nearestDivisor(inSize, Math.floor(Math.sqrt(inSize)));\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 */\n\n// Returns the image center in pixels.\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 * 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 *
==========\n */\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\n  if (batchToSpace) {\n    reshapedPermuted.push(inputShape[0] / prod);\n  } else {\n    reshapedPermuted.push(inputShape[0] * prod);\n  }\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\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*/\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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 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 *\n * This is the inverse of mergeRealAndImagArrays.\n *\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 comple 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): {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 * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n
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==========================================================================\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  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\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {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 } 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,\n batchDims: number): GatherOpShapeInfo {\n const indicesRank = indices.shape.length;\n const xRank = x.shape.length;\n\n if (batchDims !== 0) {\n if (batchDims < -indicesRank || batchDims > indicesRank) {\n throw new Error(`Expect batchDims in the range of [-${indicesRank}, ${\n indicesRank}], but got ${batchDims}`);\n }\n }\n\n if (batchDims < 0) {\n batchDims += indicesRank;\n }\n\n if (batchDims > xRank) {\n throw new Error(`batchDims (${batchDims}) must be less than rank(x) (\n ${xRank}).`);\n }\n\n if (axis < batchDims) {\n throw new Error(`batchDims (${\n batchDims}) must be less than or equal to axis (${axis}).`);\n }\n\n for (let i = 0; i < batchDims; ++i) {\n if (x.shape[i] !== indices.shape[i]) {\n throw new Error(\n `x.shape[${i}]: ${x.shape[i]} should be equal to indices.shape[${\n i}]: ${indices.shape[i]}.`);\n }\n }\n\n const dimSize = x.shape[axis];\n\n const outputShape: number[] = [];\n let batchSize = 1;\n let outerSize = 1;\n let sliceSize = 1;\n\n for (let i = 0; i < batchDims; ++i) {\n outputShape.push(x.shape[i]);\n batchSize *= x.shape[i];\n }\n\n for (let i = batchDims; i < axis; i++) {\n outputShape.push(x.shape[i]);\n outerSize *= x.shape[i];\n }\n\n for (let i = batchDims; i < indicesRank; i++) {\n outputShape.push(indices.shape[i]);\n }\n\n for (let i = axis + 1; i < xRank; i++) {\n outputShape.push(x.shape[i]);\n sliceSize *= x.shape[i];\n }\n\n return {batchSize, sliceSize, outerSize, dimSize, outputShape};\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 {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 * @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
*/\n\nexport {nonMaxSuppressionV3Impl, nonMaxSuppressionV4Impl, nonMaxSuppressionV5Impl} from
'./non_max_suppression_impl';\nexport {whereImpl} from './where_impl';\n","/**\n * @license\n * Copyright 2020
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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// 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// 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
```

'./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// 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\n// Required side effectful code.\nimport './base_side_effects';\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
*/\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

!== '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\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 */\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 */\n DENSE,\n\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 */\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

(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 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 * @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 {env, TensorInfo, util} from '@tensorflow/tfjs-core';\n\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)

{\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,\n 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.');\n  }\n}\n\nexport function createStaticVertexBuffer(\n    gl: WebGLRenderingContext, data: Float32Array): WebGLBuffer {\n  const buffer: WebGLBuffer = throwIfNull<WebGLBuffer>(\n      gl, () => gl.createBuffer(), 'Unable to create WebGLBuffer');\n  callAndCheck(gl, () => gl.bindBuffer(gl.ARRAY_BUFFER, buffer));\n  callAndCheck(gl, () => gl.bufferData(gl.ARRAY_BUFFER, data, gl.STATIC_DRAW));\n  return buffer;\n}\n\nexport function createStaticIndexBuffer(\n    gl: WebGLRenderingContext, data: Uint16Array): WebGLBuffer {\n  const buffer: WebGLBuffer = throwIfNull<WebGLBuffer>(\n      gl, () => gl.createBuffer(), 'Unable to create WebGLBuffer');\n  callAndCheck(gl, () => gl.bindBuffer(gl.ELEMENT_ARRAY_BUFFER,\n      buffer));\n  callAndCheck(\n      gl, () => gl.bufferData(gl.ELEMENT_ARRAY_BUFFER, data,\n      gl.STATIC_DRAW));\n  return buffer;\n}\n\nexport function getNumChannels(): number {\n  if (env().getNumber('WEBGL_VERSION') === 2) {\n    return 1;\n  }\n  return 4;\n}\n\nexport function createTexture(gl: WebGLRenderingContext): WebGLTexture {\n  return throwIfNull<WebGLTexture>(\n      gl, () => gl.createTexture(), 'Unable to create WebGLTexture.');\n}\n\nexport function validateTextureSize(width: number, height: number) {\n  const maxTextureSize = env().getNumber('WEBGL_MAX_TEXTURE_SIZE');\n  if ((width <= 0) || (height <= 0)) {\n    const requested = `[${width}x${height}]`;\n    throw new Error('Requested texture size ' + requested + ' is invalid.');\n  }\n  if ((width > maxTextureSize) || (height > maxTextureSize)) {\n    const requested = `[${width}x${height}]`;\n    const max = `[${maxTextureSize}x${maxTextureSize}]`;\n    throw new Error(\n        'Requested
    texture size ' + requested +\n        ' greater than WebGL maximum on this browser / GPU ' + max + '.');\n  }\n}\n\nexport function createFramebuffer(gl: WebGLRenderingContext): WebGLFramebuffer {\n  return throwIfNull<WebGLFramebuffer>(\n      gl, () => gl.createFramebuffer(), 'Unable to create WebGLFramebuffer.');\n}\n\nexport function bindVertexBufferToProgramAttribute(\n    gl: WebGLRenderingContext, program: WebGLProgram, attribute: string,\n    buffer: WebGLBuffer, arrayEntriesPerItem: number, itemStrideInBytes: number,\n    itemOffsetInBytes: number): boolean {\n  const loc = gl.getAttribLocation(program, attribute);\n  if (loc === -1) {\n    // The GPU compiler decided to strip out this attribute because it's unused,\n    // thus no need to bind.\n    return false;\n  }\n  callAndCheck(gl, () => gl.bindBuffer(gl.ARRAY_BUFFER, buffer));\n  callAndCheck(\n      gl,\n      () => gl.vertexAttribPointer(\n          loc, arrayEntriesPerItem, gl.FLOAT, false, itemStrideInBytes,\n          itemOffsetInBytes));\n  callAndCheck(gl, () => gl.enableVertexAttribArray(loc));\n  return true;\n}\n\nexport function bindTextureUnit(\n    gl: WebGLRenderingContext, texture: WebGLTexture, textureUnit: number) {\n  validateTextureUnit(gl, textureUnit);\n  callAndCheck(gl, () => gl.activeTexture(gl.TEXTURE0 + textureUnit));\n  callAndCheck(gl, () => gl.bindTexture(gl.TEXTURE_2D, texture));\n}\n\nexport function unbindTextureUnit(\n    gl: WebGLRenderingContext, textureUnit: number) {\n  validateTextureUnit(gl, textureUnit);\n  callAndCheck(gl, () => gl.activeTexture(gl.TEXTURE0 + textureUnit));\n  callAndCheck(gl, () => gl.bindTexture(gl.TEXTURE_2D, null));\n}\n\nexport function getProgramUniformLocationOrThrow(\n    gl: WebGLRenderingContext, program: WebGLProgram,\n    uniformName: string): WebGLUniformLocation {\n  return throwIfNull<WebGLUniformLocation>(\n      gl, () => gl.getUniformLocation(program, uniformName),\n      'uniform \"' + uniformName + '\" not present in
    program.');\n}\n\nexport function getProgramUniformLocation(\n    gl: WebGLRenderingContext, program: WebGLProgram,\n    uniformName: string): WebGLUniformLocation {\n  return gl.getUniformLocation(program, uniformName);\n}\n\nexport function bindTextureToProgramUniformSampler(\n    gl: WebGLRenderingContext, texture: WebGLTexture,\n    uniformSamplerLocation: WebGLUniformLocation, textureUnit: number) {\n  callAndCheck(gl, () => bindTextureUnit(gl, texture, textureUnit));\n  callAndCheck(gl, () => gl.uniform1i(uniformSamplerLocation, textureUnit));\n}\n\nexport function bindCanvasToFramebuffer(gl: WebGLRenderingContext) {\n  callAndCheck(gl, () => gl.bindFramebuffer(gl.FRAMEBUFFER, null));\n  callAndCheck(gl, () => gl.viewport(0, 0, gl.canvas.width, gl.canvas.height));\n  callAndCheck(gl, () => gl.scissor(0,
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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\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)] 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 &&\n      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 */\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.\nlet MAX_TEXTURE_SIZE: number;\nlet MAX_TEXTURES_IN_SHADER: number;\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\nexport function resetMaxTextureSize() {\n  MAX_TEXTURE_SIZE = null;\n}\nexport function resetMaxTexturesInShader() {\n  MAX_TEXTURES_IN_SHADER = null;\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\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\nexport function hasExtension(gl: WebGLRenderingContext, extensionName: string) {\n  const ext = gl.getExtension(extensionName);\n  return ext != null;\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\nexport function isCapableOfRenderingToFloatTexture(webGLVersion:\n    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:\n    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) ===\n      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  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 * @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\n/** 0: No WebGL, 1: WebGL 1.0, 2: WebGL 2.0. */\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/** Whether to check for numerical representation problems. */\nENV.registerFlag('WEBGL_CHECK_NUMERICAL_PROBLEMS', () => false);\n\nENV.registerFlag(\n 'WEBGL_BUFFER_SUPPORTED', () => ENV.get('WEBGL_VERSION') === 2);\n\n/** Whether the WebGL backend will sometimes forward ops to the CPU. */\nENV.registerFlag('WEBGL_CPU_FORWARD', () => true);\n\n/** Whether the WebGL backend will always use f16 textures for rendering. */\nENV.registerFlag('WEBGL_FORCE_F16_TEXTURES', () => false);\n\n/** Whether to turn all packing related flags on. */\nENV.registerFlag('WEBGL_PACK', () => ENV.getBool('HAS_WEBGL'));\n\n/** Whether we will pack the batchnormalization op. */\nENV.registerFlag('WEBGL_PACK_NORMALIZATION', () => ENV.getBool('WEBGL_PACK'));\n\n/** Whether we will pack the clip op. */\nENV.registerFlag('WEBGL_PACK_CLIP', () => ENV.getBool('WEBGL_PACK'));\n\n/** Whether we will pack the depthwise conv op. */\n// TODO: https://github.com/tensorflow/tfjs/issues/1679\nENV.registerFlag('WEBGL_PACK_DEPTHWISECONV', () => false);\n\n/** Whether we will pack binary ops. */\nENV.registerFlag(\n 'WEBGL_PACK_BINARY_OPERATIONS', () => ENV.getBool('WEBGL_PACK'));\n\n/** Whether we will pack unary ops. */\nENV.registerFlag(\n    'WEBGL_PACK_UNARY_OPERATIONS', () => ENV.getBool('WEBGL_PACK'));\n\n/** Whether we will pack array ops. */\nENV.registerFlag(\n 'WEBGL_PACK_ARRAY_OPERATIONS', () => ENV.getBool('WEBGL_PACK'));\n\n/** Whether we will pack image ops. */\nENV.registerFlag(\n    'WEBGL_PACK_IMAGE_OPERATIONS', () => ENV.getBool('WEBGL_PACK'));\n\n/** Whether we will pack reduce ops. */\nENV.registerFlag('WEBGL_PACK_REDUCE', () => ENV.getBool('WEBGL_PACK'));\n\n/** Whether packed WebGL kernels lazily unpack their outputs. */\nENV.registerFlag('WEBGL_LAZILY_UNPACK', () => ENV.getBool('WEBGL_PACK'));\n\n/** Whether we will use the im2col algorithm to speed up convolutions. */\nENV.registerFlag('WEBGL_CONV_IM2COL', () => ENV.getBool('WEBGL_PACK'));\n\n/** The maximum texture
 dimension. */\nENV.registerFlag(\n    'WEBGL_MAX_TEXTURE_SIZE',\n    () => getWebGLMaxTextureSize(ENV.getNumber('WEBGL_VERSION')));\n\n/** The maximum texture dimension. */\nENV.registerFlag(\n    'WEBGL_MAX_TEXTURES_IN_SHADER',\n    () => getMaxTexturesInShader(ENV.getNumber('WEBGL_VERSION')));\n\n/**\n * The disjoint_query_timer extension version.\n * 0: disabled, 1: EXT_disjoint_timer_query, 2:\n * EXT_disjoint_timer_query_webgl2.\n * In Firefox with WebGL 2.0,\n * EXT_disjoint_timer_query_webgl2 is not available, so we must use the\n * WebGL 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  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 */\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 */\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.\n */\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 * @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 {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  } 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 bvec4(isnan(val.x), isnan(val.y), isnan(val.z), isnan(val.w));\n }\n `;\n defineSpecialInf = `\n uniform float 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 + vec4(0.5)));\n }\n `;\n }\n\n return {\n version,\n attribute,\n varyingVs,\n varyingFs,\n texture2D,\n output,\n defineOutput,\n defineSpecialNaN,\n defineSpecialInf,\n defineRound\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 {util} from '@tensorflow/tfjs-core';\n\n/**\n * Produces GLSL code that derives logical coordinates 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 */\nexport function getLogicalCoordinatesFromFlatIndex(\n coords: string[], shape: number[], index = 'index'): string {\n const strides = util.computeStrides(shape);\n return strides\n .map((stride, i) => {\n const line1 = `int ${coords[i]} = ${index} / ${stride}`;\n const line2 = i === strides.length - 1 ?\n `int ${coords[i + 1]} = ${index} - ${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 `vec${x.length}(${x.join(',')})`;\n}\n\n/**\n * Produces GLSL code that computes the dot product of the input x and y\n * vectors. Handles splitting inputs into increments of vec4s when necessary.\n */\nexport function dotify(x: string[], 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 `got ${x.length} and ${y.length}`);\n }\n\n const slices: string[] = [];\n const nearestVec4 = Math.floor(x.length / 4);\n const nearestVec4Remainder = x.length % 4;\n\n for (let i = 0; i < nearestVec4; i++) {\n const xSlice = x.slice(i * 4, i * 4 + 4);\n const ySlice = y.slice(i * 4, i * 4 + 4);\n slices.push(`${buildVec(xSlice)}, ${buildVec(ySlice)}`);\n }\n\n if (nearestVec4Remainder !== 0) {\n let xSlice = x.slice(nearestVec4 * 4);\n let ySlice = y.slice(nearestVec4 * 4);\n if (xSlice.length === 1) {\n xSlice = xSlice.map(d => `float(${d})`);\n ySlice = ySlice.map(d => `float(${d})`);\n }\n slices.push(`${buildVec(xSlice)}, ${buildVec(ySlice)}`);\n }\n\n return slices.map((d, i) => `dot(${d})`).join('+');\n}\n\n/**\n * Produces GLSL that computes the flat index from 3D coordinates.\n */\nexport function getFlatIndexFrom3D(shape: [number, number,\n number]): string {\n const strides = util.computeStrides(shape).map(d => d.toString());\n\n return `\n int 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 float FLOAT_MIN = 1.17549435e-38;\n\n lowp vec4 encode_float(highp float v) {\n if (isnan(v)) {\n return vec4(255, 255, 255, 255);\n }\n\n highp float av = abs(v);\n\n if(av < FLOAT_MIN) {\n return vec4(0.0, 0.0, 0.0, 0.0);\n } else if(v > FLOAT_MAX) {\n return vec4(0.0, 0.0, 128.0, 127.0) / 255.0;\n } else if(v < -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);\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 -= c[2] / 128.0;\n c[1] = floor(32768.0 * m);\n m -= c[1] / 32768.0;\n c[0] = 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 *

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and\n * limitations under the License.\n *
==========================================================================\n
*/\n\nimport {getGlslDifferences} from './glsl_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 = getGlslDifferences();\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 * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n
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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 {getGlslDifferences} from './glsl_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 = getGlslDifferences();\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 * @license\n * Copyright 2018 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
 * ==========================================================================\n
*/\n\nimport {getGlslDifferences} from './glsl_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 =
getGlslDifferences();\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 * @license\n * Copyright 2018
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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 * limitations under the License.\n *
==========================================================================\n
*/\n\nimport {getGlslDifferences} from './glsl_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------- ------- ------- ------- ------- -------\n010|011  012|013  014|xxx  xxx|xxx  xxx|xxx  xxx|xxx\n\n100|101  102|103  104|xxx  120|121  122|123  124|xxx\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 = getGlslDifferences();\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\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\n
this.userCode = `\n    ${shader_util.getFlatIndexFrom3D(outputShape)}\n\n    void main() {\n      ivec3 coords = getOutputCoords();\n\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} = ${output};\n
    }\n  `;\n }\n}\n","/**\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
==========================================================================\n
*/\n\nimport {PixelData, TypedArray} from '@tensorflow/tfjs-core';\n\nimport {getGlslDifferences} from './glsl_version';\nimport
 * as tex_util from './tex_util';\nimport {TextureConfig} from './tex_util';\nimport * as webgl_util from './webgl_util';\n\nexport function createVertexShader(gl: WebGLRenderingContext): WebGLShader {\n  const glsl = getGlslDifferences();\n  const vertexShaderSource = `${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\nexport function createVertexBuffer(gl: WebGLRenderingContext): WebGLBuffer {\n  // [x y z u v] * [upper-left, lower-left, upper-right, lower-right]\n
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const vertexArray = new Float32Array(\n      [-1, 1, 0, 0, 1, -1, -1, 0, 0, 0, 1, 1, 0, 1, 1, 1, -1, 0, 1, 0]);\n  return
webgl_util.createStaticVertexBuffer(gl, vertexArray);\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\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\nexport function
getInternalFormatForFloat32MatrixTexture(\n    textureConfig: TextureConfig) {\n  return
textureConfig.internalFormatFloat;\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\nexport function getInternalFormatForFloat16MatrixTexture(\n    textureConfig: TextureConfig)
{\n  return textureConfig.internalFormatHalfFloat;\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\nexport function
getInternalFormatForUnsignedBytesMatrixTexture(\n    textureConfig: TextureConfig) {\n  return
textureConfig.downloadTextureFormat;\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\nexport function getInternalFormatForPackedMatrixTexture(\n
textureConfig: TextureConfig) {\n  return textureConfig.internalFormatPackedFloat;\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\nexport
function getInternalFormatForFloat16PackedMatrixTexture(\n    textureConfig: TextureConfig) {\n  return
textureConfig.internalFormatPackedHalfFloat;\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:
WebGLRenderingContext, program: WebGLProgram,\n    vertexBuffer: WebGLBuffer): boolean {\n  const
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, () =>
gl.bindBuffer(gl.ARRAY_BUFFER, vertexBuffer));\n  const success =
webgl_util.bindVertexBufferToProgramAttribute(\n      gl, program, 'clipSpacePos', vertexBuffer, 3, stride,
posOffset);\n  return success &&\n      webgl_util.bindVertexBufferToProgramAttribute(\n          gl, program, 'uv',
vertexBuffer, 2, stride, uvOffset);\n}\n\nexport
 function uploadDenseMatrixToTexture(\n    gl: WebGLRenderingContext, texture: WebGLTexture, width:
number,\n    height: number, data: TypedArray, textureConfig: TextureConfig) {\n  webgl_util.callAndCheck(gl, ()
=> gl.bindTexture(gl.TEXTURE_2D, texture));\n\n  let dataForUpload: TypedArray, texelDataType: number,
internalFormat: number;\n  if (data instanceof Uint8Array) {\n    dataForUpload = new Uint8Array(width * height *
4);\n    texelDataType = gl.UNSIGNED_BYTE;\n    internalFormat = gl.RGBA;\n  } else {\n    dataForUpload =
new Float32Array(width * height * 4);\n    texelDataType = gl.FLOAT;\n    internalFormat =
textureConfig.internalFormatPackedFloat;\n  }\n\n  dataForUpload.set(data);\n\n  webgl_util.callAndCheck(\n
gl,\n      () => gl.texImage2D(\n          gl.TEXTURE_2D, 0, internalFormat, width, height, 0, gl.RGBA,\n
texelDataType, dataForUpload));\n\n  webgl_util.callAndCheck(gl, () => gl.bindTexture(gl.TEXTURE_2D,
null));\n}\n\nexport function
 uploadPixelDataToTexture(\n    gl: WebGLRenderingContext, texture: WebGLTexture,\n    pixels:
PixelData|ImageData|HTMLImageElement|HTMLCanvasElement|\n    HTMLVideoElement) {\n
webgl_util.callAndCheck(gl, () => gl.bindTexture(gl.TEXTURE_2D, texture));\n  if ((pixels as PixelData).data
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
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 |
HTMLImageElement | HTMLCanvasElement |\n                HTMLVideoElement));\n  }\n\n
webgl_util.callAndCheck(gl, () => gl.bindTexture(gl.TEXTURE_2D, null));\n}\n\nexport function
createBufferFromOutputTexture(\n    gl2: WebGL2RenderingContext, rows: number, columns: number,\n
  textureConfig: TextureConfig): WebGLBuffer {\n  // Create and bind the buffer.\n  const buffer =
gl2.createBuffer();\n  webgl_util.callAndCheck(\n      gl2, () => gl2.bindBuffer(gl2.PIXEL_PACK_BUFFER,
buffer));\n\n  // Initialize the buffer to the size of the texture in bytes.\n  const bytesPerFloat = 4;\n  const
valuesPerTexel = 4;\n  const bufferSizeBytes = bytesPerFloat * valuesPerTexel * rows * columns;\n\n
webgl_util.callAndCheck(\n      gl2,\n      () => gl2.bufferData(\n          gl2.PIXEL_PACK_BUFFER,
bufferSizeBytes, gl2.STREAM_READ));\n\n  // Enqueue a command on the GPU command queue to copy of
texture into the\n  // buffer.\n  webgl_util.callAndCheck(\n      gl2, () => gl2.readPixels(0, 0, columns, rows,
gl2.RGBA, gl2.FLOAT, 0));\n\n  webgl_util.callAndCheck(\n      gl2, () =>
gl2.bindBuffer(gl2.PIXEL_PACK_BUFFER, null));\n\n  return buffer;\n}\n\nexport function
downloadFloat32MatrixFromBuffer(\n    gl: WebGLRenderingContext, buffer: WebGLBuffer,\n    size: number):
Float32Array
 {\n  const gl2 = gl as WebGL2RenderingContext;\n\n  const downloadTarget = new Float32Array(size);\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\nexport
function downloadByteEncodedFloatMatrixFromOutputTexture(\n    gl: WebGLRenderingContext, rows: number,
columns: number,\n    textureConfig: TextureConfig) {\n  const [w, h] =\n
tex_util.getUnpackedMatrixTextureShapeWidthHeight(rows, columns);\n\n  const numChannels = 4;\n  const
downloadTarget = new Uint8Array(\n      tex_util.getUnpackedArraySizeFromMatrixSize(rows * columns,
numChannels));\n\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\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\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 * @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 {env, PixelData, TypedArray, util} from '@tensorflow/tfjs-core';\n\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\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\n      this.colorBufferFloatExtension =\n          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 =\n            this.gl.getExtension(COLOR_BUFFER_FLOAT);\n      } else if (webgl_util.hasExtension(this.gl, COLOR_BUFFER_HALF_FLOAT)) {\n        this.colorBufferHalfFloatExtension =\n            this.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\n      |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 |\n          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,
```

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\n   if (queryTimerVersion === 2) {\n   const gl2 = this.gl as WebGL2RenderingContext;\n\n   const timeElapsedNanos = gl2.getQueryParameter(query, gl2.QUERY_RESULT);\n   // Return milliseconds.\n   return timeElapsedNanos / 1000000;\n   } else {\n   const ext = this.getQueryTimerExtensionWebGL1();\n\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\n   if (queryTimerVersion === 2) {\n   const gl2 = this.gl as WebGL2RenderingContext;\n   const ext = this.getQueryTimerExtensionWebGL2();\n\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\n   return available && !this.disjoint;\n   } else {\n   const ext = this.getQueryTimerExtensionWebGL1();\n\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\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 =\n   linearSearchLastTrue(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 ===\n   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):\n   Float32Array {\n   this.bindTextureToFrameBuffer(texture);\n   const result = downloadAndDecode();\n   this.unbindTextureToFrameBuffer();\n\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 =\n   outputMatrixTextureMaybePacked;\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\ntype PollItem = {\n isDoneFn: () => boolean,\n resolveFn: () => void\n};\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 * https://github.com/tensorflow/tfjs/issues/1145\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 compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License
 is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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';\nconst {getBroadcastDims} = backend_util;\nimport {getGlslDifferences, GLSL} from './glsl_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[], outputShape: ShapeInfo, 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\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
floatTextureSampleSnippet = getFloatTextureSampleSnippet(glsl);\n let outputSamplingSnippet: string;\n let
floatTextureSetOutputSnippet: string;\n let shaderPrefix = getShaderPrefix(glsl);\n\n if (outputShape.isPacked) {\n
 outputSamplingSnippet =\n   getPackedOutputSamplingSnippet(outputShape.logicalShape,
 outTexShape);\n   floatTextureSetOutputSnippet = getFloatTextureSetRGBASnippet(glsl);\n } else {\n
outputSamplingSnippet =\n   getOutputSamplingSnippet(outputShape.logicalShape, outTexShape);\n
floatTextureSetOutputSnippet = getFloatTextureSetRSnippet(glsl);\n }\n\n if (usesPackedTextures) {\n
shaderPrefix += SHADER_PACKED_PREFIX;\n }\n\n const source = [\n   shaderPrefix,
floatTextureSampleSnippet, floatTextureSetOutputSnippet,\n   inputPrefixSnippet, outputSamplingSnippet,
inputSamplingSnippet, userCode\n].join('\\n');\n return source;\n}\n\nfunction getSamplerFromInInfo(inInfo:
InputInfo): string {\n const shape = inInfo.shapeInfo.logicalShape;\n switch (shape.length) {\n   case 0:\n   return
getSamplerScalar(inInfo);\n   case 1:\n   return getSampler1D(inInfo);\n   case 2:\n   return
getSampler2D(inInfo);\n   case 3:\n   return getSampler3D(inInfo);\n   case 4:\n   return
getSampler4D(inInfo);\n   case 5:\n   return
 getSampler5D(inInfo);\n   case 6:\n   return getSampler6D(inInfo);\n   default:\n   throw new Error(\n
`${shape.length}-D input sampling` +\n   ` is not yet supported`);\n }\n}\n\nfunction
getPackedSamplerFromInInfo(inInfo: InputInfo): string {\n const shape = inInfo.shapeInfo.logicalShape;\n switch
(shape.length) {\n   case 0:\n   return getPackedSamplerScalar(inInfo);\n   case 1:\n   return
getPackedSampler1D(inInfo);\n   case 2:\n   return getPackedSampler2D(inInfo);\n   case 3:\n   return
getPackedSampler3D(inInfo);\n   default:\n   return getPackedSamplerND(inInfo);\n }\n}\n\nfunction
getInputSamplingSnippet(\n   inInfo: InputInfo, outShapeInfo: ShapeInfo,\n   usesPackedTextures = false): string
{\n let res = '';\n if (usesPackedTextures) {\n   res += getPackedSamplerFromInInfo(inInfo);\n } else {\n   res +=
getSamplerFromInInfo(inInfo);\n }\n\n const inShape = inInfo.shapeInfo.logicalShape;\n const outShape =
outShapeInfo.logicalShape;\n
  if (inShape.length <= outShape.length) {\n   if (usesPackedTextures) {\n   res +=
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    {\n      int x;\n      int y;\n      int
z;\n      int w;\n      int u;\n    };\n\n    struct ivec6\n    {\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}\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`;\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`;\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`;\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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getOutputScalarCoords() {\n  return `\n    int getOutputCoords() {\n      return 0;\n    }\n  `;\n}\n\nfunction
getOutputPacked1DCoords(\n    shape: [number], texShape: [number, number]): string {\n  const packedTexShape
=\n      [Math.ceil(texShape[0] / 2), Math.ceil(texShape[1] / 2)];\n  if (packedTexShape[0] === 1) {\n    return `\n
int getOutputCoords() {\n        return 2 * int(resultUV.x * ${packedTexShape[1]}.0);\n      }\n    `;\n  }\n\n  if
(packedTexShape[1] === 1) {\n    return `\n      int getOutputCoords() {\n        return 2 * int(resultUV.y *
${packedTexShape[0]}.0);\n      }\n    `;\n  }\n\n  return `\n    int getOutputCoords() {\n      ivec2 resTexRC =
ivec2(resultUV.yx *\n                             vec2(${packedTexShape[0]}, ${packedTexShape[1]}));\n
    return 2 * (resTexRC.x * ${packedTexShape[1]} + resTexRC.y);\n    }\n  `;\n}\n\nfunction
getOutput1DCoords(\n    shape: [number], texShape: [number, number]): string {\n  if (texShape[0] === 1) {\n
return `\n      int getOutputCoords() {\n        return int(resultUV.x * ${texShape[1]}.0);\n      }\n    `;\n  }\n  if
(texShape[1] === 1) {\n    return `\n      int getOutputCoords() {\n        return int(resultUV.y * ${texShape[0]}.0);\n
  }\n    `;\n  }\n  return `\n    int getOutputCoords() {\n      ivec2 resTexRC = ivec2(resultUV.yx *\n
vec2(${texShape[0]}, ${texShape[1]}));\n      return resTexRC.x * ${texShape[1]} + resTexRC.y;\n    }\n
`;\n}\n\nfunction getOutputPacked3DCoords(\n    shape: [number, number, number], texShape: [number, number]):
string {\n  const packedTexShape =\n      [Math.ceil(texShape[0] / 2), Math.ceil(texShape[1] / 2)];\n  const
texelsInLogicalRow = Math.ceil(shape[2] / 2);\n  const texelsInBatch = texelsInLogicalRow
 * Math.ceil(shape[1] / 2);\n\n  return `\n    ivec3 getOutputCoords() {\n      ivec2 resTexRC = ivec2(resultUV.yx *\n
                vec2(${packedTexShape[0]}, ${packedTexShape[1]}));\n      int index = resTexRC.x *
${packedTexShape[1]} + resTexRC.y;\n\n      int b = index / ${texelsInBatch};\n      index -= b *
${texelsInBatch};\n\n      int r = 2 * (index / ${texelsInLogicalRow});\n      int c = imod(index,
${texelsInLogicalRow}) * 2;\n\n      return ivec3(b, r, c);\n    }\n  `;\n}\n\nfunction getOutput3DCoords(\n    shape:
[number, number, number], texShape: [number, number]): string {\n  const coordsFromIndexSnippet =\n
shader_util.getLogicalCoordinatesFromFlatIndex(['r', 'c', 'd'], shape);\n\n  return `\n    ivec3 getOutputCoords() {\n
 ivec2 resTexRC = ivec2(resultUV.yx *\n                             vec2(${texShape[0]}, ${texShape[1]}));\n      int index
= resTexRC.x * ${texShape[1]} + resTexRC.y;\n      ${coordsFromIndexSnippet}\n      return
 ivec3(r, c, d);\n    }\n  `;\n}\n\nfunction getOutputPackedNDCoords(\n    shape: number[], texShape: [number,
number]): string {\n  const packedTexShape =\n      [Math.ceil(texShape[0] / 2), Math.ceil(texShape[1] / 2)];\n\n
const texelsInLogicalRow = Math.ceil(shape[shape.length - 1] / 2);\n  const texelsInBatch =\n
texelsInLogicalRow * Math.ceil(shape[shape.length - 2] / 2);\n  let texelsInBatchN = texelsInBatch;\n  let batches =
``;\n  let coords = 'b, r, c';\n\n  for (let b = 2; b < shape.length - 1; b++) {\n    texelsInBatchN *= shape[shape.length -
b - 1];\n    batches = `\n      int b${b} = index / ${texelsInBatchN};\n      index -= b${b} * ${texelsInBatchN};\n    `
+ batches;\n    coords = `b${b}, ` + coords;\n  }\n\n  return `\n    ivec${shape.length} getOutputCoords() {\n
ivec2 resTexRC = ivec2(resultUV.yx *\n                             vec2(${packedTexShape[0]},
${packedTexShape[1]}));\n      int index = resTexRC.x * ${packedTexShape[1]} + resTexRC.y;\n\n
 ${batches}\n\n      int b = index / ${texelsInBatch};\n      index -= b * ${texelsInBatch};\n\n      int r = 2 * (index /
${texelsInLogicalRow});\n      int c = imod(index, ${texelsInLogicalRow}) * 2;\n\n      return
ivec${shape.length}(${coords});\n    }\n  `;\n}\n\nfunction getOutput4DCoords(\n    shape: [number, number,
number, number],\n    texShape: [number, number]): string {\n  const coordsFromIndexSnippet =
shader_util.getLogicalCoordinatesFromFlatIndex(\n      ['r', 'c', 'd', 'd2'], shape);\n\n  return `\n    ivec4
getOutputCoords() {\n      ivec2 resTexRC = ivec2(resultUV.yx *\n        vec2(${texShape[0]}, ${texShape[1]}));\n
 int index = resTexRC.x * ${texShape[1]} + resTexRC.y;\n      ${coordsFromIndexSnippet}\n      return ivec4(r, c,
d, d2);\n    }\n  `;\n}\n\nfunction getOutput5DCoords(\n    shape: [number, number, number, number, number],\n
texShape: [number, number]): string {\n  const coordsFromIndexSnippet =
shader_util.getLogicalCoordinatesFromFlatIndex(\n
    ['r', 'c', 'd', 'd2', 'd3'], shape);\n\n  return `\n    ivec5 getOutputCoords() {\n      ivec2 resTexRC =
ivec2(resultUV.yx * vec2(${texShape[0]},\n                             ${texShape[1]}));\n\n      int index = resTexRC.x *
${texShape[1]} + resTexRC.y;\n\n      ${coordsFromIndexSnippet}\n\n      ivec5 outShape = ivec5(r, c, d, d2, d3);\n
  return outShape;\n    }\n  `;\n}\n\nfunction getOutput6DCoords(\n    shape: [number, number, number, number,
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number, number],\n    texShape: [number, number]): string {\n  const coordsFromIndexSnippet =
shader_util.getLogicalCoordinatesFromFlatIndex(\n      ['r', 'c', 'd', 'd2', 'd3', 'd4'], shape);\n\n  return `\n    ivec6
getOutputCoords() {\n      ivec2 resTexRC = ivec2(resultUV.yx *\n          vec2(${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]}, ${texShape[1]}));\n      }\n    `;\n  }\n  if (shape[1] === 1) {\n    return `\n      ivec2
getOutputCoords() {\n        ivec2 resTexRC = ivec2(resultUV.yx *\n                          vec2(${texShape[0]},
${texShape[1]}));\n        int index = resTexRC.x * ${texShape[1]} + resTexRC.y;\n        return ivec2(index, 0);\n
}\n    `;\n  }\n  if (shape[0] === 1) {\n    return `\n      ivec2 getOutputCoords() {\n        ivec2 resTexRC =
ivec2(resultUV.yx *\n                          vec2(${texShape[0]}, ${texShape[1]}));\n        int index = resTexRC.x *
${texShape[1]} + resTexRC.y;\n        return ivec2(0,
 index);\n      }\n    `;\n  }\n  return `\n    ivec2 getOutputCoords() {\n      ivec2 resTexRC = ivec2(resultUV.yx *\n
                vec2(${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  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  return `\n    float ${funcName}(int index) {\n      vec2 uv =
uvFromFlat(${tNumR}, ${tNumC}, index + ${offset});\n      return sampleTexture(${texName}, uv);\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\n        return ${glsl.texture2D}(${texName}, uv);\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\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  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  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  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
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
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\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  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}\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  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\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\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) / 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        // 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 * ${texNumC};\n
    vec2 uv = (vec2(texC, texR) + halfCR) / vec2(${texNumC}, ${texNumR});\n      return
${glsl.texture2D}(${texName}, uv);\n    }\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  if (inputInfo.shapeInfo.isUniform) {\n    // Uniform arrays will be less than
65505 (no
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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  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\nfunction 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\nfunction 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 ${funcName}(int row,
int col, int depth,\n                  int depth2, int depth3, int depth4) {\n        int index = round(dot(\n          vec4(row,
col, depth, depth2),\n          vec4(${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}, ${stride4})) +\n                  float(depth4);\n        vec2 uv = (vec2(texC,
texR) + halfCR) /\n                  vec2(${texNumC}.0, ${texNumR}.0);\n        return sampleTexture(${texName},
uv);\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
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\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 `return
${texName};`;\n  }\n  return `\n    for (int i = 0; i < ${inSize}; i++) {\n      if (i == index) {\n        return
${texName}[i];\n      }\n    }\n  `;\n}\n\nfunction getPackedSamplerAtOutputCoords(\n    inputInfo: InputInfo,
outShapeInfo: ShapeInfo) {\n  const texName = inputInfo.name;\n  const
 texFuncSnippet = texName.charAt(0).toUpperCase() + texName.slice(1);\n  const funcName = 'get' +
texFuncSnippet + 'AtOutCoords';\n  const inRank = inputInfo.shapeInfo.logicalShape.length;\n  const outRank =
outShapeInfo.logicalShape.length;\n\n  const broadcastDims = getBroadcastDims(\n
inputInfo.shapeInfo.logicalShape, outShapeInfo.logicalShape);\n\n  const type = getCoordsDataType(outRank);\n
const rankDiff = outRank - inRank;\n  let coordsSnippet: string;\n  const fields = ['x', 'y', 'z', 'w', 'u', 'v'];\n\n  if
(inRank === 0) {\n    coordsSnippet = '';\n  } else if (outRank < 2 && broadcastDims.length >= 1) {\n
coordsSnippet = 'coords = 0;';\n  } else {\n    coordsSnippet =\n        broadcastDims.map(d => `coords.${fields[d +
rankDiff]} = 0;`)\n            .join('\\n');\n  }\n  let unpackedCoordsSnippet = '';\n  if (outRank < 2 && inRank > 0) {\n
unpackedCoordsSnippet = 'coords';\n  } else {\n    unpackedCoordsSnippet = inputInfo.shapeInfo.logicalShape\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.xy);\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\n    if (broadcastDims.indexOf(rows) > -1 && broadcastDims.indexOf(cols) > -1) {\n
output = `return vec4(outputValue.x);`;\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
vec4(outputValue.xx, outputValue.zz);`;\n    }\n  }\n\n  return `\n    vec4 ${funcName}() {\n      ${type} coords =
getOutputCoords();\n      ${coordsSnippet}\n      vec4 outputValue =
get${texFuncSnippet}(${unpackedCoordsSnippet});\n      ${output}\n    }\n  `;\n}\n\nfunction
getSamplerAtOutputCoords(\n    inputInfo: InputInfo, 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 outTexShape = outShapeInfo.texShape;\n  const
inTexShape = inputInfo.shapeInfo.texShape;\n  const inRank = inputInfo.shapeInfo.logicalShape.length;\n  const
outRank = outShapeInfo.logicalShape.length;\n\n  if (!inputInfo.shapeInfo.isUniform
  && inRank === outRank &&\n      inputInfo.shapeInfo.flatOffset == null &&\n      util.arraysEqual(inTexShape,
outTexShape)) {\n    return `\n      float ${funcName}() {\n        return sampleTexture(${texName}, resultUV);\n
}\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
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.${fields[d + rankDiff]} = 0;`)\n            .join('\\n');\n  }\n
let unpackedCoordsSnippet = '';\n  if (outRank < 2 && inRank > 0) {\n    unpackedCoordsSnippet = 'coords';\n  }
else {\n    unpackedCoordsSnippet = inputInfo.shapeInfo.logicalShape\n
                .map((s, i) => `coords.${fields[i + rankDiff]}`)\n                .join(', ');\n  }\n\n  return `\n
  float ${funcName}() {\n      ${type} coords = getOutputCoords();\n      ${coordsSnippet}\n      return
get${texFuncSnippet}(${unpackedCoordsSnippet});\n    }\n  `;\n}\n\nexport function getCoordsDataType(rank:
number): string {\n  if (rank <= 1) {\n    return 'int';\n  } else if (rank === 2) {\n    return 'ivec2';\n  } else if (rank
=== 3) {\n    return 'ivec3';\n  } else if (rank === 4) {\n    return 'ivec4';\n  } else if (rank === 5) {\n    return
'ivec5';\n  } else if (rank === 6) {\n    return 'ivec6';\n  } else {\n    throw Error(`GPU for rank ${rank} is not yet
supported`);\n  }\n}\n\n/** Returns a new input info (a copy) that has a squeezed logical shape. */\nfunction
squeezeInputInfo(\n    inInfo: InputInfo, squeezedShape: number[]): InputInfo {\n  // Deep copy.\n  const
newInputInfo: InputInfo = JSON.parse(JSON.stringify(inInfo));\n
  newInputInfo.shapeInfo.logicalShape = squeezedShape;\n  return newInputInfo;\n}\n\nfunction
getSqueezedParams(params: string[], keptDims: number[]): string {\n  return keptDims.map(d => params[d]).join(',
');\n}\n","/**\n * @license\n * Copyright 2017 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 {env, Tensor, TypedArray, util} from '@tensorflow/tfjs-core';\n\nimport
 {GPGPUContext} from './gpgpu_context';\nimport * as shader_compiler from './shader_compiler';\nimport
{InputInfo, ShapeInfo} from './shader_compiler';\nimport {PackingScheme, TextureData, TextureUsage} from
'./tex_util';\n\nexport interface GPGPUProgram {\n  variableNames: string[];\n  outputShape: number[];\n
userCode: string;\n  /** If true, this program expects packed input textures. Defaults to false. */\n  packedInputs?:
boolean;\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\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] = 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    // 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\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],\n  [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  gpgpu.setProgram(binary.webGLProgram);\n\n  // Set special uniforms (NAN, INFINITY)\n  if (env().getNumber('WEBGL_VERSION') === 1) {\n    if (binary.infLoc !== null) {\n
```

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[`offset${varName}`];\n\n if (varLoc == null) {\n // The compiler inferred that this variable is not used
 in this shader.\n return;\n }\n\n if (input.isUniform) {\n // Upload the values of the tensor as uniform.\n if (util.sizeFromShape(input.shape) < 2) {\n gpgpu.gl.uniform1f(varLoc, input.uniformValues[0]);\n } else {\n let vals = input.uniformValues;\n if (!(vals instanceof Float32Array)) {\n vals = new Float32Array(vals);\n }\n gpgpu.gl.uniform1fv(varLoc, vals);\n }\n return;\n }\n\n // If the input was sliced, upload the flat offset index.\n if (input.texData.slice != null && varOffsetLoc != null) {\n gpgpu.gl.uniform1i(varOffsetLoc, input.texData.slice.flatOffset);\n }\n\n gpgpu.setInputMatrixTexture(input.texData.texture, varLoc, i);\n });\n\n if (customSetup != null) {\n customSetup(gpgpu, binary.webGLProgram);\n }\n gpgpu.executeProgram();\n}\n\nexport function makeShaderKey(\n program: GPGPUProgram, inputs: TensorData[], output: TensorData): string {\n let keyInputs =
 '';\n inputs.concat(output).forEach(x => {\n const hasOffset = x.texData != null && x.texData.slice != null &&\n x.texData.slice.flatOffset > 0;\n const texShape = x.isUniform ? 'uniform' : x.texData.texShape;\n keyInputs += `${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 * @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 * @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 {Abs, AbsInputs, KernelConfig, KernelFunc, TypedArray, util} from '@tensorflow/tfjs-core';\n\nimport {MathBackendCPU} from '../backend_cpu';\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\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

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 \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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, DataType, NumericDataType, TypedArray, util} from '@tensorflow/tfjs-core';\n\nimport {SimpleBinaryKernelImpl, SimpleBinaryOperation} from './binary_types';\n\n/**\n * Template that creates implementation for binary ops. Supports broadcast.\n */\nexport function createSimpleBinaryKernelImpl(op: SimpleBinaryOperation):\n   SimpleBinaryKernelImpl {\n return (aShape: number[], bShape: number[], aVals: TypedArray,\n   bVals: TypedArray, dtype: DataType): [TypedArray, number[]] => {\n   const newShape = backend_util.assertAndGetBroadcastShape(aShape, bShape);\n\n   const resultRank = newShape.length;\n   const resultStrides = util.computeStrides(newShape);\n   const resultSize = util.sizeFromShape(newShape);\n\n   const result =\n   util.getTypedArrayFromDType(dtype as NumericDataType, resultSize);\n\n   const aRank = aShape.length;\n
    const bRank = bShape.length;\n\n   const aStrides = util.computeStrides(aShape);\n   const bStrides = 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 + bBroadcastDims.length === 0) {\n   for (let i = 0; i < result.length; ++i) {\n   result[i] = op(aVals[i % aVals.length], bVals[i % bVals.length]);\n   }\n   } else {\n   for (let i = 0; i < result.length; ++i) {\n   const loc = util.indexToLoc(i, resultRank, resultStrides);\n\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 = util.locToIndex(bLoc, bRank, bStrides);\n\n   result[i] = op(aVals[aIndex], bVals[bIndex]);\n
    }\n   }\n\n   return [result, newShape];\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 {Complex, ComplexInputs, KernelConfig, KernelFunc, TensorInfo, TypedArray} from '@tensorflow/tfjs-core';\n\nimport {MathBackendCPU} from '../backend_cpu';\n\nexport function complex(args: {inputs: ComplexInputs,
 backend: MathBackendCPU}):\n   TensorInfo {\n const {inputs, backend} = args;\n const {real, imag} = inputs;\n\n const realVals = backend.data.get(real.dataId).values as TypedArray;\n const imagVals = backend.data.get(imag.dataId).values as TypedArray;\n\n const complexInfo = 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, when complexData is disposed the\n // underlying tensorData will be disposed.\n complex.complexTensorInfos = {\n   real: backend.makeTensorInfo(real.shape, 'float32', realVals),\n   imag: backend.makeTensorInfo(imag.shape, '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 * @license\n * Copyright 2020 Google LLC. All Rights

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==========\n
*/\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\n return complex({inputs: {real, imag}, backend});\n }\n\n const values = util.makeZerosTypedArray(util.sizeFromShape(shape), dtype);\n\n return backend.makeTensorInfo(shape, dtype, values);\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 {Identity, IdentityInputs, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-core';\n\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\n backend.incRef(x.dataId);\n\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 * @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
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*/\n\nimport {KernelConfig, KernelFunc, Real, RealInputs, TensorInfo} from '@tensorflow/tfjs-core';\n\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\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 * @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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License.\n *
==========\n
*/\nimport {Cast, CastAttrs, CastInputs, KernelConfig, KernelFunc, TensorInfo, TypedArray, util} from '@tensorflow/tfjs-core';\n\nimport {MathBackendCPU} from '../backend_cpu';\nimport {createSimpleBinaryKernelImpl} from '../utils/binary_impl';\nimport {zeros} from '../utils/zeros_impl';\n\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\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 * @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
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==========\n
*/\n\nimport {backend_util, BinaryInputs, DataType, KernelFunc, TypedArray, util} from '@tensorflow/tfjs-core';\n\nimport {MathBackendCPU} from '../backend_cpu';\nimport {assertNotComplex} from '../cpu_util';\nimport {cast} from '../kernels/Cast';\nimport {complex} from '../kernels/Complex';\n\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\n      const aVals = cpuBackend.data.get(a.dataId).values as TypedArray;\n      const bVals = cpuBackend.data.get(b.dataId).values as TypedArray;\n\n      const $dtype = dtype || a.dtype;\n\n      const [resultData, resultShape] =\n          simpleImpl(a.shape, b.shape, aVals, bVals, $dtype);\n\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\n      const $aComplexVals = cpuBackend.data.get($aComplex.dataId);\n\n      const aReal = $aComplexVals.complexTensorInfos.real;\n      const aImag = $aComplexVals.complexTensorInfos.imag;\n\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\n      const $bComplex = cast(\n          {inputs: {x: b}, backend: cpuBackend, attrs: {dtype: 'complex64'}});\n\n      const $bComplexVals = cpuBackend.data.get($bComplex.dataId);\n\n      const bReal = $bComplexVals.complexTensorInfos.real;\n      const bImag = $bComplexVals.complexTensorInfos.imag;\n\n      const bRealVals =\n          cpuBackend.data.get(bReal.dataId).values as Float32Array;\n      const bImagVals =\n          cpuBackend.data.get(bImag.dataId).values as Float32Array;\n\n      const [resultRealData, resultImagData, resultShape] = complexImpl(\n          a.shape, b.shape, aRealVals, aImagVals, bRealVals, bImagVals);\n\n      const resultReal =\n          cpuBackend.makeTensorInfo(resultShape, 'float32', resultRealData);\n\n      const resultImag =\n          cpuBackend.makeTensorInfo(resultShape, 'float32', resultImagData);\n\n      const result = complex(\n          {inputs: {real: resultReal, imag: resultImag}, backend: cpuBackend});\n\n      cpuBackend.disposeIntermediateTensorInfo($aComplex);\n      cpuBackend.disposeIntermediateTensorInfo($bComplex);\n      cpuBackend.disposeIntermediateTensorInfo(resultReal);\n      cpuBackend.disposeIntermediateTensorInfo(resultImag);\n\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\n      const $dtype = dtype || a.dtype;\n\n      const [resultData, resultShape] =\n          simpleImpl(a.shape, b.shape, aVals, bVals, $dtype);\n\n      return cpuBackend.makeTensorInfo(resultShape, $dtype, resultData);\n    }\n  };\n}\n\n/**\n * Template that creates the complex type implementation for binary ops.\n * Supports broadcast.\n */\nexport 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,\n        bShape);\n    const resultSize = util.sizeFromShape(resultShape);\n    const resultRank = resultShape.length;\n    const resultStrides = util.computeStrides(resultShape);\n\n    const resultRealVals =\n        util.getTypedArrayFromDType('float32', resultSize);\n    const resultImagVals =\n        util.getTypedArrayFromDType('float32', resultSize);\n\n    const aBroadcastDims =\n        backend_util.getBroadcastDims(aShape, resultShape);\n    const bBroadcastDims =\n        backend_util.getBroadcastDims(bShape, resultShape);\n\n    const aVals =\n        backend_util.mergeRealAndImagArrays(aRealVals, aImagVals);\n    const bVals =\n        backend_util.mergeRealAndImagArrays(bRealVals, bImagVals);\n\n    const aRank = aShape.length;\n    const aStrides = util.computeStrides(aShape);\n\n    const bRank = bShape.length;\n    const bStrides =\n        util.computeStrides(bShape);\n\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\n        const result =\n            op(aVals[aIdx * 2], aVals[aIdx * 2 + 1], bVals[bIdx * 2],\n                bVals[bIdx * 2 + 1]);\n\n        resultRealVals[i]
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= result.real;\n resultImagVals[i] = result.imag;\n }\n } else {\n for (let i = 0; i < resultRealVals.length; i++) {\n const loc = util.indexToLoc(i, resultRank, resultStrides);\n\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 = util.locToIndex(bLoc, bRank, bStrides);\n\n const opResult =\n op(aVals[aIndex * 2], aVals[aIndex * 2 + 1], bVals[bIndex * 2],\n bVals[bIndex * 2 + 1]);\n\n resultRealVals[i] = opResult.real;\n resultImagVals[i] = opResult.imag;\n

}\n }\n return [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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {Add, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createSimpleBinaryKernelImpl} from '../utils/binary_impl';\nimport {binaryKernelFunc, createComplexBinaryKernelImpl} from '../utils/binary_utils';\n\nexport

const addImpl = createSimpleBinaryKernelImpl(((a, b) => a + b));\nexport const addComplexImpl =\n createComplexBinaryKernelImpl(((aReal, aImag, bReal, bImag) => {\n return {real: aReal + bReal, imag: aImag + bImag};\n }));\n\nexport const add = binaryKernelFunc(Add, addImpl, addComplexImpl);\n\nexport const addConfig: KernelConfig = {\n kernelName: Add,\n backendName: 'cpu',\n kernelFunc: add\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 {buffer, DataType, Rank, TensorBuffer, TypedArray, util} from '@tensorflow/tfjs-core';\n\nexport function 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\n if (value >= size) {\n continue;\n }\n\n if (weightsSize > 0) {\n outVals[value] += weightsVals[i];\n } else {\n outVals[value] += 1;\n }\n }\n\n return outVals;\n}\n\nexport function bincountReduceImpl<R extends Rank>(\n xBuf: TensorBuffer<R>,
weightsBuf: TensorBuffer<R>, size: number,\n binaryOutput = false): TensorBuffer<R> {\n const numRows = xBuf.shape[0];\n const numCols = xBuf.shape[1];\n\n const outBuf = buffer([numRows, size], weightsBuf.dtype);\n\n for (let i = 0; i < numRows; i++) {\n for (let j = 0; j < numCols; j++) {\n const value = xBuf.get(i, j);\n if (value < 0) {\n throw new Error('Input x must be non-negative!');\n }\n\n if (value >= size) {\n continue;\n }\n\n if (binaryOutput) {\n outBuf.set(1, i, value);\n } else {\n if (weightsBuf.size > 0) {\n outBuf.set(outBuf.get(i, value) + weightsBuf.get(i, j), i, value);\n } else {\n outBuf.set(outBuf.get(i, value) + 1, i, value);\n }\n }\n }\n }\n\n return outBuf as TensorBuffer<R>;\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
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==========\n */\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 */\nexport function createSimpleUnaryImpl(op: SimpleUnaryOperation):\n SimpleUnaryImpl {\n return (values, dtype, attrs) => {\n const newValues =\n util.getTypedArrayFromDType(dtype as NumericDataType, values.length);\n
for (let i = 0; i < values.length; ++i) {\n newValues[i] = op(values[i], attrs);\n }\n return newValues;\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 {DataType, KernelFunc, TypedArray, UnaryInputs, util} from '@tensorflow/tfjs-core';\n\nimport {MathBackendCPU} from '../backend_cpu';\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 */\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 for (let i = 0; i < xSize; ++i) {\n newValues[i] = op(values[i], attrs);\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 */\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 return
cpuBackend.makeTensorInfo(x.shape, $dtype, newValues);\n };\n}\n","/**\n * @license\n * Copyright 2020
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*/\n\nimport {Ceil, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createSimpleUnaryImpl} from
'../utils/unary_impl';\nimport {unaryKernelFuncFromImpl} from '../utils/unary_utils';\n\nexport const ceilImpl =
createSimpleUnaryImpl((xi) => Math.ceil(xi));\nexport const ceil = unaryKernelFuncFromImpl(Ceil,
ceilImpl);\n\nexport const ceilConfig: KernelConfig = {\n  kernelName: Ceil,\n  backendName: 'cpu',\n  kernelFunc:
ceil,\n};\n","/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache
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=============================================================================\n
*/\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\n      (outVals as TypedArray).set(input.vals as TypedArray, offset);\n      offset
+= size;\n    });\n  } else {\n    let colOffset = 0;\n\n    inputs.forEach(input
 => {\n      const decodedData = dtype === 'string' ?\n          backend_util.fromUint8ToStringArray(input.vals as
Uint8Array[]) :\n          input.vals as TypedArray;\n\n      let tIdx = 0;\n\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      }\n\n      colOffset += input.shape[1];\n    });\n
}\n\n  return outVals;\n}\n","/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
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*/\n\nimport {Exp, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createSimpleUnaryImpl} from
'../utils/unary_impl';\nimport {unaryKernelFuncFromImpl} from '../utils/unary_utils';\n\nexport const expImpl =
createSimpleUnaryImpl((xi) => Math.exp(xi));\nexport const exp = unaryKernelFuncFromImpl(Exp,
expImpl);\n\nexport const expConfig: KernelConfig = {\n  kernelName: Exp,\n  backendName: 'cpu',\n  kernelFunc:
exp,\n};\n","/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache
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=============================================================================\n
*/\n\nimport {Expm1, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createSimpleUnaryImpl} from
'../utils/unary_impl';\nimport {unaryKernelFuncFromImpl} from '../utils/unary_utils';\n\nexport const expm1Impl =
createSimpleUnaryImpl((xi) => Math.expm1(xi));\nexport const expm1 = unaryKernelFuncFromImpl(Expm1,
expm1Impl);\n\nexport const expm1Config: KernelConfig = {\n  kernelName: Expm1,\n  backendName: 'cpu',\n
kernelFunc: expm1,\n};\n","/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
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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
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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\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\n   const originalIndex =
xBuf.locToIndex(originalLoc);\n   outBuf.values[i] = xBuf.values[originalIndex];\n }\n\n return outBuf as
TensorBuffer<R, D>;\n}\n","/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
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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 * @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*/\n\nimport {KernelConfig, Less} from '@tensorflow/tfjs-core';\n\nimport {createSimpleBinaryKernelImpl} from '../utils/binary_impl';\nimport {binaryKernelFunc} from '../utils/binary_utils';\n\nexport const lessImpl =\n createSimpleBinaryKernelImpl((a: number, b: number) => (a < b) ? 1 : 0);\nexport const less =\n binaryKernelFunc(Less, lessImpl, null /* complexImpl */, 'bool');\n\nexport const lessConfig: KernelConfig = {\n kernelName: Less,\n backendName:
'cpu',\n kernelFunc: less\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 {TypedArray, util} from '@tensorflow/tfjs-core';\n\nexport function linSpaceImpl(\n start: number, stop: number, num: number): TypedArray {\n const step = (stop - start) / (num - 1);\n\n const values =
util.makeZerosTypedArray(num,
'float32');\n values[0] = start;\n for (let i = 1; i < values.length; i++) {\n values[i] = values[i - 1] + step;\n }\n\n return values;\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, Log} from '@tensorflow/tfjs-core';\n\nimport {createSimpleUnaryImpl} from '../utils/unary_impl';\nimport
{unaryKernelFuncFromImpl} from '../utils/unary_utils';\n\nexport const logImpl = createSimpleUnaryImpl((xi) => Math.log(xi));\nexport const log = unaryKernelFuncFromImpl(Log, logImpl);\n\nexport const logConfig: KernelConfig = {\n kernelName: Log,\n backendName: 'cpu',\n kernelFunc: log,\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 {DataType, NumericDataType, TypedArray, util} from '@tensorflow/tfjs-core';\n\nexport function maxImpl(\n aVals: TypedArray, reduceSize: number, outShape: number[],\n dtype: DataType): TypedArray {\n const vals = util.getTypedArrayFromDType(\n dtype as NumericDataType, util.sizeFromShape(outShape));\n\n for (let i = 0; i < vals.length; ++i) {\n const offset = i * reduceSize;\n let max = aVals[offset];\n for (let j = 0; j < reduceSize; ++j) {\n const value = aVals[offset + j];\n if (value > max) {\n max = value;\n }\n }\n vals[i] = max;\n }\n return vals;\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, Maximum} from '@tensorflow/tfjs-core';\n\nimport {createSimpleBinaryKernelImpl} from '../utils/binary_impl';\nimport {binaryKernelFunc} from '../utils/binary_utils';\n\nexport const maximumImpl = createSimpleBinaryKernelImpl(\n ((aValue, bValue) => Math.max(aValue, bValue)));\nexport const maximum = binaryKernelFunc(Maximum, maximumImpl);\n\nexport const maximumConfig: KernelConfig = {\n kernelName: Maximum,\n backendName: 'cpu',\n kernelFunc: maximum\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, Minimum} from '@tensorflow/tfjs-core';\n\nimport {createSimpleBinaryKernelImpl} from '../utils/binary_impl';\nimport {binaryKernelFunc} from '../utils/binary_utils';\n\nexport const minimumImpl = createSimpleBinaryKernelImpl(\n ((aValue, bValue) => Math.min(aValue, bValue)));\nexport const minimum = binaryKernelFunc(Minimum, minimumImpl);\n\nexport const minimumConfig: KernelConfig = {\n kernelName: Minimum,\n backendName: 'cpu',\n kernelFunc: minimum\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, Multiply} from '@tensorflow/tfjs-core';\nimport {createSimpleBinaryKernelImpl} from '../utils/binary_impl';\nimport {binaryKernelFunc, createComplexBinaryKernelImpl} from '../utils/binary_utils';\n\nexport const multiplyImpl =\n createSimpleBinaryKernelImpl(((aValue, bValue) => aValue * bValue));\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\nexport const multiplyConfig: KernelConfig = {\n kernelName: Multiply,\n backendName: 'cpu',\n kernelFunc: multiply\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\n License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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, KernelFunc, Neg, TensorInfo, TypedArray, UnaryInputs, util} from '@tensorflow/tfjs-core';\n\nimport {MathBackendCPU} from '../backend_cpu';\nimport {assertNotComplex} from '../cpu_util';\nimport {multiplyImpl} from './Multiply';\n\nexport function negImpl(xVals: TypedArray, xShape: number[], xDtype: DataType):\n [TypedArray, number[]] {\n const minusOne =\n util.createScalarValue(-1 as

{} as 'float32', xDtype) as TypedArray;\n return multiplyImpl([], xShape, minusOne, xVals, xDtype);\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\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 * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 * @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 {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 Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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';\n\nimport {MathBackendCPU} from '../backend_cpu';\nimport {assertNotComplex} from '../cpu_util';\n\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,

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\nexport const transposeConfig: KernelConfig = {\n kernelName: Transpose,\n backendName: 'cpu',\n kernelFunc: transpose 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 {backend_util, DataType, KernelConfig, KernelFunc, Prod, ProdAttrs, ProdInputs, TensorInfo, TypedArray, upcastType, util} from '@tensorflow/tfjs-core';\n\nimport {MathBackendCPU} from '../backend_cpu';\nimport {assertNotComplex} from '../cpu_util';\nimport {transpose} from './Transpose';\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\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 return backend.makeTensorInfo(resultShape, outDtype, outVals);\n}\n\nexport const prodConfig: KernelConfig = {\n kernelName: Prod,\n backendName: 'cpu',\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 {DataTypeMap, util} from '@tensorflow/tfjs-core';\n\nexport function rangeImpl(\n   start: number, stop: number, step: number,\n   dtype: 'float32'|'int32'): DataTypeMap['float32' | 'int32'] {\n const sameStartStop =

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 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, 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));\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 under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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, 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 isContinous = slice_util.isSliceContinous(shape, begin, size);\n const length = util.sizeFromShape(size);\n const xStrides = util.computeStrides(shape);\n\n if (isContinous) {\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 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 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 {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\nexport function tileImpl<R extends Rank>(\n xBuf: TensorBuffer<R, DataType>,\n reps: number[]): 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\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\n const originalIndex = xBuf.locToIndex(originalLoc);\n\n result.values[i] = xBuf.values[originalIndex];\n }\n return result as TensorBuffer<R, DataType>;\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/** 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[], xDtype: NumericDataType, k: number,\n sorted: boolean):\n [TensorBuffer<R, NumericDataType>, 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\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 * @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 {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 //\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 //\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 //\n // Note that this is not the final output shape. This will be the shape for an\n // intermediate TensorBuffer (see inputBuffer

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].\n 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","/**\n
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 ==\n
 */\n\n// Shared functionality among backends.\nexport {simpleAbsImpl} from './kernels/Abs';\nexport {addImpl} from './kernels/Add';\nexport {bincountImpl, bincountReduceImpl} from './kernels/Bincount_impl';\nexport {ceilImpl} from './kernels/Ceil';\nexport {concatImpl} from './kernels/Concat_impl';\nexport
 {expImpl} from './kernels/Exp';\nexport {expm1Impl} from './kernels/Expm1';\nexport {floorImpl} from './kernels/Floor';\nexport {gatherV2Impl} from './kernels/GatherV2_impl';\nexport {greaterImpl} from

'./kernels/Greater';\nexport {lessImpl} from './kernels/Less';\nexport {linSpaceImpl} from
'./kernels/LinSpace_impl';\nexport {logImpl} from './kernels/Log';\nexport {maxImpl} from
'./kernels/Max_impl';\nexport {maximumImpl} from './kernels/Maximum';\nexport {minimumImpl} from
'./kernels/Minimum';\nexport {multiplyImpl} from './kernels/Multiply';\nexport {negImpl} from
'./kernels/Neg';\nexport {notEqualImpl} from './kernels/NotEqual';\nexport {prodImpl} from
'./kernels/Prod';\nexport {rangeImpl} from './kernels/Range_impl';\nexport {rsqrtImpl} from
'./kernels/Rsqrt';\nexport {sliceImpl} from './kernels/Slice';\nexport {squaredDifferenceImpl} from
'./kernels/SquaredDifference';\nexport {stridedSliceImpl} from './kernels/StridedSlice_impl';\nexport {subImpl}
from './kernels/Sub';\nexport
{tileImpl} from './kernels/Tile_impl';\nexport {topKImpl} from './kernels/TopK_impl';\nexport {transposeImpl}
from './kernels/Transpose_impl';\nexport {uniqueImpl} from './kernels/Unique_impl';\nexport
{ComplexBinaryKernelImpl, SimpleBinaryKernelImpl} from './utils/binary_types';\n","\n/**\n * @license\n *
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==\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 * as shared from '@tensorflow/tfjs-backend-cpu/dist/shared';\n// tslint:disable-
next-line: no-imports-from-dist\nimport {SimpleBinaryKernelImpl} from '@tensorflow/tfjs-backend-
cpu/dist/shared';\n// tslint:disable-next-line: no-imports-from-dist\nimport {SimpleUnaryImpl} from
'@tensorflow/tfjs-backend-cpu/dist/utils/unary_types';\n\nexport type SimpleBinaryKernelImplCPU =
SimpleBinaryKernelImpl;\nexport 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 * @license\n * Copyright 2018 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\nexport function getVecChannels(name: string, rank: number): string[] {\n return ['x', 'y', 'z', 'w', 'u', 'v'].slice(0,

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\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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';\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:\n number[]) { // 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,\n 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\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 return coords;\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\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\n bool cEdge = cp1 >= ${cols};\n bool rEdge = rp1 >= ${rows};\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 * @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

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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: [\n    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\n      mainLoop += `\n
${thisRC}\n        ${i > 0 ? `if(thisRC.y < rows && thisRC.z < cols){` : ''}\n          int flatIndex =
getFlatIndex(thisRC);\n\n          ivec3 inputRC = inputCoordsFromReshapedOutCoords(flatIndex);\n          vec2
inputRCInnerDims = vec2(float(inputRC.y),float(inputRC.z));\n\n          result[${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\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\nfunction
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
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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 {env} from '@tensorflow/tfjs-core';\n\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: ${this._numBytesFree} (${\n        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\n  let
numElements: number;\n  if (isPacked) {\n    const [packedWidth, packedHeight] =\n
```

getPackedMatrixTextureShapeWidthHeight(shape[0], shape[1]);\n   numElements = packedWidth * packedHeight;\n\n } else {\n   const [width, height] =\n getUnpackedMatrixTextureShapeWidthHeight(shape[0], shape[1]);\n   numElements = width * height;\n }\n\n const 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\n if (isPacked) {\n   return PhysicalTextureType.PACKED_2X2_FLOAT16;\n }\n return PhysicalTextureType.UNPACKED_FLOAT16;\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 ${logicalTexType}`);\n}\n\nfunction getKeyFromTextureShape(\n shapeRowsCol: [number, number], physicalTexType: PhysicalTextureType,\n   isPacked: boolean): string {\n return `${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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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:\n string) {\n   this.outputShape = aShape;\n   this.userCode = `\n      float unaryOperation(float x) {\n        ${opSnippet}\n      }\n\n      void main() {\n        float x = getAAtOutCoords();\n        float y = unaryOperation(x);\n\n        setOutput(y);\n      }\n    `;\n }\n}\n\nexport const CHECK_NAN_SNIPPET = `if (isnan(x)) return x;`;\n\nexport const LINEAR = `return x;`;\n\nexport const ABS = `return abs(x);`;\n\nexport function STEP(alpha = 0.0) {\n return CHECK_NAN_SNIPPET + `\n    return x > 0.0 ? 1.0 : float(${alpha});\n  `;\n}\n\nexport const ELU = `return (x >= 0.0) ? x : (exp(x) - 1.0);`;\n\nexport const RELU = CHECK_NAN_SNIPPET + `\n  return (x < 0.0) ? 0.0 : x;\n`;\n\nexport const RELU6 = CHECK_NAN_SNIPPET +

`\n  return (x < 0.0) ? 0.0 : min(6.0, x);\n`;\n\nexport const CLONE = 'return x;';\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
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==========\n */\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport const LINEAR = `return x;`;\n\nexport const ELU = `\n  vec4 result;\n\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\n  return result;\n`;\n\nexport const RELU = `\n vec4 result = x * vec4(greaterThanEqual(x, vec4(0.0)));\n
  bvec4 isNaN = isnan(x);\n\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\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\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\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 ${opSnippet}\n   }\n\n   void main() {\n   vec4 x = getAAtOutCoords();\n   vec4 y = unaryOperation(x);\n\n
    setOutput(y);\n   }\n   `;\n }\n}\n","/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
==========\n */\n\nimport {GPGPUProgram} from './gpgpu_math';\nimport {getChannels, getSourceCoords} from './packing_util';\nimport {getCoordsDataType} from './shader_compiler';\n\nexport class UnpackProgram implements GPGPUProgram {\n variableNames
 = ['A'];\n packedInputs = true;\n packedOutput = false;\n outputShape: number[];\n userCode: string;\n\n constructor(outputShape: number[]) {\n   this.outputShape = outputShape;\n   const rank = outputShape.length;\n\n
 const channels = getChannels('rc', rank);\n   const dtype = getCoordsDataType(rank);\n   const sourceCoords = getSourceCoords(rank, channels);\n   const innerDims = channels.slice(-2);\n   const coords = rank <= 1 ? 'rc' : `vec2(${innerDims.join(',')})`;\n\n   this.userCode = `\n   void main() {\n ${dtype} rc = getOutputCoords();\n
      vec4 packedInput = getA(${sourceCoords});\n\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 *
==========\n */\n\n// Import webgl flags.\nimport './flags_webgl';\n\nimport * as tf from '@tensorflow/tfjs-core';\nimport

{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';\nimport {DecodeMatrixProgram} from './decode_matrix_gpu';\nimport {DecodeMatrixPackedProgram} from './decode_matrix_packed_gpu';\nimport {EncodeFloatProgram} from './encode_float_gpu';\nimport {EncodeFloatPackedProgram} from './encode_float_packed_gpu';\nimport {EncodeMatrixProgram} from './encode_matrix_gpu';\nimport {EncodeMatrixPackedProgram} from './encode_matrix_packed_gpu';\nimport {GPGPUContext} from './gpgpu_context';\nimport * as gpgpu_math from './gpgpu_math';\nimport {GPGPUBinary, GPGPUProgram, TensorData} from './gpgpu_math';\nimport {simpleAbsImplCPU} from './kernel_utils/shared';\nimport {PackProgram} from './pack_gpu';\nimport {ReshapePackedProgram} from './reshape_packed_gpu';\nimport * as tex_util from './tex_util';\nimport {TextureData, TextureUsage} from './tex_util';\nimport {TextureManager} from './texture_manager';\nimport * as unary_op from './unaryop_gpu';\nimport {UnaryOpProgram} from './unaryop_gpu';\nimport {UnaryOpPackedProgram} from './unaryop_packed_gpu';\nimport {UnpackProgram} from './unpack_gpu';\nimport * as webgl_util from './webgl_util';\n\nconst whereImpl = kernel_impls.whereImpl;\n\nexport const EPSILON_FLOAT32 = 1e-7;\nexport const EPSILON_FLOAT16 = 1e-4;\n\ntype KernelInfo = {\n name: string; query: Promise<number>;\n};\n\nexport type TimerNode = RecursiveArray<KernelInfo>|KernelInfo;\nexport interface CPUTimerQuery {\n startMs: number;\n endMs?: number;\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\nexport interface WebGLTimingInfo extends TimingInfo {\n uploadWaitMs: number;\n downloadWaitMs: number;\n}\n\nconst binaryCaches: {[webGLVersion: string]: {[key: string]: GPGPUBinary}} = {};\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// Empirically determined constant used to determine size threshold for handing\n// off execution to the CPU.\nconst CPU_HANDOFF_SIZE_THRESHOLD = 128;\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.\nconst BEFORE_PAGING_CONSTANT = 600;\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\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 // 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

(!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\n    if (values != null) {\n      return this.convertAndCacheOnCPU(dataId);\n    }\n\n    if
(!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\n    let buffer = null;\n    let tmpDownloadTarget:
TensorInfo;\n\n    if (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\n      buffer = this.gpgpu.createBufferFromTexture(\n
  tmpData.texture, ...tex_util.getDenseTexShape(shape));\n    }\n\n    this.pendingRead.set(dataId, []);\n\n    if (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.\n    let vals:
Float32Array;\n    if (dtype === 'complex64') {\n      const ps = await Promise.all([\n
this.read(complexTensorInfos.real.dataId),\n          this.read(complexTensorInfos.imag.dataId)\n      ]);\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    if (tmpDownloadTarget != null) {\n
this.disposeIntermediateTensorInfo(tmpDownloadTarget);\n    }\n    const dTypeVals =
this.convertAndCacheOnCPU(dataId, vals);\n\n    const subscribers = this.pendingRead.get(dataId);\n
this.pendingRead.delete(dataId);\n\n    // Notify all pending reads.\n    subscribers.forEach(resolve =>
resolve(dTypeVals));\n    if (this.pendingDisposal.has(dataId)) {\n      this.pendingDisposal.delete(dataId);\n      if
(this.disposeData(dataId)) {\n        engine().removeDataId(dataId, this);\n      }\n      this.pendingDeletes--;\n    }\n
return dTypeVals;\n  }\n\n  bufferSync<R extends Rank>(t:
  TensorInfo): TensorBuffer<R> {\n    const data = this.readSync(t.dataId);\n    let decodedData = data as
DataValues;\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    return buffer(t.shape as ShapeMap[R], t.dtype, decodedData) as\n
TensorBuffer<R>;\n  }\n\n  private 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\n
private 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\n      this.disposeIntermediateTensorInfo(tmpTarget);\n\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
  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\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\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  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
  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\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\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, [{shape: shapeAs3D, dtype, dataId}], dtype,\n        null /* customSetup */, 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\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\n      if (texData.texture ==\n          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\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\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 = 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, width], isByteArray);\n } else {\n program =\n new EncodeMatrixProgram(shapeAs3D, [height, 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, 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 = this.runWebGLProgram(\n program, [tempDenseInputHandle], dtype, null, preventEagerUnpacking);\n\n // Have the original texture assume the identity of the encoded output.\n const outputTexData = this.texData.get(encodedOutputTarget.dataId);\n texData.texture = outputTexData.texture;\n texData.texShape = outputTexData.texShape;\n texData.isPacked = outputTexData.isPacked;\n texData.usage = outputTexData.usage;\n\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 = newTexture;\n }\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\n if (float32Values != null) {\n texData.values = float32ToTypedArray(float32Values, dtype as 'float32');\n }\n return texData.values as TypedArray;\n }\n\n private acquireTexture(\n texShape: [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 / 1024).toFixed(2);\n this.warnedAboutMemory = true;\n console.warn(\n `High memory usage in GPU: ${mb} MB, ` +\n `most likely due to a memory leak`);\n }\n return this.textureManager.acquireTexture(texShape, texType, isPacked);\n }\n\n private computeBytes(shape: [number, number], dtype: DataType) {\n return shape[0] * shape[1] * util.bytesPerElement(dtype);\n }\n}\n\nfunction float32ToTypedArray<D extends NumericDataType>(\n a: Float32Array, dtype: D): tf.DataTypeMap[D] {\n if (dtype === 'float32' || 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 Uint8Array(a.length);\n for (let i = 0; i < result.length; ++i) {\n result[i] = Math.round(a[i]);\n }\n return result as tf.DataTypeMap[D];\n } else {\n throw new Error(`Unknown dtype ${dtype}`);\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 {env} from '@tensorflow/tfjs-core';\n\nimport * as gpgpu_util from './gpgpu_util';\nimport * as webgl_util from './webgl_util';\n\nexport {MathBackendWebGL, WebGLMemoryInfo, WebGLTimingInfo} from './backend_webgl';\nexport {setWebGLContext} from './canvas_util';\nexport {GPGPUContext} from './gpgpu_context';\nexport {GPGPUProgram} from './gpgpu_math';\n// WebGL specific utils.\nexport {gpgpu_util,

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 * @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\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);';\nexport class BinaryOpProgram implements GPGPUProgram {\n variableNames = ['A', 'B'];\n outputShape: number[];\n userCode: string;\n\n constructor(op: string, aShape: number[],\n 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 * @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\n License.\n *\n ==\n */\n\nimport {backend_util, util} from '@tensorflow/tfjs-core';\n\nimport {GPGPUProgram} from './gpgpu_math';\nimport {getChannels} from './packing_util';\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) >= ${this.outputShape[0]} ? 0. : result.y;\n result.z = 0.;\n            result.w = 0.;\n          `;\n   } else {\n   const channels = getChannels('coords', rank);\n   checkOutOfBoundsString += `\n   bool nextRowOutOfBounds\n =\n   (${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\n    this.userCode = `\n   vec4

binaryOperation(vec4 a, vec4 b) {\n ${op}\n }\n\n void main() {\n vec4 a = getAAtOutCoords();\n vec4 b = getBAtOutCoords();\n\n vec4 result = binaryOperation(a, b);\n ${checkOutOfBoundsString}\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, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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, 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\n const $alpha = backend.makeTensorInfo(\n [], 'float32',\n util.createScalarValue(alpha as {} as 'float32', 'float32'));\n\n const program = env().getBool('WEBGL_PACK_BINARY_OPERATIONS') ?\n new BinaryOpPackedProgram(LEAKYRELU_PACKED, x.shape, $alpha.shape) :\n new BinaryOpProgram(LEAKYRELU, x.shape, $alpha.shape);\n const result = backend.runWebGLProgram(program, [x, $alpha], x.dtype);\n\n backend.disposeIntermediateTensorInfo($alpha);\n\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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, Prelu, PreluInputs, TensorInfo} from '@tensorflow/tfjs-core';\n\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: {inputs: PreluInputs, backend: MathBackendWebGL}):\n TensorInfo {\n const {inputs, backend} = args;\n const {x, alpha} = inputs;\n\n const program = env().getBool('WEBGL_PACK_BINARY_OPERATIONS') ?\n new BinaryOpPackedProgram(PRELU_PACKED, x.shape, alpha.shape) :\n 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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required
by applicable law or agreed to in writing, software\n * distributed under 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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==========================================================================\n
*/\n\nimport {backend_util, BinaryInputs, DataType, env, KernelFunc, TypedArray, UnaryInputs, upcastType}
from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\nimport
{BinaryOpProgram} from '../binaryop_gpu';\nimport {BinaryOpPackedProgram} from
'../binaryop_packed_gpu';\nimport {complex} from '../kernels/Complex';\nimport {LEAKYRELU,
LEAKYRELU_PACKED} from '../kernels/LeakyRelu';\nimport {PRELU, PRELU_PACKED} from
'../kernels/Prelu';\nimport * as unary_op from '../unaryop_gpu';\nimport {UnaryOpProgram} from
'../unaryop_gpu';\nimport * as unary_packed_op from '../unaryop_packed_gpu';\nimport
 {UnaryOpPackedProgram} from '../unaryop_packed_gpu';\n\nimport {SimpleBinaryKernelImplCPU,
SimpleUnaryKernelImplCPU} from './shared';\n\nexport const CHECK_NAN_SNIPPET_UNARY = `if (isnan(x))
return x;`;\n\nexport const CHECK_NAN_SNIPPET_BINARY = `\n  if (isnan(a)) return a;\n  if (isnan(b)) return
b;\n`;\n\nexport const CHECK_NAN_SNIPPET_BINARY_PACKED = `\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\ntype UnaryKernelFuncConfig = {\n  opSnippet: string,\n  packedOpSnippet?: string,\n
cpuKernelImpl?: SimpleUnaryKernelImplCPU,\n  dtype?: DataType\n};\n\n/**\n * Template that creates a
`KernelFunc` for unary ops.\n * @param opSnippet Op snippet to create `UnaryOpProgram`.\n * @param
packedOpSnippet Op snippet to create `UnaryOpPackedProgram`.\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 unaryKernelFunc(\n    {opSnippet, packedOpSnippet, cpuKernelImpl, dtype}:
UnaryKernelFuncConfig):\n    KernelFunc {\n  return ({inputs, backend}) => {\n    const {x} = inputs as
UnaryInputs;\n    const webglBackend = backend as MathBackendWebGL;\n\n    const $dtype = dtype || x.dtype;\n
if (webglBackend.shouldExecuteOnCPU([x]) && cpuKernelImpl != null) {\n      const xData =
webglBackend.texData.get(x.dataId);\n      const outValues = cpuKernelImpl(xData.values as TypedArray,
$dtype);\n      return webglBackend.makeTensorInfo(x.shape, $dtype, outValues);\n    }\n\n    const
shouldUsePackedProgram =\n        env().getBool('WEBGL_PACK_UNARY_OPERATIONS') &&
packedOpSnippet != null;\n    let program: UnaryOpProgram|UnaryOpPackedProgram;\n    if
(shouldUsePackedProgram) {\n      program = new UnaryOpPackedProgram(x.shape, packedOpSnippet);\n
   } else {\n      program = new UnaryOpProgram(x.shape, opSnippet);\n    }\n\n    return
webglBackend.runWebGLProgram(program, [x], $dtype);\n  };\n}\n\ntype BinaryKernelFuncConfig = {\n
opSnippet: string,\n  packedOpSnippet?: string,\n  checkOutOfBounds?: boolean,\n  supportsComplex?: boolean,\n
cpuKernelImpl?: SimpleBinaryKernelImplCPU,\n  dtype?: DataType\n};\n\n/**\n * Template that creates a
`KernelFunc` for binary ops.\n * @param opSnippet Op snippet to create `BinaryOpProgram`.\n * @param
packedOpSnippet Op snippet to create `BinaryOpPackedProgram`.\n * @param
checkOutOfBoundsForPackedProgram Whether to set checkOutOfBounds=true\n *     when creating
BinaryOpPackedProgram.\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  opSnippet,\n  packedOpSnippet,\n  checkOutOfBounds
 = false,\n  supportsComplex = false,\n  cpuKernelImpl,\n  dtype\n}: BinaryKernelFuncConfig): KernelFunc {\n
return ({inputs, backend}) => {\n    const {a, b} = inputs as BinaryInputs;\n    const webglBackend = backend as
MathBackendWebGL;\n\n    if (supportsComplex && a.dtype === 'complex64') {\n      const aData =
webglBackend.texData.get(a.dataId);\n      const bData = webglBackend.texData.get(b.dataId);\n\n      const [real,
imag] = [\n        [aData.complexTensorInfos.real, bData.complexTensorInfos.real],\n
[aData.complexTensorInfos.imag, bData.complexTensorInfos.imag]\n      ].map(complexParts => {\n        const
[aPart, bPart] = complexParts;\n\n        const aHandle = {\n          dataId: aPart.dataId,\n          dtype: aPart.dtype,\n
     shape: a.shape\n        };\n        const bHandle = {\n          dataId: bPart.dataId,\n          dtype: bPart.dtype,\n
shape: b.shape\n        };\n\n        const program = new BinaryOpProgram(opSnippet, a.shape,
```

```
b.shape);\n  return webglBackend.runWebGLProgram(\n  program, [aHandle, bHandle],
upcastType(aPart.dtype, bPart.dtype));\n  });\n\n  const complexOutput =\n  complex({inputs: {real,
imag}, backend: webglBackend});\n\n  webglBackend.disposeIntermediateTensorInfo(real);\n
webglBackend.disposeIntermediateTensorInfo(imag);\n\n  // TODO(annxingyuan): Implement CPU forwarding
for complex inputs.\n\n  return complexOutput;\n  }\n\n  const $dtype = dtype || upcastType(a.dtype,
b.dtype);\n  if (webglBackend.shouldExecuteOnCPU([a, b]) && cpuKernelImpl != null) {\n  const aData =
webglBackend.texData.get(a.dataId);\n  const bData = webglBackend.texData.get(b.dataId);\n  const
[outValues, outShape] = cpuKernelImpl(\n  a.shape, b.shape, aData.values as TypedArray,\n  bData.values
as TypedArray, $dtype);\n\n  const out = webglBackend.makeTensorInfo(outShape, $dtype);\n  const outData
= webglBackend.texData.get(out.dataId);\n
  outData.values = outValues;\n  return out;\n  }\n\n  const shouldUsePackedProgram =\n
env().getBool('WEBGL_PACK_BINARY_OPERATIONS') &&\n  packedOpSnippet != null;\n  let program:
BinaryOpProgram|BinaryOpPackedProgram;\n  if (shouldUsePackedProgram) {\n  program = new
BinaryOpPackedProgram(\n  packedOpSnippet, a.shape, b.shape, checkOutOfBounds);\n  } else {\n
program = new BinaryOpProgram(opSnippet, a.shape, b.shape);\n  }\n\n  return
webglBackend.runWebGLProgram(program, [a, b], $dtype);\n  };\n}\n\nexport function
mapActivationToShaderProgram(\n  activation: backend_util.Activation, packed = false): string {\n  if (activation
=== 'linear') {\n  if (packed) {\n  return unary_packed_op.LINEAR;\n  }\n  return unary_op.LINEAR;\n  }
else if (activation === 'relu') {\n  if (packed) {\n  return unary_packed_op.RELU;\n  }\n  return
unary_op.RELU;\n  } else if (activation === 'elu') {\n  if (packed)
  {\n  return unary_packed_op.ELU;\n  }\n  return unary_op.ELU;\n  } else if (activation === 'relu6') {\n  if
(packed) {\n  return unary_packed_op.RELU6;\n  }\n  return unary_op.RELU6;\n  } else if (activation ===
'prelu') {\n  if (packed) {\n  return PRELU_PACKED;\n  }\n  return PRELU;\n  } else if (activation ===
'leakyrelu') {\n  if (packed) {\n  return LEAKYRELU_PACKED;\n  }\n  return LEAKYRELU;\n  }\n  throw
new Error(`Activation ${\n  activation} has not been implemented for the WebGL backend.`);\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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  BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 MatMulPackedProgram implements
GPGPUProgram {\n  variableNames = ['matrixA', 'matrixB'];\n  packedInputs = true;\n  packedOutput = true;\n
outputShape: number[];\n  userCode: string;\n\n  constructor(\n  aShape: [number, number, number], bShape:
[number, number, number],\n  outputShape: [number, number, number], transposeA = false,\n  transposeB =
false, addBias = false, activation: string = null,\n  hasPreluActivation = false, hasLeakyreluActivation = false) {\n
  this.outputShape = outputShape;\n\n  const sharedDim = transposeA ? aShape[1] : aShape[2];\n  const
sharedDimensionPacked = Math.ceil(sharedDim / 2);\n\n  const aSample
  = transposeA ? 'i * 2, rc.y' : 'rc.y, i * 2';\n  const bSample = transposeB ? 'rc.z, i * 2' : 'i * 2, rc.z';\n  const
aSwizzle = transposeA ? ['a.xxyy', 'a.zzww'] : ['a.xxzz', 'a.yyww'];\n  const bSwizzle = transposeB ? ['b.xzxz',
'b.ywyw'] : ['b.xyxy', 'b.zwzw'];\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 (hasLeakyreluActivation)
{\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\n if (hasLeakyreluActivation) {\n this.variableNames.push('leakyreluAlpha');\n }\n\n let batchASnippet = 'rc.x';\n let batchBSnippet = 'rc.x';\n if (aShape[0] < bShape[0]) {\n   batchASnippet = `int(min(float(rc.x), ${aShape[0] - 1}.))`;\n } else if (bShape[0] < aShape[0]) {\n   batchBSnippet = `int(min(float(rc.x), ${bShape[0] - 1}.))`;\n }\n\n this.userCode = `\n ${activationSnippet}\n\n   const float sharedDimension = ${sharedDimensionPacked}.0;\n\n   vec4 dot2x2ARowBCol(ivec3 rc) {\n   vec4 result = vec4(0);\n   for (int i = 0; i < ${sharedDimensionPacked}; i++) {\n   int batchA = ${batchASnippet};\n   int batchB = ${batchBSnippet};\n   vec4 a = getMatrixA(batchA, ${aSample});\n   vec4 b = getMatrixB(batchB, ${bSample});\n\n   // These swizzled products need to be separately added.\n   // See: https://github.com/tensorflow/tfjs/issues/1735\n   result += (${aSwizzle[0]} * ${bSwizzle[0]});\n   result += (${aSwizzle[1]} * ${bSwizzle[1]});\n   }\n   return result;\n   }\n\n   void main() {\n   ivec3 rc = getOutputCoords();\n   vec4 result = dot2x2ARowBCol(rc);\n\n ${addBiasSnippet}\n\n ${applyActivationSnippet}\n\n   setOutput(result);\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} from '@tensorflow/tfjs-core';\nimport {GPGPUProgram} from './gpgpu_math';\n\n// (Ar + Ai)(Br + Bi) =\n// ArBr + ArBi + AiBr + AiBi = ArBr - AB + ArBi + AiBr\n// Yr = ArBr - AB\n// Yi = ArBi + AiBr\nexport const COMPLEX_MULTIPLY = {\n REAL: 'return areal * breal - aimag * bimag;',\n IMAG: 'return areal * bimag + aimag * breal;'\n};\n\nexport class BinaryOpComplexProgram implements GPGPUProgram {\n variableNames = ['AReal', 'AImag', 'BReal', 'BImag'];\n userCode: string;\n outputShape: number[];\n\n constructor(op: string, aShape: number[], bShape: number[]) {\n   this.outputShape = backend_util.assertAndGetBroadcastShape(aShape, bShape);\n\n   this.userCode = `\n   float binaryOpComplex(\n   float areal, float
 aimag, float breal, float bimag) {\n ${op}\n   }\n\n   void main() {\n   float areal = getARealAtOutCoords();\n   float aimag = getAImagAtOutCoords();\n   float breal = getBRealAtOutCoords();\n   float bimag = getBImagAtOutCoords();\n   setOutput(binaryOpComplex(areal, aimag, breal, bimag));\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 \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {ReshapePackedProgram} from '../reshape_packed_gpu';\nimport {getBatchDim, getRowsCols} from '../webgl_util';\n\nexport function packedReshape(\n   input: TensorInfo, afterShape: number[],\n   backend: MathBackendWebGL): TensorInfo {\n const input3DShape =\n   [getBatchDim(input.shape),\n   ...getRowsCols(input.shape)] as [number, number, number];\n const input3D: TensorInfo = {\n   dtype: input.dtype,\n   shape: input3DShape,\n   dataId: input.dataId\n };\n const afterShapeAs3D =\n   [getBatchDim(afterShape),\n   ...getRowsCols(afterShape)] as [number, number,

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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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, 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\n const xSize = util.sizeFromShape(x.shape);\n const $shape = util.inferFromImplicitShape(shape, xSize);\n const $xSize = util.sizeFromShape($shape);\n\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\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\n webglBackend.incRef(x.dataId);\n\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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';\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\n   const windowSizeNearestVec4 = Math.floor(windowSize / 4) * 4;\n   const windowSizeVec4Remainder = windowSize % 4;\n\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\n   let checkOutOfBounds = '';\n   if (inSize % windowSize > 0) {\n   checkOutOfBounds
 = `\n        if (inIdx < 0 || inIdx >= ${inSize}) {\n          return 0.0;\n        }\n      `;\n   }\n\n   this.userCode = `\n const vec4 ones = vec4(1.0, 1.0, 1.0, 1.0);\n\n   float getValue(int batch, int inIdx) {\n ${checkOutOfBounds}\n   return getX(batch, inIdx);\n   }\n\n   void main() {\n   ivec2 coords = getOutputCoords();\n   int batch = coords[0];\n   int outIdx = coords[1];\n   int inOffset = outIdx * ${windowSize};\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          ${updateSnippet}\n        }\n\n        int inIdx = inOffset + ${windowSizeNearestVec4};\n        if (${windowSizeVec4Remainder === 1}) {\n          vec4 values =
 vec4(getValue(batch, inIdx), 0.0, 0.0, 0.0);\n\n          ${updateSnippet}\n        } else if (${windowSizeVec4Remainder === 2}) {\n          vec4 values = vec4(\n            getValue(batch, inIdx),\n getValue(batch, inIdx + 1), 0.0, 0.0);\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), 0.0);\n\n          ${updateSnippet}\n        }\n        setOutput(sumValue);\n      }\n    `;\n }\n}","/**\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License
 is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
 ==========================================================================\n */\n\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class ReduceProgram implements GPGPUProgram {\n  variableNames = ['x'];\n outputShape: number[];\n  userCode: string;\n\n  constructor(\n      reduceInfo: backend_util.ReduceInfo,\n reduceType: 'all'|'any'|'max'|'min'|'sum'|'prod') {\n    const {windowSize, batchSize, inSize, outSize} = reduceInfo;\n this.outputShape = [batchSize, outSize];\n\n    let initializationValue = '0.0';\n    let compareOp = ``;\n\n    if (reduceType === 'prod') {\n      initializationValue = '1.0';\n    } else if (reduceType === 'min') {\n      // WebGL on Firefox Linux can't compile
 1/0 so we do 1/eps.\n      initializationValue = '1.0 / 1e-20';\n      compareOp = `min`;\n    } else if (reduceType === 'max') {\n      // WebGL on Firefox Linux can't compile 1/0 so we do 1/eps.\n      initializationValue = '-1.0 / 1e-20';\n      compareOp = `max`;\n    }\n\n    let returnValue = `${reduceType}(${reduceType}(${reduceType}(` +\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 (reduceType === 'all') {\n      returnValue = `allValue`;\n    } else if (reduceType === 'any') {\n      returnValue = `anyValue`;\n    }\n\n    const windowSizeNearestVec4 = Math.floor(windowSize / 4) * 4;\n    const windowSizeVec4Remainder = windowSize % 4;\n\n    let updateSnippet = `\n      if (${reduceType === 'sum'}) {\n
    sumValue += dot(values, ones);\n      } else if (${reduceType === 'prod'}) {\n
      vec2 tmp = vec2(values[0], values[1]) * vec2(values[2], values[3]);\n        prodValue *= tmp[0] * tmp[1];\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 = all(values);\n        float floatedReducedAllValue = float(reducedAllValue);\n        allValue = float(allValue >= 1.0 && 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 floatedReducedAnyValue = float(reducedAnyValue);\n        anyValue = float(anyValue >= 1.0 || floatedReducedAnyValue >= 1.0);\n      `;\n      vecType = `bvec4`;\n    }\n\n    let checkOutOfBounds = '';\n    if (inSize % windowSize > 0) {\n      checkOutOfBounds = `\n        if (inIdx < 0
 || inIdx >= ${inSize}) {\n          return initializationValue;\n        }\n      `;\n    }\n    this.userCode = `\n      const float initializationValue = ${initializationValue};\n      const vec4 ones = vec4(1.0, 1.0, 1.0, 1.0);\n\n      float getValue(int batch, int inIdx) {\n        ${checkOutOfBounds}\n        return getX(batch, inIdx);\n      }\n\n      void main() {\n        ivec2 coords = getOutputCoords();\n        int batch = coords[0];\n        int outIdx = coords[1];\n        int inOffset = outIdx * ${windowSize};\n\n        vec4 minMaxValue = vec4(${initializationValue});\n        float 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 = ${vecType}(\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 + ${windowSizeNearestVec4};\n if (${windowSizeVec4Remainder === 1}) {\n ${vecType} values = ${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 ${updateSnippet}\n } else if (${windowSizeVec4Remainder === 3}) {\n ${vecType} values = ${vecType}(\n getValue(batch, inIdx),\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. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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, DataType, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {MeanProgram} from '../mean_gpu';\nimport {ReduceProgram} from '../reduce_gpu';\n\ntype
ReduceTypes = '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<{inSize: number, windowSize: number, outSize: number}> {\n const stages = [];\n\n while (stages.length === 0 || stages[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,
windowSize, outSize} = reductionStages[i];\n\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 (previousResult.dataId !== x.dataId) {\n backend.disposeIntermediateTensorInfo(previousResult);\n }\n }\n\n return result;\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 {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\nfunction 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 * @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 {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] = 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 ${this.rank} is not yet supported.`);\n }\n const dtype = getCoordsDataType(this.rank);\n\n const outputOrder = getVecChannels('rc', this.rank);\n const switchedOrder = new Array(this.rank);\n for (let i = 0; i < newDim.length; i++) {\n switchedOrder[newDim[i]] = outputOrder[i];\n }\n const innerDims = `vec2(${switchedOrder.slice(-2).join()})`;\n const nextColumn =\n `++${outputOrder[this.rank - 1]} < ${outputShape[this.rank - 1]}`;\n const getc = `getChannel(getA(${switchedOrder.join()}), ${innerDims})`;\n\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, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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, sumOutType, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {reduce} from '../kernel_utils/reduce';\nimport {reshape} from './Reshape';\n\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 =

x.shape.length;\n\n const origAxes = util.parseAxisParam(reductionIndices, x.shape);\n let axes = origAxes;\n const permutedAxes = backend_util.getAxesPermutation(axes, xRank);\n const sumInputIsTransposed = permutedAxes != null;\n\n let sumInput = x;\n if (sumInputIsTransposed) {\n   sumInput = transposeImpl(x, permutedAxes, backend);\n\n   axes = backend_util.getInnerMostAxes(axes.length, xRank);\n }\n\n backend_util.assertAxesAreInnerMostDims('sum', axes, xRank);\n const [sumOutShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(sumInput.shape, axes);\n\n let outShape = sumOutShape;\n if (keepDims) {\n   // rather than reshape at the end, set the target shape here.\n outShape = backend_util.expandShapeToKeepDim(sumOutShape, origAxes);\n }\n\n const inSize = util.sizeFromShape(reduceShape);\n const xSize = util.sizeFromShape(x.shape);\n const batchSize = xSize / inSize;\n const reshapedInput = reshape(\n   {inputs: {x: sumInput}, attrs: {shape: [batchSize, inSize]}, backend});\n\n const outType = sumOutType(x.dtype);\n\n const reduced = reduce(reshapedInput, outType, 'sum', backend);\n const out =\n   reshape({inputs: {x: reduced}, attrs: {shape: outShape}, backend});\n\n backend.disposeIntermediateTensorInfo(reshapedInput);\n backend.disposeIntermediateTensorInfo(reduced);\n if (sumInputIsTransposed) {\n   backend.disposeIntermediateTensorInfo(sumInput);\n }\n\n return out;\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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==\n
*/\n\nimport {KernelConfig, KernelFunc, Sum, SumAttrs, SumInputs} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\n\nimport {sumImpl} from './Sum_impl';\n\nexport function sum(\n   args: {inputs: SumInputs, attrs: SumAttrs, backend: MathBackendWebGL}) {\n const {inputs, backend, attrs} = args;\n\n const {x} = inputs;\n const {axis, keepDims} = attrs;\n\n return sumImpl(x,
 axis, keepDims, backend);\n}\n\nexport const sumConfig: KernelConfig = {\n kernelName: Sum,\n backendName: 'webgl',\n kernelFunc: sum 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 {backend_util, TensorInfo, upcastType, util} from '@tensorflow/tfjs-core';\n\nimport
{MathBackendWebGL}
 from '../backend_webgl';\nimport {mapActivationToShaderProgram} from
'../kernel_utils/kernel_funcs_utils';\nimport {MatMulPackedProgram} from '../mulmat_packed_gpu';\n\nimport
{multiply} from './Multiply';\nimport {reshape} from './Reshape';\nimport {sum} from './Sum';\nimport {transpose}
from './Transpose';\n\n// Empirically determined minimal shared dimension in matmul before we forward\n// to
a.mul(b).sum() in order to take advantage of GPU parallelism. See\n// https://github.com/tensorflow/tfjs-
core/pull/1379 for benchmarks.\nexport const MATMUL_SHARED_DIM_THRESHOLD = 1000;\n\ntype
BatchMatMulConfig = {\n a: TensorInfo,\n b: TensorInfo,\n transposeA: boolean,\n transposeB: boolean,\n
backend: MathBackendWebGL,\n bias?: TensorInfo,\n preluActivationWeights?: TensorInfo,\n leakyreluAlpha?:
number,\n activation?: backend_util.Activation\n};\n\nexport function batchMatMulImpl({\n a,\n b,\n
transposeA,\n transposeB,\n backend,\n bias = null,\n preluActivationWeights

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 = 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 */\n\nimport {_FusedMatMul, _FusedMatMulAttrs, _FusedMatMulInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\n\nimport
{MathBackendWebGL} from '../backend_webgl';\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
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==========\n */\n\nimport {Acos, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {unaryKernelFunc} from '../kernel_utils/kernel_funcs_utils';\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/**\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 {Acosh, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {unaryKernelFunc} from '../kernel_utils/kernel_funcs_utils';\nimport {CHECK_NAN_SNIPPET} from '../unaryop_gpu';\n\nconst ACOSH = CHECK_NAN_SNIPPET + `\n if (x < 1.0) return NAN;\nreturn log(x + sqrt(x * x - 1.0));`;\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

on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 AddNProgram implements GPGPUProgram {\n variableNames: string[];\n outputShape:
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\n float result = ${operation};\n setOutput(result);\n }\n `;\n }\n}\n","/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n
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==========\n */\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class AddNPackedProgram implements GPGPUProgram {\n variableNames: string[];\n outputShape: number[] = [];\n userCode: string;\n packedInputs = true;\n packedOutput = true;\n\n constructor(outputShape: number[], shapes: number[][]) {\n this.outputShape = outputShape;\n this.variableNames = shapes.map((_, i) => `T${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\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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}):\n TensorInfo {\n const {inputs, backend} = args;\n\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 =\n tensors.map(t => t.dtype).reduce((d1,

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\nexport const addNConfig: KernelConfig = {\n kernelName: AddN,\n backendName: 'webgl',\n kernelFunc: addN as {} as KernelFunc\n};\n","/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License,
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*/\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';\n\nimport {reshape} from './Reshape';\nimport {transpose} from './Transpose';\n\nexport function all(\n   args: {inputs: AllInputs, backend: MathBackendWebGL,
 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,
 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\nexport const allConfig: KernelConfig = {\n kernelName: All,\n backendName: 'webgl',\n kernelFunc: all 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
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*/\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

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: [-1, inSize]}});\n const reduced = reduce(a2D, a2D.dtype, 'any', backend);\n\n let res;\n if (keepDims) {\n   const newShape = backend_util.expandShapeToKeepDim(outShape, 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\nexport const anyConfig: KernelConfig = {\n kernelName: Any,\n backendName: 'webgl',\n kernelFunc: any 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 *\n ===\n */\n\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport
 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: boolean) {\n   const {windowSize, batchSize, outSize} = reduceInfo;\n   if (!firstPass) {\n this.variableNames.push('bestIndicesA');\n   }\n   this.outputShape = [batchSize, outSize];\n   const compOp = (op === 'max') ? '>' : '<';\n   const indexSnippet = firstPass ?\n   'inOffset + i;' :\n   'round(getBestIndicesA(batch, inOffset + i));';\n\n   this.userCode = `\n   void main() {\n   ivec2 coords = getOutputCoords();\n   int batch = coords[0];\n   int outIdx = coords[1];\n   int inOffset = outIdx * ${windowSize};\n\n   int bestIndex = inOffset;\n   float bestValue = getA(batch, bestIndex);\n\n   for (int i = 0; i < ${windowSize}; i++) {\n int inIdx = ${indexSnippet};\n
 float candidate = getA(batch, inIdx);\n   if (candidate ${compOp} bestValue) {\n   bestValue = candidate;\n   bestIndex = inIdx;\n   }\n   }\n   setOutput(float(bestIndex));\n   }\n   `;\n }\n}\n","/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n ===\n */\n\nimport {util} from '@tensorflow/tfjs-core';\n\nimport
 {GPGPUProgram} from './gpgpu_math';\nimport {getChannels} from './packing_util';\nimport {getCoordsDataType} from './shader_compiler';\n\nexport class ArgMinMaxPackedProgram implements GPGPUProgram {\n variableNames = ['A'];\n outputShape: number[];\n userCode: string;\n packedInputs = true;\n packedOutput = true;\n\n constructor(\n   shape: number[], windowSize: number, op: 'max'|'min',\n   firstPass: boolean) {\n   util.assert(\n   shape.length > 2,\n   () => `Packed arg${\n            op.charAt(0).toUpperCase() +\n            op.slice(1)} supports only inputs with rank above 2.`);\n   const inSize = shape[shape.length - 1];\n   const outSize = Math.ceil(inSize / windowSize);\n   this.outputShape = shape.slice(0, -1);\n   if (outSize > 1) {\n   this.outputShape.push(outSize);\n   }\n   if (!firstPass) {\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\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        vec4 bestIndex = vec4(inIdx);\n        vec4 bestValue = ${fetchValue};\n\n        for (int i
= 0; i < ${windowSize}; i++) {\n          inIdx = srcIdx;\n          ${fetchCandidateIdx}\n          vec4 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 * @license\n * Copyright 2020 Google LLC. All Rights
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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 * @license\n * Copyright 2020 Google LLC.
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==========================================================================\n
*/\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 return out;\n}\n\nexport const argMaxConfig: KernelConfig = {\n kernelName: ArgMax,\n backendName: 'webgl',\n kernelFunc: argMax 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 {ArgMin, ArgMinAttrs, ArgMinInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {argMinMaxReduce} from '../kernel_utils/arg_min_max';\nimport {transpose} from './Transpose';\n\nexport function argMin(\n   args:\n   {inputs: ArgMinInputs, backend: MathBackendWebGL, attrs: ArgMinAttrs}):\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, $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 return out;\n}\n\nexport const argMinConfig: KernelConfig = {\n kernelName: ArgMin,\n backendName: 'webgl',\n kernelFunc: argMin 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 {Asin, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {unaryKernelFunc} from '../kernel_utils/kernel_funcs_utils';\nimport {CHECK_NAN_SNIPPET} from '../unaryop_gpu';\n\nconst ASIN = CHECK_NAN_SNIPPET + `\n  if (abs(x) > 1.) {\n    return NAN;\n  }\n  return asin(x);\n`;\n\nexport const asin = unaryKernelFunc({opSnippet: ASIN});\n\nexport const asinConfig: KernelConfig = {\n kernelName: Asin,\n backendName: 'webgl',\n kernelFunc: asin,\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 {Asinh, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {unaryKernelFunc} from '../kernel_utils/kernel_funcs_utils';\nimport {CHECK_NAN_SNIPPET} from '../unaryop_gpu';\n\nconst ASINH = CHECK_NAN_SNIPPET + `return log(x + sqrt(x * x + 1.0));`;\n\nexport const asinh =

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 *
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*/\n\nimport {Atan, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {unaryKernelFunc} from '../kernel_utils/kernel_funcs_utils';\nimport {CHECK_NAN_SNIPPET} from '../unaryop_gpu';\n\nconst ATAN = CHECK_NAN_SNIPPET + `\n  return atan(x);\n`;\n\nexport const atan = unaryKernelFunc({opSnippet: 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
 law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS 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 {Atan2} from '@tensorflow/tfjs-core';\nimport {KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {binaryKernelFunc, CHECK_NAN_SNIPPET_BINARY, CHECK_NAN_SNIPPET_BINARY_PACKED} from '../kernel_utils/kernel_funcs_utils';\n\nconst ATAN2 = CHECK_NAN_SNIPPET_BINARY + `\n  return atan(a, b);\n`;\n\nconst ATAN2_PACKED = `\n  vec4 result = 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:
 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\nimport {Atanh, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {unaryKernelFunc} from '../kernel_utils/kernel_funcs_utils';\nimport {CHECK_NAN_SNIPPET} from '../unaryop_gpu';\n\nconst
 ATANH = CHECK_NAN_SNIPPET + `\n  if ((x < -1.0) || (x > 1.0)) return NAN;\nreturn (log(1.0 + x) - log(1.0 - x)) / 2.0;`;\n\nexport const atanh = unaryKernelFunc({opSnippet: ATANH});\n\nexport const atanhConfig: 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 \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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';\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.');\n    }\n\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 = convInfo.padInfo.top;\n
    const padLeft = convInfo.padInfo.left;\n    this.outputShape = convInfo.outShape;\n\n    const isAvgPool =
poolType === 'avg';\n    const batchFlattenPositionStr = `((batch  * ${convInfo.inHeight} + xR) * ${\n
convInfo.inWidth} + xC) * ${convInfo.inChannels} + d`;\n    const flattenPositionStr =\n        `(xR *
${convInfo.inWidth} + xC) * ${convInfo.inChannels} + d`;\n\n    let initializationValue = '0.0';\n    if (!isAvgPool)
{\n      // WebGL on Firefox Linux can't compile 1/0 so we do 1/eps.\n      initializationValue = '-1.0 / 1e-20';\n
}\n\n    if (computePositions) {\n      const compareOp = '>=';\n\n      this.userCode = `\n        const ivec2 strides =
ivec2(${strideHeight}, ${strideWidth});\n        const ivec2 pads = ivec2(${padTop}, ${padLeft});\n\n        void
main() {\n          ivec4 coords = getOutputCoords();\n          int batch = coords[0];\n          int d = coords[3];\n\n
ivec2 xRCCorner = coords.yz * strides - pads;\n          int xRCorner
 = xRCCorner.x;\n          int xCCorner = xRCCorner.y;\n\n          // max/min x(?, ?, d) to get y(yR, yC, d).\n          // ?
= to be determined\n          float minMaxValue = 0.0;\n          float minMaxValueFound = 0.0;\n          int
minMaxPosition = 0;\n          float avgValue = 0.0;\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, xR, xC, d);\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 ? (includeBatchInIndex ? batchFlattenPositionStr :\n
flattenPositionStr) :\n                                `wR * ${effectiveFilterWidth} + wC`};\n              }\n            }\n          }\n
    setOutput(float(minMaxPosition));\n        }\n      `;\n      return;\n    }\n\n    const compareOp = 'max';\n\n    let
returnValue = `${poolType}(${poolType}(${poolType}(` +\n        'minMaxValue[0], minMaxValue[1]),
minMaxValue[2]), minMaxValue[3])';\n    if (poolType === 'avg') {\n      returnValue = `avgValue / count`;\n
}\n\n    const filterWidthNearestVec4 = Math.floor(filterWidth / 4) * 4;\n    const filterWidthVec4Remainder =
filterWidth % 4;\n\n    const updateSnippet = `\n
    if (${isAvgPool}) {\n        avgValue += dot(values, ones);\n      } else {\n        minMaxValue =
${compareOp}(values, minMaxValue);\n      }\n    `;\n\n    this.userCode = `\n      const ivec2 strides =
ivec2(${strideHeight}, ${strideWidth});\n      const ivec2 pads = ivec2(${padTop}, ${padLeft});\n      const float
initializationValue = ${initializationValue};\n      const vec4 ones = vec4(1.0, 1.0, 1.0, 1.0);\n\n      float count =
0.0;\n\n      float getValue(int batch, int xR, int xC, int d) {\n        if (xC < 0 || xC >= ${convInfo.inWidth}) {\n
return initializationValue;\n        }\n        count += 1.0;\n        return getX(batch, xR, xC, d);\n      }\n\n      void
main() {\n        ivec4 coords = getOutputCoords();\n        int batch = coords[0];\n        int d = coords[3];\n\n
ivec2 xRCCorner = coords.yz * strides - pads;\n        int xRCorner = xRCCorner.x;\n        int xCCorner =
xRCCorner.y;\n\n        // max/min x(?, ?, d) to get y(yR, yC, d).\n
    // ? = to be determined\n        vec4 minMaxValue = vec4(${initializationValue});\n        float avgValue = 0.0;\n
 count = 0.0;\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 < ${filterWidthNearestVec4}; wC += 4) {\n          int xC = xCCorner + wC *
${dilationWidth};\n\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          ${updateSnippet}\n        }\n      }\n
setOutput(${returnValue});\n    }\n  `;\n }\n}\n\nexport class Pool3DProgram implements GPGPUProgram {\n
variableNames = ['x'];\n
 outputShape: number[];\n  userCode: string;\n\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\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.inHeight} + xR) * ${\n                    convInfo.inWidth} + xC) * ${convInfo.inChannels} +
ch`) :\n            `wD * ${effectiveFilterHeight} * ${effectiveFilterWidth} +\n                  wR *
${effectiveFilterWidth} + wC`};\n              }\n            }\n          }\n        }\n
setOutput(float(minMaxPosition));\n      }\n    `;\n
  return;\n  }\n\n  const compareOp = 'max';\n\n  let returnValue = `${poolType}(${poolType}(${poolType}(`
+\n      'minMaxValue[0], minMaxValue[1]), minMaxValue[2]), minMaxValue[3])';\n  if (poolType === 'avg')
{\n    returnValue = `avgValue / count`;\n  }\n\n  const filterWidthNearestVec4 = Math.floor(filterWidth / 4) *
4;\n  const filterWidthVec4Remainder = filterWidth % 4;\n\n  const updateSnippet = `\n    if (${isAvgPool}) {\n
    avgValue += dot(values, ones);\n    } else {\n      minMaxValue = ${compareOp}(values, minMaxValue);\n
}\n  `;\n\n  this.userCode = `\n    const ivec3 strides =\n      ivec3(${strideDepth}, ${strideHeight},
${strideWidth});\n    const ivec3 pads = ivec3(${padFront}, ${padTop}, ${padLeft});\n    const float
initializationValue = ${initializationValue};\n    const vec4 ones = vec4(1.0, 1.0, 1.0, 1.0);\n\n    float count =
0.0;\n\n    float getValue(int batch, int xD, int xR, int xC, int ch) {\n      if (xC
< 0 || xC >= ${convInfo.inWidth}) {\n        return initializationValue;\n      }\n      count += 1.0;\n      return
getX(batch, xD, xR, xC, ch);\n    }\n\n    void main() {\n      ivec5 coords = getOutputCoords();\n      int batch =
coords.x;\n      int ch = coords.u;\n\n      ivec3 xCorner = ivec3(coords.y, coords.z, coords.w) * strides - pads;\n
 int xDCorner = xCorner.x;\n      int xRCorner = xCorner.y;\n      int xCCorner = xCorner.z;\n\n      // max/min
x(?, ?, ?, d) to get y(yD, yR, yC, ch).\n      // ? = to be determined\n      vec4 minMaxValue =
vec4(${initializationValue});\n      float avgValue = 0.0;\n      count = 0.0;\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 < ${filterWidthNearestVec4}; wC += 4) {\n            int xC = xCCorner + wC *
${dilationWidth};\n\n            vec4 values = vec4(\n              getValue(batch, xD, xR, xC, ch),\n
getValue(batch, xD, xR, xC + ${dilationWidth}, ch),\n              getValue(batch, xD, xR, xC + 2 *
${dilationWidth}, ch),\n              getValue(batch, xD, xR, xC + 3 * ${dilationWidth}, ch)\n            );\n\n
${updateSnippet}\n          }\n\n          int xC = xCCorner + ${filterWidthNearestVec4};\n          if
(${filterWidthVec4Remainder === 1}) {\n            vec4 values = vec4(\n              getValue(batch, xD, xR, xC,
ch),\n              initializationValue,\n              initializationValue,\n              initializationValue\n            );\n\n
    ${updateSnippet}\n
        } else if (${filterWidthVec4Remainder === 2}) {\n            vec4 values = vec4(\n              getValue(batch,
xD, xR, xC, ch),\n              getValue(batch, xD, xR, xC + ${dilationWidth}, ch),\n              initializationValue,\n
        initializationValue\n            );\n\n            ${updateSnippet}\n          } else if (${filterWidthVec4Remainder
=== 3}) {\n            vec4 values = vec4(\n              getValue(batch, xD, xR, xC, ch),\n              getValue(batch,
xD, xR, xC + ${dilationWidth}, ch),\n              getValue(batch, xD, xR, xC + 2 * ${dilationWidth}, ch),\n
initializationValue\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 Apache License, Version 2.0 (the \"License\");\n * you may not use this
 file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF 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 {AvgPool, AvgPoolAttrs, AvgPoolInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util}
from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\nimport
{Pool2DProgram} from '../pool_gpu';\nimport {assertNotComplex} from '../webgl_util';\nimport {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 * @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 {AvgPool3D, AvgPool3DAttrs, AvgPool3DInputs, backend_util, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\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 * @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';\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class AvgPool2DBackpropProgram implements GPGPUProgram {\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 -

```
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 >= ${convInfo.outWidth}.0 ||\n                fract(dyC) > 0.0) {\n              continue;\n            }\n            int idyC = int(dyC);\n\n            float dyValue = getDy(b, idyR, idyC, d);\n\n            dotProd += dyValue * avgMultiplier;\n          }\n        }\n        setOutput(dotProd);\n      }\n    `;\n  }\n}\n\nexport class AvgPool3DBackpropProgram implements GPGPUProgram
 {\n  variableNames = ['dy'];\n  outputShape: number[];\n  userCode: string;\n\n  constructor(convInfo: backend_util.Conv3DInfo) {\n    this.outputShape = convInfo.inShape;\n    const filterDepth = convInfo.filterDepth;\n    const filterHeight = convInfo.filterHeight;\n    const filterWidth = convInfo.filterWidth;\n    const strideDepth = convInfo.strideDepth;\n    const strideHeight = convInfo.strideHeight;\n    const strideWidth = convInfo.strideWidth;\n    const dilationDepth = convInfo.dilationDepth;\n    const dilationHeight = convInfo.dilationHeight;\n    const dilationWidth = convInfo.dilationWidth;\n    const effectiveFilterDepth = convInfo.effectiveFilterDepth;\n    const effectiveFilterHeight = convInfo.effectiveFilterHeight;\n    const effectiveFilterWidth = convInfo.effectiveFilterWidth;\n\n    const padFront = effectiveFilterDepth - 1 - convInfo.padInfo.front;\n    const padTop = effectiveFilterHeight - 1 - convInfo.padInfo.top;\n    const padLeft = effectiveFilterWidth
 - 1 - convInfo.padInfo.left;\n\n    const avgMultiplier = 1 / (filterDepth * filterHeight * filterWidth);\n\n    this.userCode = `\n      const ivec3 pads = ivec3(${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 * @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
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*/\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
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/\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
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==\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

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==========\n
*/\n\nimport {env, FusedBatchNorm, FusedBatchNormAttrs, FusedBatchNormInputs, KernelConfig, KernelFunc,
TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\nimport
{BatchNormProgram} from '../batchnorm_gpu';\nimport {BatchNormPackedProgram} from
'../batchnorm_packed_gpu';\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,
finalInputs[0].dtype);\n\n return output;\n};\n\nexport const batchNormConfig: KernelConfig = {\n kernelName:
FusedBatchNorm,\n backendName: 'webgl',\n kernelFunc: batchNorm as {} as KernelFunc,\n};\n","/**\n *
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==========\n
*/\n\nimport {GPGPUContext} from './gpgpu_context';\nimport {GPGPUProgram} from './gpgpu_math';\nimport
{getCoordsDataType} from './shader_compiler';\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   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\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 ${rank} is not yet supported`);\n  }\n}\n","/**\n * @license\n * Copyright 2019
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
==========================================================================\n
 */\n\nimport {GPGPUContext} from './gpgpu_context';\nimport {GPGPUProgram} from './gpgpu_math';\nimport
{getChannels} from './packing_util';\nimport {getCoordsDataType} from './shader_compiler';\n\nexport class
SlicePackedProgram implements GPGPUProgram {\n  variableNames = ['source'];\n  packedInputs = true;\n
packedOutput = true;\n  outputShape: number[];\n  userCode: string;\n  rank: number;\n\n  // Caching uniform
location for speed.\n  startLoc: WebGLUniformLocation;\n\n  constructor(destSize: number[]) {\n
this.outputShape = destSize;\n    this.rank = destSize.length;\n\n    const dtype = getCoordsDataType(this.rank);\n
const coords = getChannels('coords', this.rank);\n    const sourceLoc = getChannels('sourceLoc', this.rank);\n\n
const innerDims =\n        this.rank === 1 ? 'sourceLoc' : `vec2(${sourceLoc.slice(-2).join()})`;\n    const getChannel
=\n        `getChannel(getSource(${sourceLoc.join()}), ${innerDims})`;\n
    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    `;\n    const lowerRow = this.rank === 1 ? '' : `\n      --${coords[this.rank - 1]};\n      if (++${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\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        ${lowerRow}\n        setOutput(result);\n      }\n    `;\n  }\n\n
getCustomSetupFunc(start: number[]) {\n    if (start.length !== this.rank) {\n      throw Error(\n          `The rank
(${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        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
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==========================================================================\n
*/\n\nimport {backend_util, BatchToSpaceND, BatchToSpaceNDAttrs, BatchToSpaceNDInputs, KernelConfig,
KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from
'../backend_webgl';\n\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 yet');\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 toDispose = [];\n\n const reshapedIntermediate =\n   reshape({inputs: {x}, backend, attrs: {shape: reshaped}});\n const transposedIntermediate
 = transpose(\n   {inputs: {x: reshapedIntermediate}, backend, attrs: {perm: permuted}});\n const reshapedIntermediate2 = reshape({\n   inputs: {x: transposedIntermediate},\n   backend,\n   attrs: {shape: reshapedPermuted}\n });\n const sliced = slice({\n   inputs: {x: reshapedIntermediate2},\n   backend,\n   attrs: {begin: sliceBeginCoords, size: sliceSize}\n });\n\n toDispose.push(reshapedIntermediate);\n toDispose.push(transposedIntermediate);\n toDispose.push(reshapedIntermediate2);\n\n toDispose.forEach(t => backend.disposeIntermediateTensorInfo(t));\n\n return sliced;\n};\n\nexport const batchToSpaceNDConfig: KernelConfig = {\n kernelName: BatchToSpaceND,\n backendName: 'webgl',\n kernelFunc: batchToSpaceND 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
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 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}\n\nexport const bincountConfig: KernelConfig = {\n kernelName: Bincount,\n backendName: 'webgl',\n kernelFunc: bincount 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 {TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {UnaryOpProgram} from '../unaryop_gpu';\n\nconst TO_INT = `return float(int(x));`;\n\nexport function int(input: TensorInfo, backend: MathBackendWebGL): TensorInfo {\n const program = new UnaryOpProgram(input.shape, TO_INT);\n const output = backend.runWebGLProgram(program, [input], 'int32');\n return {dataId: output.dataId, shape: output.shape, dtype: output.dtype};\n}\n","/**\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version

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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 {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\n setOutput(clamp(value, minVal, maxVal));\n }\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 * @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 {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\n if (any(isnan(value))) {\n setOutput(value);\n return;\n }\n\n setOutput(clamp(value, vec4(minVal), vec4(maxVal)));\n }\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 * @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 {ClipByValue, ClipByValueAttrs, ClipByValueInputs, env, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-core';\n\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 * @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 {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 * 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 {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.\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 * @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

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the License.\n *
============================================================================\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  // Concats 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;
i++) {\n      const shift = offsets[i - 1];\n      snippets.push(\n          `else if (yC < ${offsets[i]}) ` +\n
`setOutput(getT${i}(yR, yC-${shift}));`);\n    }\n    const lastIndex = offsets.length;\n    const lastShift =
offsets[offsets.length - 1];\n    snippets.push(`else setOutput(getT${lastIndex}(yR, yC-${lastShift}));`);\n\n
this.userCode = `\n      void main() {\n        ivec2 coords = getOutputCoords();\n        int yR = coords.x;\n        int yC
= coords.y;\n\n        ${snippets.join('\\n        ')}\n      }\n    `;\n  }\n}\n","/**\n * @license\n * Copyright 2019 Google
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express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
============================================================================\n
*/\n\nimport {backend_util} from '@tensorflow/tfjs-core';\n\nimport {GPGPUProgram} from
'./gpgpu_math';\nimport {getChannels} from './packing_util';\nimport {getCoordsDataType} from
'./shader_compiler';\n\nexport class ConcatPackedProgram implements GPGPUProgram {\n  variableNames:
string[];\n  packedInputs = true;\n  packedOutput = true;\n  outputShape: number[] = [];\n  userCode: string;\n\n
constructor(shapes: number[][], axis: number) {\n    this.outputShape =
  backend_util.computeOutShape(shapes, axis);\n    const shape = this.outputShape;\n    const rank = shape.length;\n
const dtype = getCoordsDataType(rank);\n    const coords = getChannels('coords', rank);\n    const channels = ['x',
'y', 'z', 'w', 'u', 'v'].slice(0, rank);\n    this.variableNames = shapes.map((_, i) => `T${i}`);\n\n    const offsets:
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
= channels.slice(-2);\n    const allChannels = channels.join();\n\n    let getValueSnippet = `if (${channel} <
${offsets[0]}) {\n        return getChannel(\n            getT0(${allChannels}), vec2(${lastChannels.join()}));\n
}`;\n    for (let i = 1; i < offsets.length; i++) {\n      const shift = offsets[i - 1];\n      // Note: the >= comparison below
may seem unnecessary given the check\n
      // above but is needed to workaround branch execution issues on some\n      // devices. It makes all the
conditions exclusive without relying on\n      // execution order.\n      getValueSnippet += `\n        if (${channel} <
${offsets[i]}  && ${channel} >= ${offsets[i - 1]}) {\n          return getChannel(\n
getT${i}(${shiftedChannels(channels, channel, shift)}),\n            vec2(${shiftedChannels(lastChannels, channel,
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,
shift)}),\n            vec2(${shiftedChannels(lastChannels, channel, shift)}));`;\n\n    this.userCode = `\n      float
getValue(${channels.map(x => 'int ' + x)}) {\n        ${getValueSnippet}\n      }\n\n      void main() {\n        ${dtype}
coords = getOutputCoords();\n        vec4 result = vec4(getValue(${coords}), 0.,
  0., 0.);\n\n        ${coords[rank - 1]} = ${coords[rank - 1]} + 1;\n        if (${coords[rank - 1]} < ${shape[rank - 1]})
{\n          result.g = getValue(${coords});\n        }\n\n        ${coords[rank - 2]} = ${coords[rank - 2]} + 1;\n        if
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(${coords[rank - 2]} < ${shape[rank - 2]}) {\n result.a = getValue(${coords});\n }\n\n ${coords[rank - 1]} = ${coords[rank - 1]} - 1;\n if (${coords[rank - 2]} < ${shape[rank - 2]} &&\n ${coords[rank - 1]} < ${shape[rank - 1]}) {\n result.b = getValue(${coords});\n }\n setOutput(result);\n }\n `;\n }\n}\n\n/**\n * Return an expression for coordinates into a vector where a given channel\n * will be offset by [shift].\n *\n * @param channels the channels to consider\n * @param channel the channel we want shifted\n * @param shift the amount to subtract from the channel.\n *\n * @returns a string of the form 'x, y-[shift], z' where any one channel can\n * have the shift applied.\n */\nfunction shiftedChannels(channels: string[], channel: string, shift: number) {\n const channelIdx = channels.indexOf(channel);\n const res = channels.map((c, idx) => {\n if (idx === channelIdx) {\n return `${c} - ${shift}`;\n } else {\n return c;\n }\n });\n return res.join();\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 {Imag, ImagInputs, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {identity} from './Identity';\n\nexport function imag(args: {inputs: ImagInputs, backend: MathBackendWebGL}):\n TensorInfo {\n const {inputs, backend} = args;\n const {input} = inputs;\n const inputData = backend.texData.get(input.dataId);\n\n return identity({inputs: {x: inputData.complexTensorInfos.imag}, backend});\n}\n\nexport const imagConfig: KernelConfig = {\n kernelName: Imag,\n backendName: 'webgl',\n kernelFunc: imag 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, Concat, ConcatAttrs, ConcatInputs, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {concatImpl} from './Concat_impl';\nimport {identity} from './Identity';\n\nexport function concat(\n args:\n {inputs: ConcatInputs, attrs: ConcatAttrs, backend: MathBackendWebGL}):\n TensorInfo {\n const {inputs, backend, attrs} = args;\n const {axis} = attrs;\n\n const $axis = util.parseAxisParam(axis, inputs[0].shape)[0];\n const outShape =\n backend_util.computeOutShape(inputs.map(t => t.shape), $axis);\n\n if (util.sizeFromShape(outShape) === 0) {\n return backend.makeTensorInfo(outShape, inputs[0].dtype, []);\n }\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 shapes = $inputs.map(t => t.shape);\n backend_util.assertParamsConsistent(shapes, $axis);\n\n return concatImpl($inputs, $axis, backend);\n}\n\nexport const concatConfig: KernelConfig = {\n kernelName: Concat,\n backendName: 'webgl',\n kernelFunc: concat 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

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==========================================================================\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\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
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\n          if (${inputDepthVec4Remainder === 1}) {\n\n            if
(${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,
${inputDepthNearestVec4}, d2);\n            }\n\n          } else if (${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,
```

```
${inputDepthNearestVec4} + 1)\n );\n dotProd += dot(xValues, wValues);\n } else {\n vec2 xValues = vec2(\n getX(batch, ${inputDepthNearestVec4}, xR, xC),\n getX(batch, ${inputDepthNearestVec4} + 1, xR, xC)\n );\n dotProd += dot(xValues, wValues);\n }\n\n } else if (${inputDepthVec4Remainder === 3}) {\n vec3 wValues = vec3(\n getW(wR, wC, ${inputDepthNearestVec4}, d2),\n getW(wR, wC, ${inputDepthNearestVec4} + 1, d2),\n getW(wR, wC, ${inputDepthNearestVec4} + 2, d2)\n );\n\n if (${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 += dot(xValues, wValues);\n }\n\n }\n }\n }\n\n float result = dotProd;\n ${addBiasSnippet}\n ${applyActivationSnippet}\n setOutput(result);\n }\n `;\n }\n}\n\nexport class Conv3DProgram implements GPGPUProgram {\n variableNames = ['x', 'W'];\n outputShape: number[];\n userCode: string;\n\n constructor(convInfo: backend_util.Conv3DInfo) {\n this.outputShape = convInfo.outShape;\n const padFront = convInfo.padInfo.front;\n const padTop = convInfo.padInfo.top;\n const padLeft = convInfo.padInfo.left;\n const strideDepth = convInfo.strideDepth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const dilationDepth = convInfo.dilationDepth;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const filterDepth = convInfo.filterDepth;\n const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n\n const inputDepthNearestVec4 = Math.floor(convInfo.inChannels / 4) * 4;\n const inputDepthVec4Remainder = convInfo.inChannels % 4;\n\n this.userCode = `\n const ivec3 strides = ivec3(${strideDepth}, ${strideHeight}, ${\n strideWidth});\n const ivec3 pads = ivec3(${padFront}, ${padTop}, ${padLeft});\n\n void main() {\n ivec5 coords = getOutputCoords();\n int batch = coords.x;\n int d2 = coords.u;\n\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\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 for (int d1 = 0; d1 < ${inputDepthNearestVec4}; d1 += 4) {\n vec4 xValues = vec4(\n getX(batch, xF, xR, xC, d1),\n getX(batch, xF, xR, xC, d1 + 1),\n getX(batch, xF, xR, xC, d1 + 2),\n getX(batch, xF, xR, xC, d1 + 3)\n );\n vec4 wValues = vec4(\n getW(wF, wR, wC, d1, d2),\n getW(wF, wR, wC, d1 + 1, d2),\n getW(wF, wR, wC, d1 + 2, d2),\n getW(wF, wR, wC, d1 + 3, d2)\n );\n\n dotProd += dot(xValues, wValues);\n }\n\n if (${inputDepthVec4Remainder === 1}) {\n dotProd +=\n getX(batch, xF, xR, xC, ${inputDepthNearestVec4}) *\n getW(wF, wR, wC, ${inputDepthNearestVec4}, d2);\n } else if (${inputDepthVec4Remainder === 2}) {\n vec2 xValues = vec2(\n getX(batch, xF, xR, xC, ${inputDepthNearestVec4}),\n getX(batch, xF, xR, xC, ${inputDepthNearestVec4} + 1)\n );\n vec2 wValues = vec2(\n getW(wF, wR, wC, ${inputDepthNearestVec4}, d2),\n getW(wF, wR, wC, ${inputDepthNearestVec4} + 1, d2)\n );\n dotProd += dot(xValues, wValues);\n } else if (${inputDepthVec4Remainder === 3}) {\n vec3 xValues = vec3(\n```
```

```
getX(batch, xF,
 xR, xC, ${inputDepthNearestVec4}),\n                getX(batch, xF, xR, xC, ${inputDepthNearestVec4} + 1),\n
      getX(batch, xF, xR, xC, ${inputDepthNearestVec4} + 2)\n              );\n              vec3 wValues = vec3(\n
      getW(wF, wR, wC, ${inputDepthNearestVec4}, d2),\n                getW(wF, wR, wC,
${inputDepthNearestVec4} + 1, d2),\n                getW(wF, wR, wC, ${inputDepthNearestVec4} + 2, d2)\n
 );\n              dotProd += dot(xValues, wValues);\n            }\n          }\n        }\n      }\n
setOutput(dotProd);\n    }\n  `;\n }\n}\n","/**\n * @license\n * Copyright 2019 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 *
==========================================================================\n
*/\n\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {getGlslDifferences} from
'./glsl_version';\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class Im2ColPackedProgram
implements GPGPUProgram {\n  variableNames = ['A'];\n  packedInputs = true;\n  packedOutput = true;\n
outputShape: number[];\n  userCode: string;\n\n  constructor(\n      outputShape: number[], inputShape: number[],\n
   convInfo: backend_util.Conv2DInfo) {\n    this.outputShape = outputShape;\n\n    const {\n      filterWidth,\n
inChannels,\n      strideWidth,\n      strideHeight,\n      padInfo,\n      outWidth,\n      dilationWidth,\n
 dilationHeight,\n      dataFormat\n    } = convInfo;\n    const {left, top} = padInfo;\n    const itemsPerBlockRow =
inChannels * filterWidth;\n    const glsl = getGlslDifferences();\n    const isChannelsLast = dataFormat ===
'channelsLast';\n    const rowDim = isChannelsLast ? 0 : 1;\n    const colDim = isChannelsLast ? 1 : 2;\n\n    let
unrolled = ``;\n\n    for (let row = 0; row <= 1; row++) {\n      for (let col = 0; col <= 1; col++) {\n        unrolled +=
`\n          blockIndex = rc.y + ${col};\n          pos = rc.x + ${row};\n\n          if(blockIndex < ${outputShape[1]} &&
pos < ${outputShape[0]}) {\n            offsetY = int(blockIndex / (${outWidth})) * ${strideHeight} - ${\n
top};\n            d0 = offsetY + ${dilationHeight} * (pos / ${itemsPerBlockRow});\n\n            if(d0 <
${inputShape[rowDim]} && d0 >= 0) {\n\n              offsetX = int(mod(float(blockIndex), ${outWidth}.) * ${\n
   strideWidth}. - ${left}.);\n              d1 = offsetX + ${dilationWidth}
 * (int(mod(float(pos), ${\n            itemsPerBlockRow}.) / ${inChannels}.));\n\n              if(d1 <
${inputShape[colDim]} && d1 >= 0) {\n\n                ch = int(mod(float(pos), ${inChannels}.));\n\n                if
(${isChannelsLast}) {\n                  innerDims = vec2(d1, ch);\n                  result[${row * 2 + col}] = getChannel(\n
                getA(d0, int(innerDims.x),\n                  int(innerDims.y)), innerDims);\n                } else {\n
innerDims = vec2(d0, d1);\n                  result[${row * 2 + col}] = getChannel(\n                  getA(ch,
int(innerDims.x),\n                  int(innerDims.y)), innerDims);\n              }\n            }\n          }\n        }\n
`;\n    }\n  }\n\n  this.userCode = `\n    void main() {\n      ivec2 rc = getOutputCoords();\n\n      vec4 result =
vec4(0);\n\n      int blockIndex, pos, offsetY, d0, offsetX, d1, ch;\n      vec2 innerDims;\n\n      ${unrolled}\n\n
      ${glsl.output} = 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,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY 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, env, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL}
from '../backend_webgl';\nimport {Im2ColPackedProgram} from '../im2col_packed_gpu';\nimport
{mapActivationToShaderProgram}
```

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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).\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\n    out = reshape(\n        {inputs: {x: result}, backend, 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 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} 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 -
there is no need for expensive reshape as data\n  // layout is already correct.\n  pointwiseConvTexData.shape =
convInfo.outShape;\n\n  out = identity({inputs: {x: pointwiseConv}, backend});\n  out.shape =
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
outlined in \"High Performance\n// Convolutional Neural Networks for Document Processing\" (Suvisoft,
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
conv2d input so each block to be convolved over forms the\n  // column of a new matrix with shape [filterWidth *
filterHeight *\n  // inChannels, outHeight * outWidth]. The filter is also rearranged so each\n  // output channel
forms a row of a new matrix with shape [outChannels,\n  // filterWidth * filterHeight * inChannels]. The
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\n  const sharedDim = filterWidth * filterHeight *
inChannels;\n  const numCols = outHeight * outWidth;\n  const x2ColShape = [sharedDim, numCols];\n  const
transposeA
 = 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:
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
Im2ColPackedProgram(x2ColShape, xSqueezed.shape, convInfo);\n  const im2Col =
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
hasPreluActivationWeights = preluActivationWeights != null;\n  const hasLeakyreluAlpha = activation ===
'leakyrelu';\n  const fusedActivation =\n      activation ?
 mapActivationToShaderProgram(activation, true) : null;\n  const matmulProgram = new MatMulPackedProgram(\n
   im2ColReshaped.shape as [number, number, number],\n      w2Row.shape as [number, number, number],\n      [1,
numCols, convInfo.outChannels], transposeA, transposeB, hasBias,\n      fusedActivation,
hasPreluActivationWeights, hasLeakyreluAlpha);\n  const inputs: TensorInfo[] = [im2ColReshaped, w2Row];\n  if
(bias) {\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  const product = backend.runWebGLProgram(matmulProgram, inputs,
'float32');\n\n  const outShape = isChannelsLast ?\n      [1, outHeight, outWidth, convInfo.outChannels] :\n      [1,
convInfo.outChannels,
 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 * @license\n * Copyright 2020 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
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License.\n *
```

```
=============================================================================\n
*/\n\nimport
 {backend_util, Conv2D, Conv2DAttrs, Conv2DInputs, env, KernelConfig, KernelFunc, TensorInfo} from
'@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {Conv2DProgram}
from '../conv_gpu';\nimport {conv2dByMatMul, conv2dWithIm2Row} from './Conv2D_impl';\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\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\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\n  const outReshaped =\n      reshape({inputs: {x:
out}, backend, attrs: {shape: convInfo.outShape}});\n  backend.disposeIntermediateTensorInfo(out);\n\n  return
outReshaped;\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
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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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WITHOUT WARRANTIES OR CONDITIONS OF ANY 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';\nimport {GPGPUProgram} from
'./gpgpu_math';\n\nexport class Conv2DDerFilterProgram 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 isChannelsLast = convInfo.dataFormat === 'channelsLast';\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 d2 = coords.w;\n\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\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 >= ${convInfo.inWidth}) {\n                continue;\n              }\n\n              if
(${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        }\n      }\n      setOutput(dotProd);\n    }\n  `;\n }\n}\n\nexport class Conv2DDerInputProgram
implements GPGPUProgram {\n  variableNames = ['dy', 'W'];\n  outputShape: number[];\n  userCode: string;\n\n
constructor(convInfo: backend_util.Conv2DInfo) {\n    this.outputShape = convInfo.inShape;\n\n    const
```

```
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
    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 ||\n              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 <
${convInfo.outChannels}; d2++) {\n\n              if (${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        }\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 >= ${convInfo.inWidth}) {\n                  continue;\n                }\n\n                float dyValue = getDy(b, yF,
yR, yC, d2);\n                float xValue = getX(b, xF, xR, xC, d1);\n                dotProd += (xValue * dyValue);\n
  }\n            }\n          }\n        }\n        setOutput(dotProd);\n      }\n    `;\n  }\n}\n\nexport
 class Conv3DDerInputProgram implements GPGPUProgram {\n  variableNames = ['dy', 'W'];\n  outputShape:
number[];\n  userCode: string;\n\n  constructor(convInfo: backend_util.Conv3DInfo) {\n    this.outputShape =
convInfo.inShape;\n\n    const filterDepth = convInfo.filterDepth;\n    const filterHeight = convInfo.filterHeight;\n
const filterWidth = convInfo.filterWidth;\n    const strideDepth = convInfo.strideDepth;\n    const strideHeight =
convInfo.strideHeight;\n    const strideWidth = convInfo.strideWidth;\n\n    const padFront = filterDepth - 1 -
convInfo.padInfo.front;\n    const padTop = filterHeight - 1 - convInfo.padInfo.top;\n    const padLeft = filterWidth -
1 - convInfo.padInfo.left;\n\n    this.userCode = `\n      const ivec3 pads = ivec3(${padFront}, ${padTop},
${padLeft});\n\n      void main() {\n        ivec5 coords = getOutputCoords();\n        int batch = coords.x;\n        int d1
= coords.u;\n\n\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\n        float dotProd = 0.0;\n        for (int wF = 0; wF < ${filterDepth}; wF++) {\n          float dyF =
```

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\n int wFPerm = ${filterDepth} - 1 - wF;\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 ||\n 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 ||\n 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 float xValue = getDy(batch, idyF, idyR, idyC, d2);\n float wValue = getW(wFPerm, wRPerm, wCPerm, d1, d2);\n dotProd += xValue * wValue;\n }\n }\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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, Conv2DBackpropFilter, Conv2DBackpropFilterAttrs, Conv2DBackpropFilterInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\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 */,\n $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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\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);\n return 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 * @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, 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 * @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\n function conv3DBackpropFilterV2(args: {\n inputs: Conv3DBackpropFilterV2Inputs,\n attrs: Conv3DBackpropFilterV2Attrs,\n backend: MathBackendWebGL\n}) {\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,\n   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 * @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\n may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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

{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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n
 * WITHOUT WARRANTIES OR CONDITIONS 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 {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 * 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 {Cosh, KernelConfig} from '@tensorflow/tfjs-core';\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 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
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*/\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',\n   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 '0.0',\n '0.0',\n `0.5 * (y1+y2) * ${inputHeightFloat}`,\n];\n const [widthRatio, widthScale, inX] = cropWidth > 1 ?\n [\n `${(imageWidth - 1) / (cropWidth - 1)}`,\n '(x2-x1) * width_ratio',\n `x1*${inputWidthFloat} + float(x)*(width_scale)`,\n] :\n [\n '0.0',\n '0.0',\n `0.5 * (x1+x2) * ${inputWidthFloat}`,\n];\n\n // Reference implementation\n // tslint:disable-next-line:max-line-length\n // https://github.com/tensorflow/tensorflow/blob/master/tensorflow/core/kernels/crop_and_resize_op_gpu.cu.cc\n this.userCode = `\n const float height_ratio = float(${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\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\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\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\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 License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {CropAndResize, CropAndResizeAttrs, CropAndResizeInputs, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\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 {} 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 *
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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\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\nfunction 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 ${rank} is not yet supported`);\n }\n}\n\nfunction getFinalCoord(rank: number, name: string): string {\n if (rank === 1) {\n return `${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 ${rank} is not yet supported`);\n }\n}\n","/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS
IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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*/\n\nimport {backend_util, Cumsum, CumsumAttrs, CumsumInputs, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {CumSumProgram} from '../cumsum_gpu';\n\nimport {identity} from './Identity';\nimport {transpose} from './Transpose';\n\nexport function cumsum(\n args:\n {inputs: CumsumInputs, backend: MathBackendWebGL, attrs: CumsumAttrs}):\n TensorInfo {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {axis, exclusive, reverse} = attrs;\n\n const xRank = x.shape.length;\n const permutation = backend_util.getAxesPermutation([axis], xRank);\n let permutedX = x;\n if (permutation != null) {\n
permutedX = transpose({inputs: {x}, backend, attrs: {perm: permutation}});\n }\n const permutedAxis = backend_util.getInnerMostAxes(1, xRank)[0];\n\n if (permutedAxis !== xRank - 1) {\n throw new Error(\n `WebGL cumsum shader expects an inner-most axis=${\n x.shape.length - 1} ` +\n `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 }\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 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 * @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 {DenseBincount, DenseBincountAttrs, DenseBincountInputs, KernelConfig, KernelFunc, TensorInfo, TypedArray} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\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 * @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 {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\n  private getWidthCoordString(): string {\n    if (this.dataFormat === 'NHWC') {\n      return `coords[2]`;\n    } else {\n      return `coords[3]`;\n    }\n  }\n\n  private getDepthCoordString(): string {\n    if (this.dataFormat === 'NHWC') {\n      return `coords[3]`;\n    } else {\n      return `coords[1]`;\n    }\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\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 * 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 {DepthToSpace, DepthToSpaceAttrs, DepthToSpaceInputs, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\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\n util.assert(\n   blockSize > 1,\n   () => `blockSize should be > 1 for depthToSpace, but was: ${blockSize}`);\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 program = new DepthToSpaceProgram(outputShape, blockSize, dataFormat);\n return backend.runWebGLProgram(program, [x], x.dtype);\n}\n\nexport const depthToSpaceConfig: KernelConfig = {\n kernelName: DepthToSpace,\n backendName: 'webgl',\n kernelFunc: depthToSpace 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 *\n ==\n */\n\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {GPGPUProgram} from

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'./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        // TODO(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\n          if (xR < 0 || xR >= ${xNumRows}) {\n            continue;\n          }\n\n          for (int wC = 0; wC < ${filterWidth}; wC++) {\n            int xC = xCCorner + wC * ${dilationWidth};\n\n            if (xC < 0 || xC >= ${xNumCols}) {\n              continue;\n            }\n\n            float xVal = getX(batch, xR,
 xC, d1);\n            float wVal = getW(wR, wC, d1, q);\n            dotProd += xVal * wVal;\n          }\n        }\n\n        float result = dotProd;\n        ${addBiasSnippet}\n        ${applyActivationSnippet}\n        setOutput(result);\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\nexport class DepthwiseConvPacked2DProgram implements GPGPUProgram {\n  variableNames = ['x', 'W'];\n  packedInputs = true;\n  packedOutput = true;\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 =
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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;`;\n\n    for (let r = 0; r < filterHeight; r++) {\n
for (let c = 0; c < filterWidth; c++) {\n        mainLoop += `\n          vec4 xTexelR${r}C${c * 2} = vec4(0.);\n
vec4 wR${r}C${c} = vec4(0.);\n          vec4 xR${r}C${c} = vec4(0.);`;\n      }\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\n        mainLoop += `\n
xR = xRCorner + ${r *
 dilationHeight};\n          xC = xCCorner + ${c * dilationWidth};\n        `;\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\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\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${c}.zw = vec2(0.);\n                }\n              } else {\n
xTexelR${r}C${c} = vec4(0.);\n              }\n\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\n                // Need to manually clear unused channels in case\n                // we're
reading from recycled texture.\n                if(xCOffset + 1 >= ${xNumCols}) {\n                  previous.zw =
vec2(0.);\n                }\n\n                xR${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${c} = vec4(0.);\n              }\n\n
xR${r}C${c} = xTexelR${r}C${c};\n            `;\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\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${c}
 = vec4(0.);\n                }\n                `;\n              }\n\n              mainLoop += `\n                xR${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${c
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+ 2} = getX(batch, xR, xCOffset, d1);\n }\n\n xR${r}C${c + 1} = xTexelR${r}C${c + 2};\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\n ${mainLoop}\n\n vec4 result = dotProd;\n ${addBiasSnippet}\n ${applyActivationSnippet}\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
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==========================================================================\n
*/\n\nimport {backend_util, DepthwiseConv2dNative, DepthwiseConv2dNativeAttrs, DepthwiseConv2dNativeInputs, env, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {DepthwiseConv2DProgram} from '../conv_gpu_depthwise';\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 * @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} from '@tensorflow/tfjs-core';\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 >= ${convInfo.inWidth}) {\n            continue;\n          }\n\n          float dyValue = getDy(b,
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yR, yC, d2);\n float xValue = getX(b, xR, xC, d1);\n dotProd += (xValue * dyValue);\n }\n }\n }\n setOutput(dotProd);\n }\n `;\n }\n}\n\nexport class DepthwiseConv2DDerInputProgram implements GPGPUProgram {\n variableNames = ['dy', 'W'];\n outputShape: number[];\n userCode: string;\n\n constructor(convInfo: backend_util.Conv2DInfo) {\n this.outputShape = convInfo.inShape;\n\n const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n\n const padTop = filterHeight - 1 - convInfo.padInfo.top;\n const padLeft = filterWidth - 1 - convInfo.padInfo.left;\n const channelMul = convInfo.outChannels / convInfo.inChannels;\n\n this.userCode = `\n const ivec2 pads = ivec2(${padTop}, ${padLeft});\n\n void main() {\n ivec4 coords = getOutputCoords();\n int batch = coords[0];\n int d1 = coords[3];\n ivec2 dyCorner = coords.yz - pads;\n int dyRCorner = dyCorner.x;\n int dyCCorner = dyCorner.y;\n\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 ||\n fract(dyC) > 0.0) {\n continue;\n }\n int idyC = int(dyC);\n\n int wCPerm = ${filterWidth} - 1 - wC;\n\n // TO DO: Vec4 over the channelMul\n for (int dm = 0; dm < ${channelMul}; dm++) {\n int d2 = d1 * ${channelMul} + dm;\n float xValue = getDy(batch, idyR, idyC, d2);\n float wValue = getW(wRPerm, wCPerm, d1, dm);\n dotProd += xValue * wValue;\n }\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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, DepthwiseConv2dNativeBackpropFilter, DepthwiseConv2dNativeBackpropFilterAttrs, DepthwiseConv2dNativeBackpropFilterInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {DepthwiseConv2DDerFilterProgram} from '../conv_backprop_gpu_depthwise';\n\nexport function depthwiseConv2dNativeBackpropFilter(args: {\n inputs: DepthwiseConv2dNativeBackpropFilterInputs,\n attrs: DepthwiseConv2dNativeBackpropFilterAttrs,\n backend: MathBackendWebGL\n}) {\n const {inputs, backend, attrs} = args;\n const {x, dy} = inputs;\n const {strides, dilations, pad, dimRoundingMode, filterShape} = attrs;\n\n const convInfo = backend_util.computeConv2DInfo(\n x.shape as [number, number, number, number], filterShape, strides,\n dilations, pad, dimRoundingMode, true /* depthwise */);\n\n const program = new DepthwiseConv2DDerFilterProgram(convInfo);\n return backend.runWebGLProgram(program, [x, dy], 'float32');\n}\n\nexport const depthwiseConv2dNativeBackpropFilterConfig: KernelConfig = {\n kernelName: DepthwiseConv2dNativeBackpropFilter,\n backendName: 'webgl',\n kernelFunc: depthwiseConv2dNativeBackpropFilter 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 {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 * @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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*/\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 * @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 {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 * @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

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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\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      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\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 * @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, 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  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  backend.disposeIntermediateTensorInfo(out);\n\n  return outReshaped;\n}\n\nexport const dilation2DConfig: KernelConfig
 = {\n  kernelName: Dilation2D,\n  backendName: 'webgl',\n  kernelFunc: dilation2D 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 {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 = `\n  vec4 result;\n\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\n  return result;\n`;\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 * @license\n * Copyright 2020 Google
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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 {EluGrad, EluGradInputs, env, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-
core';\n\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);`;\nconst ELU_DER_PACKED = `\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 eluGrad
=\n    (args: {inputs: EluGradInputs, backend: MathBackendWebGL}): TensorInfo => {\n      const {inputs,
backend} = args;\n      const {dy, y} = inputs;\n\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 * @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
*/\n\nimport {Equal, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport {binaryKernelFunc} from
'../kernel_utils/kernel_funcs_utils';\n\nconst PACKED_EQUAL = `\n  return vec4(equal(a, b));\n`;\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 * @license\n * Copyright 2020
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the License.\n *
==========================================================================\n
*/\n\nimport {backend_util, Erf, KernelConfig} from '@tensorflow/tfjs-core';\n\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 * @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 {ExpandDims, ExpandDimsAttrs, ExpandDimsInputs,
 KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\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 $dim = inputRank + dim + 1;\n }\n newShape.splice($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 * @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 {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 * ${Math.PI}`;\n   const resultDenominator = inverse ? `${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(\n   `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   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, i);\n\n result +=\n unaryOpComplex(real, expR, imag, expI) / ${resultDenominator};\n }\n\n return result;\n }\n\n void main() {\n ivec2 coords = getOutputCoords();\n setOutput(mulMatDFT(coords[0], 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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless
required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {FFTProgram} from '../fft_gpu';\n\nimport {complex} from './Complex';\nimport {reshape} from './Reshape';\n\nexport function fftImpl(\n x: TensorInfo, inverse: boolean, backend: MathBackendWebGL): TensorInfo {\n const xData = backend.texData.get(x.dataId);\n\n const inputSize = 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: 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 reshape({inputs: {x: complexOutput}, backend, attrs: {shape: x.shape}});\n\n backend.disposeIntermediateTensorInfo(input2D);\n backend.disposeIntermediateTensorInfo(complexOutput);\n return complexOutputReshaped;\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 {FFT, FFTInputs, KernelConfig,
TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\n\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 */, backend);\n}\n\nexport const fftConfig: KernelConfig = {\n kernelName: FFT,\n backendName: 'webgl',\n kernelFunc: fft\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

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==========\n
*/\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\n valueLoc: WebGLUniformLocation;\n\n constructor(shape: number[], value: number) {\n
this.variableNames = ['x'];\n this.outputShape = shape;\n\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 * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
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==========\n
*/\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\n dtype = dtype || util.inferDtype(value);\n\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 * @license\n * Copyright 2020 Google LLC. All Rights
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the License.\n *
==========\n
*/\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class FlipLeftRightProgram implements
GPGPUProgram {\n variableNames = ['Image'];\n outputShape: number[] = [];\n userCode: string;\n\n
constructor(imageShape: [number, number, number, number]) {\n const imageWidth = imageShape[2];\n
this.outputShape = imageShape;\n\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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Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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, 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 * @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 {FloorDiv, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\n\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 * @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 {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) /

vec2(${width}.0, ${height}.0);\n\n vec4 values = ${glsl.texture2D}(A, uv);\n float value;\n if (depth == 0) {\n value = values.r;\n } else if (depth == 1) {\n value = values.g;\n } else if (depth == 2) {\n value = values.b;\n } else if (depth == 3) {\n value = values.a;\n }\n\n setOutput(floor(value * 255.0 + 0.5));\n }\n `;\n }\n}\n","/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in
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==========\n */\n\nimport {getGlslDifferences} from '../../glsl_version';\nimport {GPGPUProgram} from '../../gpgpu_math';\n\nexport class FromPixelsPackedProgram implements GPGPUProgram {\n variableNames = ['A'];\n userCode: string;\n outputShape: number[];\n packedInputs = false;\n packedOutput = true;\n\n constructor(outputShape: number[]) {\n const glsl = getGlslDifferences();\n const [height, width,] = outputShape;\n this.outputShape = outputShape;\n
this.userCode = `\n void main() {\n ivec3 coords = getOutputCoords();\n int texR = coords[0];\n int texC = coords[1];\n int depth = coords[2];\n\n vec4 result = vec4(0.);\n\n for(int row=0; row<=1; row++) {\n for(int col=0; col<=1; col++) {\n texC = coords[1] + row;\n depth = coords[2] + col;\n\n vec2 uv = (vec2(texC, texR) + halfCR) /\n vec2(${width}.0, ${height}.0);\n vec4 values = ${glsl.texture2D}(A, uv);\n float value;\n if (depth == 0) {\n value = values.r;\n } else if (depth == 1) {\n value = values.g;\n } else if (depth == 2) {\n value = values.b;\n } else if (depth == 3) {\n value = values.a;\n }\n\n result[row * 2 + col] = floor(value * 255.0 + 0.5);\n }\n }\n\n ${glsl.output} = 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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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, TensorInfo} from '@tensorflow/tfjs-core';\nimport {FromPixels, FromPixelsAttrs, FromPixelsInputs} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {TextureUsage} from '../tex_util';\n\nimport
{FromPixelsProgram} from './FromPixels_utils/from_pixels_gpu';\nimport {FromPixelsPackedProgram} from './FromPixels_utils/from_pixels_packed_gpu';\n\nexport const fromPixelsConfig: KernelConfig = {\n kernelName: FromPixels,\n backendName: 'webgl',\n kernelFunc: fromPixels as {} as KernelFunc,\n};\n\nlet fromPixels2DContext: CanvasRenderingContext2D;\n\nfunction fromPixels(args: {\n inputs: FromPixelsInputs,\n backend: MathBackendWebGL,\n attrs: FromPixelsAttrs\n}): TensorInfo {\n const {inputs, backend, attrs} = args;\n let {pixels} = inputs;\n const {numChannels} = attrs;\n\n const isVideo = typeof (HTMLVideoElement) !== 'undefined' &&\n pixels instanceof HTMLVideoElement;\n const isImage = typeof (HTMLImageElement) !== 'undefined' &&\n pixels instanceof HTMLImageElement;\n const isImageBitmap = typeof(ImageBitmap) !== 'undefined' &&\n pixels instanceof ImageBitmap;\n const [width, height] = isVideo ?\n [\n (pixels as HTMLVideoElement).videoWidth,\n
(pixels as HTMLVideoElement).videoHeight\n] :\n [pixels.width, pixels.height];\n\n const texShape: [number, number] = [height, width];\n const outShape = [height, width, numChannels];\n\n if (isImage || isVideo ||

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 * @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, 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';\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 */, $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,
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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, env, FusedDepthwiseConv2D, FusedDepthwiseConv2DAttrs, FusedDepthwiseConv2DInputs,
KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from
'../backend_webgl';\nimport {DepthwiseConv2DProgram} from '../conv_gpu_depthwise';\nimport
{DepthwiseConvPacked2DProgram} from '../conv_packed_gpu_depthwise';\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  const fusedActivation = activation ?\n
mapActivationToShaderProgram(activation, shouldPackDepthwiseConv) :\n      null;\n  const programInputs:
TensorInfo[] = [x, filter];\n\n  const hasBias = bias != null;\n  const hasPreluActivationWeights =
preluActivationWeights != null;\n  const hasLeakyreluAlpha = activation === 'leakyrelu';\n\n  if (hasBias) {\n
programInputs.push(bias);\n  }\n
  if (hasPreluActivationWeights) {\n    programInputs.push(preluActivationWeights);\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  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
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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 {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
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==========\n
*/\n\nimport {backend_util, GatherNd, GatherNdInputs, KernelConfig, KernelFunc, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\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] =\n
backend_util.prepareAndValidate(params, indices);\n\n const flattenIndices = reshape(\n {inputs: {x: indices},
backend, attrs: {shape: [numSlices, sliceRank]}});\n const flattenX = reshape({\n inputs: {x: params},\n
backend,\n 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 * @license\n * Copyright 2017 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 {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 = `\n

void main() {\n ${dtype} resRC = getOutputCoords();\n setOutput(getA(${sourceCoords}));\n }\n `;\n }\n}\n\n// The input and output are always flattened into rank 4 tensors.\nfunction getSourceCoords(aShape: number[], axis: number): string {\n const currentCoords = ['resRC.x', 'resRC.y', 'resRC.z', 'resRC.w'];\n\n const sourceCoords = [];\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 * @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, GatherV2, GatherV2Attrs, GatherV2Inputs, KernelConfig, KernelFunc, TensorInfo, TypedArray, util} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {GatherProgram} from '../gather_gpu';\nimport {gatherV2ImplCPU} from '../kernel_utils/shared';\n\nimport {reshape} from './Reshape';\n\nexport function gatherV2(args: {\n inputs: GatherV2Inputs,\n backend: MathBackendWebGL,\n attrs: GatherV2Attrs\n}): TensorInfo {\n const {inputs, backend, attrs} = args;\n const {x, indices} = inputs;\n const {axis, batchDims} = attrs;\n\n const parsedAxis = util.parseAxisParam(axis, x.shape)[0];\n const shapeInfo = backend_util.segment_util.collectGatherOpShapeInfo(\n x, indices, parsedAxis, batchDims);\n\n const indicesSize = util.sizeFromShape(indices.shape);\n\n const toDispose = [];\n\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\n const flattenIndex = reshape({\n inputs: {x: indices},\n backend,\n attrs: {shape: [shapeInfo.batchSize, indicesSize / shapeInfo.batchSize]}\n });\n\n toDispose.push(flattenX);\n toDispose.push(flattenIndex);\n\n const flattenOutputShape = [\n shapeInfo.batchSize, shapeInfo.outerSize, indicesSize / shapeInfo.batchSize,\n shapeInfo.sliceSize\n];\n\n if (backend.shouldExecuteOnCPU([x, indices]) || x.dtype === 'string') {\n const indicesBuf = backend.bufferSync(flattenIndex);\n const xBuf = backend.bufferSync(flattenX);\n const outBuf = gatherV2ImplCPU(xBuf, indicesBuf, flattenOutputShape);\n\n toDispose.forEach(t => backend.disposeIntermediateTensorInfo(t));\n\n return backend.makeTensorInfo(\n shapeInfo.outputShape, outBuf.dtype, outBuf.values as TypedArray);\n }\n\n const program = new GatherProgram(flattenX.shape, flattenOutputShape);\n const res = backend.runWebGLProgram(\n program, [flattenX, flattenIndex], flattenX.dtype);\n toDispose.push(res);\n\n const reshaped = reshape(\n {inputs: {x: res}, backend, attrs: {shape: shapeInfo.outputShape}});\n toDispose.forEach(t => 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 * @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 {GreaterEqual, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport {binaryKernelFunc} from '../kernel_utils/kernel_funcs_utils';\n\nconst GREATER_EQUAL = `return float(a >= b);`;\nconst GREATER_EQUAL_PACKED = `\n return vec4(greaterThanEqual(a, b));\n`;\n\nexport const greaterEqual = binaryKernelFunc({\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 {} 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 {IFFT, IFFTInputs, KernelConfig, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\n\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\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n
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==\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
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==\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
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==\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 */\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);`;\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 */\n\nimport {KernelConfig, KernelFunc, LinSpace, LinSpaceAttrs, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\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
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==========\n */\n\nimport {KernelConfig, Log1p} from '@tensorflow/tfjs-core';\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
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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, LogicalAnd} from '@tensorflow/tfjs-core';\n\nimport {binaryKernelFunc} from '../kernel_utils/kernel_funcs_utils';\n\nconst LOGICAL_AND = `return float(a >= 1.0 && b >= 1.0);`;\nconst LOGICAL_AND_PACKED = `\n  return vec4(\n    vec4(greaterThanEqual(a, vec4(1.0))) *\n vec4(greaterThanEqual(b, vec4(1.0))));\n`;\n\nexport const logicalAnd = binaryKernelFunc({\n opSnippet: LOGICAL_AND,\n packedOpSnippet: LOGICAL_AND_PACKED,\n dtype: 'bool'\n});\n\nexport const logicalAndConfig: KernelConfig = {\n kernelName: LogicalAnd,\n backendName: 'webgl',\n kernelFunc: logicalAnd 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,
 LogicalNot} from '@tensorflow/tfjs-core';\nimport {unaryKernelFunc} from '../kernel_utils/kernel_funcs_utils';\n\nconst LOGICAL_NOT = `return float(!(x >= 1.0));`;\n\nexport const logicalNot = unaryKernelFunc({opSnippet: LOGICAL_NOT});\n\nexport const logicalNotConfig: KernelConfig = {\n kernelName: LogicalNot,\n backendName: 'webgl',\n kernelFunc: logicalNot,\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, LogicalOr} from '@tensorflow/tfjs-core';\n\nimport {binaryKernelFunc} from '../kernel_utils/kernel_funcs_utils';\n\nconst LOGICAL_OR = `return float(a >= 1.0 || b >= 1.0);`;\nconst LOGICAL_OR_PACKED = `\n  return min(\n    vec4(greaterThanEqual(a, vec4(1.0))) +\n vec4(greaterThanEqual(b, vec4(1.0))),\n    vec4(1.0));\n`;\n\nexport const logicalOr = binaryKernelFunc(\n {opSnippet: LOGICAL_OR, packedOpSnippet: LOGICAL_OR_PACKED, dtype: 'bool'});\n\nexport const logicalOrConfig: KernelConfig = {\n kernelName: LogicalOr,\n backendName: 'webgl',\n kernelFunc: logicalOr 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 *
==========\n
*/\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class LRNProgram implements GPGPUProgram {\n variableNames = ['x'];\n outputShape: number[] = [];\n userCode: string;\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/26033a1644a9c4a5fbe3170ab2e864b6a4ccd4ca/..\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[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 float sum = 0.0;\n for (int j = -${rad}; j <= ${rad}; j++) {\n int idx = d + j;\n if (idx >= 0 && idx <= ${maxD}) {\n float z = getX(b, r, c, idx);\n sum += z * z;\n }\n }\n float val = x * ${powOperator};\n setOutput(val);\n }\n `;\n }\n}\n","/**\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
==\n */\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class LRNPackedProgram implements GPGPUProgram {\n variableNames = ['x'];\n outputShape: number[] = [];\n userCode: string;\n packedInputs = true;\n packedOutput = true;\n\n constructor(\n xShape: number[], radius: number, bias: number, alpha: number,\n beta:
number) {\n const rad = radius;\n const maxD = xShape[3] - 1;\n this.outputShape = xShape;\n\n // optimize pow(bias + alpha * sum, -beta)\n // src: https://github.com/tensorflow/tensorflow/..\n // blob/26033a1644a9c4a5fbe3170ab2e864b6a4ccd4ca/..\n // tensorflow/core/kernels/mkl_lrn_op.cc#L320\n let powOperator;\n const basis = `float(${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 * @license\n * Copyright 2020 Google LLC. All Rights

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==========\n */\n\nimport {env, KernelConfig, KernelFunc, LRN, LRNAttrs, LRNInputs, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {LRNProgram} from '../lrn_gpu';\nimport {LRNPackedProgram} from '../lrn_packed_gpu';\n\nexport const lrn =\n    (args: {inputs: LRNInputs, backend: MathBackendWebGL,
 attrs: LRNAttrs}):\n        TensorInfo => {\n          const {inputs, backend, attrs} = args;\n          const {x} = inputs;\n          const {depthRadius, bias, alpha, beta} = attrs;\n\n          const program = env().getBool('WEBGL_PACK_NORMALIZATION') ?\n              new LRNPackedProgram(x.shape, depthRadius, bias, alpha, beta) :\n              new LRNProgram(x.shape, depthRadius, bias, alpha, beta);\n          return backend.runWebGLProgram(program, [x], x.dtype);\n        };\n\n// tslint:disable-next-line: variable-name\nexport const LRNConfig: KernelConfig = {\n  kernelName: LRN,\n  backendName: 'webgl',\n  kernelFunc: lrn 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
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==========\n */\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class LRNGradProgram implements GPGPUProgram {\n  variableNames = ['inputImage', 'outputImage', 'dy'];\n  outputShape: number[] = [];\n  userCode: string;\n  depthRadius: number;\n  bias: number;\n  alpha: number;\n  beta: number;\n  depth: number;\n\n  constructor(\n      inputShape: number[], depthRadius: number, bias: number, alpha: number,\n      beta: number) {\n    this.outputShape = inputShape;\n    this.depth = inputShape[3];\n    this.depthRadius = depthRadius;\n    this.bias = bias;\n    this.alpha = alpha;\n    this.beta = beta;\n    this.userCode
 = `\n      void main() {\n        ivec4 coords = getOutputCoords();\n        int b = coords[0];\n        int r = coords[1];\n        int c = coords[2];\n\n        float result = 0.0;\n        for (int d = 0; d < ${this.depth}; ++d) {\n          int depthBegin = int(max(0.0, float(d - ${depthRadius})));\n          int depthEnd = int(min(float(${this.depth}),\n              float(d + ${depthRadius} + 1)));\n\n          const int MIN_DEPTH_BEGIN = 0;\n          const int MAX_DEPTH_END = ${this.depth};\n\n          float norm = 0.0;\n          for (int k = MIN_DEPTH_BEGIN; k < MAX_DEPTH_END; ++k) {\n            if (k < depthBegin){\n              continue;\n            }\n            else if (k >= depthBegin && k < depthEnd) {\n              norm += getInputImage(b, r, c, k) * getInputImage(b, r, c, k);\n            }\n            else {\n              break;\n            }\n          }\n\n          norm = float(${alpha}) * norm + float(${bias});\n\n          for(int k = MIN_DEPTH_BEGIN;
 k < MAX_DEPTH_END; ++k){\n            if (k < depthBegin){\n              continue;\n            }\n            else if (k >= depthBegin && k < depthEnd){\n              float dyi = -2.0 * float(${alpha})\n                * float(${beta})\n                * getInputImage(b ,r ,c, k) * getOutputImage(b, r, c, d)\n                / norm;\n              if (k == d) {\n                dyi += pow(norm, -1.0 * ${beta});\n              }\n              if (k == coords[3]) {\n                dyi *= getDy(b, r, c, d);\n                result += dyi;\n              }\n            }\n            else {\n              break;\n            }\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 *
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==========\n
*/\n\nimport {KernelConfig, KernelFunc, LRNGrad, LRNGradAttrs, LRNGradInputs, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {LRNGradProgram} from '../lrn_grad_gpu';\n\nexport const lrnGrad = (args: {\n inputs: LRNGradInputs,\n backend: MathBackendWebGL,\n attrs: LRNGradAttrs\n}): TensorInfo => {\n const {inputs, backend, attrs} = args;\n const {x, y, dy} = inputs;\n const {depthRadius, bias, alpha, beta} = attrs;\n\n const program = new LRNGradProgram(x.shape, depthRadius, bias, alpha, beta);\n
  return backend.runWebGLProgram(program, [x, y, dy], x.dtype);\n};\n\n// tslint:disable-next-line: variable-name\nexport const LRNGradConfig: KernelConfig = {\n kernelName: LRNGrad,\n backendName: 'webgl',\n kernelFunc: lrnGrad 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 {KernelFunc,
  Max, MaxAttrs, MaxInputs, TensorInfo} from '@tensorflow/tfjs-core';\nimport {backend_util, KernelConfig, TypedArray, util} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {maxImplCPU} from '../kernel_utils/shared';\n\nimport {maxImpl} from './Max_impl';\nimport {transposeImpl, transposeImplCPU} from './Transpose_impl';\n\nexport function max(\n args: {inputs: MaxInputs, backend: MathBackendWebGL, attrs: MaxAttrs}):\n   TensorInfo {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {reductionIndices, keepDims} = attrs;\n\n const xRank = x.shape.length;\n\n const origAxes = util.parseAxisParam(reductionIndices, x.shape);\n let axes = origAxes;\n const permutedAxes = backend_util.getAxesPermutation(axes, xRank);\n const maxInputIsTransposed = permutedAxes != null;\n const shouldExecuteOnCPU = backend.shouldExecuteOnCPU([x]);\n\n let maxInput = x;\n if (maxInputIsTransposed) {\n   if (shouldExecuteOnCPU)
  {\n   const xTexData = backend.texData.get(maxInput.dataId);\n   const values = xTexData.values as TypedArray;\n\n   const newShape: number[] = new Array(xRank);\n   for (let i = 0; i < newShape.length; i++)
  {\n   newShape[i] = x.shape[permutedAxes[i]];\n   }\n   const maxInputValues =\n   transposeImplCPU(values, x.shape, x.dtype, permutedAxes, newShape);\n\n   maxInput = backend.makeTensorInfo(newShape, x.dtype);\n   const maxInputData = backend.texData.get(maxInput.dataId);\n
    maxInputData.values = maxInputValues;\n   } else {\n   maxInput = transposeImpl(x, permutedAxes, backend);\n   }\n\n   axes = backend_util.getInnerMostAxes(axes.length, xRank);\n }\n\n backend_util.assertAxesAreInnerMostDims('max', axes, xRank);\n const [maxOutShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(maxInput.shape, axes);\n\n let outShape = maxOutShape;\n if (keepDims) {\n   // rather than reshape at the end, set the target
  shape here.\n   outShape = backend_util.expandShapeToKeepDim(maxOutShape, origAxes);\n }\n\n let out;\n if (shouldExecuteOnCPU) {\n   const xTexData = backend.texData.get(maxInput.dataId);\n   const values = xTexData.values as TypedArray;\n\n   const outValues =\n   maxImplCPU(values, util.sizeFromShape(reduceShape), outShape, x.dtype);\n\n   out = backend.makeTensorInfo(outShape, x.dtype);\n   const outData = backend.texData.get(out.dataId);\n   outData.values = outValues;\n } else {\n   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 Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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, MaxPool, MaxPoolAttrs, MaxPoolInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\n\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\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, 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 Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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, MaxPool3D, MaxPool3DAttrs, MaxPool3DInputs, TensorInfo} from '@tensorflow/tfjs-core';\n\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\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. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance

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==========================================================================\n
*/\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\n    const padTop = effectiveFilterHeight - 1 - convInfo.padInfo.top;\n    const padLeft = effectiveFilterWidth - 1 - convInfo.padInfo.left;\n\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\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}; wC++) {\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            int maxPosValue = ${lastIndex} - int(getMaxPos(b, idyR, idyC, d));\n\n            // Get the current value, check it against the value from the\n            // position matrix.\n            int curPosValue = wR * ${effectiveFilterWidth} + wC;\n            float mask = float(maxPosValue == curPosValue ? 1.0 : 0.0);\n\n            dotProd += dyValue * mask;\n          }\n        }\n        setOutput(dotProd);\n      }\n    `;\n  }\n}\n\nexport class MaxPool3DBackpropProgram implements GPGPUProgram {\n  variableNames = ['dy', 'maxPos'];\n  outputShape: number[];\n  userCode: string;\n\n  constructor(convInfo: backend_util.Conv3DInfo) {\n    this.outputShape = convInfo.inShape;\n    const strideDepth = convInfo.strideDepth;\n    const strideHeight = convInfo.strideHeight;\n    const strideWidth = convInfo.strideWidth;\n    const dilationDepth = convInfo.dilationDepth;\n    const dilationHeight = convInfo.dilationHeight;\n    const dilationWidth = convInfo.dilationWidth;\n    const effectiveFilterDepth = convInfo.effectiveFilterDepth;\n    const effectiveFilterHeight = convInfo.effectiveFilterHeight;\n    const effectiveFilterWidth = convInfo.effectiveFilterWidth;\n\n    const padFront = effectiveFilterDepth - 1 - convInfo.padInfo.front;\n    const padTop = effectiveFilterHeight - 1 - convInfo.padInfo.top;\n    const padLeft = effectiveFilterWidth - 1 - convInfo.padInfo.left;\n\n    const lastIndex =\n        effectiveFilterDepth * effectiveFilterHeight * effectiveFilterWidth - 1;\n    this.userCode = `\n      const ivec3 pads = ivec3(${padFront}, ${padTop}, ${padLeft});\n\n      void main() {\n        ivec5 coords = getOutputCoords();\n        int batch = coords.x;\n        int ch = coords.u;\n\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\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 int maxPosValue = ${lastIndex} -\n int(getMaxPos(batch, idyD, idyR, idyC, ch));\n\n // Get the current value, check it against the value from the\n // position matrix.\n int curPosValue =\n wD * ${effectiveFilterHeight} * ${effectiveFilterWidth} +\n wR * ${effectiveFilterWidth} + wC;\n float mask = float(maxPosValue == curPosValue ? 1.0 : 0.0);\n\n dotProd += dyValue * mask;\n }\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF 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, MaxPool3DGrad, MaxPool3DGradAttrs, MaxPool3DGradInputs, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {MaxPool3DBackpropProgram} from '../max_pool_backprop_gpu';\nimport {Pool3DProgram} from '../pool_gpu';\n\nexport function maxPool3DGrad(args: {\n inputs: MaxPool3DGradInputs,\n backend: MathBackendWebGL,\n attrs: MaxPool3DGradAttrs\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\n const maxPool3dPositionsProgram =\n new Pool3DProgram(convInfo, 'max', true / get positions */);\n const maxPool3dPositions =\n backend.runWebGLProgram(maxPool3dPositionsProgram, [x], x.dtype);\n const maxPoolBackpropProgram = new MaxPool3DBackpropProgram(convInfo);\n const result = backend.runWebGLProgram(\n maxPoolBackpropProgram, [dy, maxPool3dPositions], x.dtype);\n backend.disposeIntermediateTensorInfo(maxPool3dPositions);\n return result;\n}\n\nexport const maxPoolGrad3DConfig: KernelConfig = {\n kernelName: MaxPool3DGrad,\n backendName: 'webgl',\n kernelFunc: maxPool3DGrad 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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*/\nimport {backend_util, KernelConfig, KernelFunc, MaxPoolGrad, MaxPoolGradAttrs, MaxPoolGradInputs, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {MaxPool2DBackpropProgram} from '../max_pool_backprop_gpu';\nimport {Pool2DProgram} from '../pool_gpu';\nimport {assertNotComplex} from '../webgl_util';\n\nexport function maxPoolGrad(args: {\n inputs: MaxPoolGradInputs,\n backend: MathBackendWebGL,\n attrs: MaxPoolGradAttrs\n}): TensorInfo {\n const

{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 =\n backend.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 Reserved.\n * Licensed under the Apache License, Version 2.0 (the
 \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\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 * @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
 {MaxPoolWithArgmax, MaxPoolWithArgmaxAttrs, MaxPoolWithArgmaxInputs} from '@tensorflow/tfjs-core';\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","/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the

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language governing permissions and\n * limitations under the License.\n *
==========\n */\n\nimport {TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {reduce} from '../kernel_utils/reduce';\nimport {reshape} from '../kernels/Reshape';\n\nexport function meanImpl(\n x: TensorInfo, reduceShape: number[], outShape: 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, 'float32', 'mean', backend);\n const reshapedOutput =\n reshape({inputs: {x: reduced}, attrs: {shape: outShape}, backend});\n\n backend.disposeIntermediateTensorInfo(reshapedInput);\n backend.disposeIntermediateTensorInfo(reduced);\n\n
return reshapedOutput;\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, KernelConfig, Mean, MeanAttrs, MeanInputs, TensorInfo, TypedArray, util} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\n\nimport {meanImpl} from './Mean_impl';\nimport
{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 as MeanInputs;\n const {keepDims, axis} = attrs as {} as MeanAttrs;\n const webglBackend = backend as MathBackendWebGL;\n\n const xRank = x.shape.length;\n const origAxes = util.parseAxisParam(axis, x.shape);\n\n let axes = origAxes;\n const permutedAxes = backend_util.getAxesPermutation(axes, xRank);\n const meanInputIsTransposed = permutedAxes != null;\n const shouldExecuteOnCPU = webglBackend.shouldExecuteOnCPU([x]);\n\n const intermediates: TensorInfo[] = [];\n\n let meanInput = x;\n if (meanInputIsTransposed) {\n if (shouldExecuteOnCPU) {\n const xTexData = webglBackend.texData.get(meanInput.dataId);\n const values = xTexData.values as TypedArray;\n\n const newShape: number[] = new Array(xRank);\n
for (let i = 0; i < newShape.length; i++) {\n newShape[i] = x.shape[permutedAxes[i]];\n }\n const meanInputValues =\n transposeImplCPU(values, x.shape, x.dtype, permutedAxes, newShape);\n\n meanInput = webglBackend.makeTensorInfo(newShape, x.dtype);\n const meanInputData = webglBackend.texData.get(meanInput.dataId);\n meanInputData.values = meanInputValues;\n } else {\n meanInput = transposeImpl(x, permutedAxes, webglBackend);\n }\n\n intermediates.push(meanInput);\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 if (keepDims) {\n // rather than reshape at the end, set the target shape here.\n outShape = backend_util.expandShapeToKeepDim(meanOutShape,

origAxes);\n }\n\n const out = meanImpl(meanInput, reduceShape, outShape, webglBackend);\n for (const i of 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 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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, Min,\n MinAttrs, MinInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {reduce} from '../kernel_utils/reduce';\n\nimport {reshape} from './Reshape';\nimport {transpose} from './Transpose';\n\nexport function min(\n args: {inputs: MinInputs, backend: MathBackendWebGL, attrs: MinAttrs}):\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, x.shape.length);\n }\n\n backend_util.assertAxesAreInnerMostDims('min', axes, xRank);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(permutedX.shape,\n axes);\n const inSize = util.sizeFromShape(reduceShape);\n const a2D =\n reshape({inputs: {x: permutedX}, backend, attrs: {shape: [-1, inSize]}});\n const reduced = reduce(a2D, a2D.dtype, 'min', backend);\n\n let res;\n if (keepDims) {\n const newShape = backend_util.expandShapeToKeepDim(outShape, 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\nexport const minConfig: KernelConfig = {\n kernelName: Min,\n backendName: 'webgl',\n kernelFunc: min as {} as KernelFunc\n};\n","/**\n * @license\n * Copyright 2020 Google LLC. 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 the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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';\nimport {getCoordsDataType} from './shader_compiler';\n\nexport class MirrorPadProgram implements GPGPUProgram {\n variableNames = ['x'];\n outputShape: number[];\n userCode: string;\n\n constructor(\n xShape: number[], paddings: Array<[number, number]>,\n mode: 'reflect'|'symmetric') {\n this.outputShape = paddings.map(\n (p,\n i) => p[0] /* beforePad */ + xShape[i] + p[1] /* afterPad */);\n const rank = xShape.length;\n const dtype = getCoordsDataType(rank);\n\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 const offset = mode === 'reflect' ? 0 : 1;\n\n if (rank === 1) {\n this.userCode = `\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 = (end - 1) * 2 - outC + ${offset};\n  }\n  setOutput(getX(outC - start));\n  }\n  `;\n return;\n }\n

```
this.userCode = `\n      ${dtype} start = ${dtype}(${start});\n      ${dtype} end = ${dtype}(${end});\n\n      void main() {\n
    ${dtype} outC = getOutputCoords();\n        for (int i = 0; i < ${rank}; i++) {\n          if (outC[i] < start[i]) {\n
 outC[i] = start[i] * 2 - outC[i] - ${offset};\n          } else if(outC[i] >= end[i]) {\n            outC[i] = (end[i] - 1) * 2 -
outC[i] + ${offset};\n          }\n        }\n        ${dtype} coords = outC - start;\n
setOutput(getX(${unpackedCoords}));\n      }\n    `;\n  }\n}\n","/**\n * @license\n * Copyright 2020 Google LLC.
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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,
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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 {GPGPUProgram} from './gpgpu_math';\nimport {getChannels} from './packing_util';\nimport
{getCoordsDataType} from './shader_compiler';\n\n/**\n * Example shader code for\n * `mirrorPad(tf.tensor1d([1,
2, 3], 'int32'), [[2, 2]], 'reflect')`\n * ```\n *    const int start = int(2);\n *    const int end = int(5);\n *\n *    void main()
{\n *      int outputLoc = getOutputCoords();\n *      vec4 result = vec4(0.);\n *\n *      int rc = outputLoc;\n *\n *
 int source = rc;\n *      if (source < start) {\n *        source = start * 2 - source - 0;\n *      } else if (source >= end)
{\n *        source = (end - 1) * 2 - source + 0;\n *      }\n *      source -= start;\n *\n *      result[0] =
getChannel(getX(source), source);\n *      rc += 1;\n *      if(rc < 6) {\n *        int source = rc;\n *        if (source <
start)
 {\n *          source = start * 2 - source - 0;\n *        } else if (source >= end) {\n *          source = (end - 1) * 2 -
source + 0;\n *        }\n *        source -= start;\n *\n *        result[1] = getChannel(getX(source), source);\n *
}\n *\n *      setOutput(result);\n *    }\n * ```\n */\nexport class MirrorPadPackedProgram implements
GPGPUProgram {\n  variableNames = ['x'];\n  packedInputs = true;\n  packedOutput = true;\n  outputShape:
number[];\n  userCode: string;\n\n  constructor(\n      xShape: number[], paddings: Array<[number, number]>,\n
mode: 'reflect'|'symmetric') {\n    this.outputShape = paddings.map(\n        (p, i) => p[0] /* beforePad */ + xShape[i]
+ p[1] /* afterPad */);\n    const rank = xShape.length;\n    const dtype = getCoordsDataType(rank);\n\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 offset = mode === 'reflect' ?
0 : 1;\n\n    let mainLoop = '';\n    if (rank === 1) {\n      const padSetup = `\n        ${dtype} source = rc;\n        if
(source < start) {\n          source = start * 2 - source - ${offset};\n        } else if (source >= end) {\n          source =
(end - 1) * 2 - source + ${offset};\n        }\n        source -= start;\n      `;\n      mainLoop = `\n        ${dtype} rc =
outputLoc;\n        ${padSetup}\n        result[0] = getChannel(getX(${source.join()}), ${innerDims});\n
${coords[rank - 1]} += 1;\n        if(${cLimit}) {\n          ${padSetup}\n          result[1] =
getChannel(getX(${source.join()}), ${innerDims});\n        }\n      `;\n    } else {\n      const padSetup = `\n
${dtype} source = rc;\n        ${dtype} lt = ${dtype}(lessThan(source,
 start));\n        ${dtype} gte = ${dtype}(greaterThanEqual(source, end));\n        ${dtype} orig = 1 - (lt + gte);\n
source = orig * source +\n                 lt * (start * 2 - source - ${offset}) +\n                 gte * ((end - 1) * 2 - source +
${offset});\n        source -= start;\n      `;\n\n      mainLoop = `\n        ${dtype} rc = outputLoc;\n        ${padSetup}\n
    result[0] = getChannel(getX(${source.join()}), ${innerDims});\n        ${coords[rank - 1]} += 1;\n
if(${cLimit}) {\n          ${padSetup}\n          result[1] = getChannel(getX(${source.join()}), ${innerDims});\n
}\n        rc = outputLoc;\n        ${coords[rank - 2]} += 1;\n        if(${coords[rank - 2]} < ${this.outputShape[rank -
2]}) {\n          ${padSetup}\n          result[2] = getChannel(getX(${source.join()}), ${innerDims});\n
${coords[rank - 1]} += 1;\n          if(${cLimit}) {\n            ${padSetup}\n            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\n void main() {\n ${dtype} outputLoc =
getOutputCoords();\n vec4 result = vec4(0.);\n ${mainLoop}\n setOutput(result);\n }\n `;\n
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BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
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* ==\n
*/\n\nimport {env, KernelConfig, KernelFunc, MirrorPad, MirrorPadAttrs, MirrorPadInputs, TensorInfo} from
'@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {MirrorPadProgram}
from '../mirror_pad_gpu';\nimport {MirrorPadPackedProgram} from '../mirror_pad_packed_gpu';\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\n const program = env().getBool('WEBGL_PACK_ARRAY_OPERATIONS') ?\n new
MirrorPadPackedProgram(x.shape, paddings, mode) :\n new MirrorPadProgram(x.shape, paddings, mode);\n\n
const output = backend.runWebGLProgram(program, [x], x.dtype);\n\n return output;\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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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, Mod} from '@tensorflow/tfjs-core';\n\nimport
{CHECK_NAN_SNIPPET} from '../binaryop_packed_gpu';\nimport {binaryKernelFunc} from
'../kernel_utils/kernel_funcs_utils';\n\nconst
MOD = `if (b == 0.0) return NAN;\n return mod(a, b);`;\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\nexport const
mod = binaryKernelFunc({\n opSnippet: MOD,\n packedOpSnippet: MOD_PACKED,\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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*/\n\nimport {GPGPUContext} from './gpgpu_context';\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport
class MultinomialProgram implements GPGPUProgram {\n variableNames = ['probs'];\n outputShape: number[];\n
userCode: string;\n\n // Caching uniform location for speed.\n seedLoc: WebGLUniformLocation;\n\n
constructor(batchSize: number, numOutcomes: number, numSamples: number) {\n this.outputShape = [batchSize,
numSamples];\n\n this.userCode = `\n uniform float seed;\n\n void main() {\n ivec2 coords =

getOutputCoords();\n int batch = coords[0];\n\n float r = random(seed);\n float cdf = 0.0;\n\n for (int i = 0; i < ${numOutcomes - 1}; i++) {\n cdf += getProbs(batch, i);\n\n if (r < cdf) {\n setOutput(float(i));\n return;\n
}\n }\n\n // If no other event happened, last event happened.\n setOutput(float(${numOutcomes - 1}));\n }\n `;\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","/**\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 {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 // 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 * @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 {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

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 Apache License, Version 2.0 (the \"License\");\n
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*/\n\nimport {KernelConfig, KernelFunc, Multinomial, MultinomialAttrs, MultinomialInputs, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\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 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. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except
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*/\n\nimport {backend_util, kernel_impls, KernelConfig, KernelFunc, NonMaxSuppressionV3, NonMaxSuppressionV3Attrs, NonMaxSuppressionV3Inputs, TypedArray} from '@tensorflow/tfjs-core';\n\nconst nonMaxSuppressionV3Impl = kernel_impls.nonMaxSuppressionV3Impl;\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 Apache License, Version 2.0 (the \"License\");\n

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 nonMaxSuppressionV5Impl = kernel_impls.nonMaxSuppressionV5Impl;\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 * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the

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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 {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\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
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==========\n*/\n\nimport {KernelConfig, KernelFunc, OneHot, OneHotAttrs, OneHotInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\n\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 =\n 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 * @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\nimport {KernelConfig, KernelFunc, TensorInfo, ZerosLike, ZerosLikeInputs} from '@tensorflow/tfjs-core';\n\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: {inputs: ZerosLikeInputs, backend: MathBackendWebGL}): 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:

{real: r, 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 return fill({\n attrs: {\n shape: x.shape,\n dtype: x.dtype,\n value: x.dtype === 'string' ? '' : 0\n },\n backend\n });\n }\n}\n\nexport const zerosLikeConfig: KernelConfig = {\n kernelName: ZerosLike,\n backendName: 'webgl',\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\nimport {KernelConfig, KernelFunc, OnesLike, OnesLikeInputs, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\n\nimport {complex} from './Complex';\nimport {fill} from './Fill';\nimport {imag} from './Imag';\nimport {real} from './Real';\nimport {zerosLike} from './ZerosLike';\n\nexport function onesLike(\n args: {inputs: OnesLikeInputs, backend: MathBackendWebGL}): TensorInfo {\n const {inputs, backend} = args;\n const {x} = inputs;\n\n if (x.dtype === 'string') {\n throw new Error('onesLike is not supported under string dtype');\n } else if (x.dtype === 'complex64') {\n const realPart = real({inputs: {input: x}, backend});\n const r = onesLike({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: {real: r, 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 shader for onesLike:\n // https://github.com/tensorflow/tfjs/issues/1293\n return fill({attrs: {shape: 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 * @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, Pack, PackAttrs, PackInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\n\nimport {concat} from './Concat';\nimport {expandDims} from './ExpandDims';\n\nexport function pack(\n args: {inputs: PackInputs, backend: MathBackendWebGL, 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(\n t => backend.disposeIntermediateTensorInfo(t));\n\n return result;\n}\n\nexport const packConfig: KernelConfig =

{\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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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';\nimport {getCoordsDataType} from './shader_compiler';\n\nexport class PadProgram implements GPGPUProgram {\n variableNames = ['x'];\n outputShape: number[];\n userCode: string;\n\n constructor(\n   xShape: number[], paddings: Array<[number, number]>,\n   constantValue: number) {\n   this.outputShape = paddings.map(\n   (p, i) => p[0] /* beforePad */ + xShape[i] + p[1] /* afterPad */);\n   const rank = xShape.length;\n   const type = getCoordsDataType(rank);\n\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\n   if (rank === 1) {\n   this.userCode = `\n   int start = ${start};\n
        int end = ${end};\n\n   void main() {\n   int outC = getOutputCoords();\n   if (outC < start || outC >= end) {\n   setOutput(float(${constantValue}));\n   } else {\n   setOutput(getX(outC - start));\n   }\n   }\n   `;\n      return;\n    }\n    this.userCode = `\n ${type} start = ${type}(${start});\n ${type} end = ${type}(${end});\n\n   void main() {\n ${type} outC = getOutputCoords();\n   if (any(lessThan(outC, start)) || any(greaterThanEqual(outC, end))) {\n   setOutput(float(${constantValue}));\n   } else {\n ${type} coords = outC - start;\n   setOutput(getX(${unpackedCoords}));\n   }\n   }\n   `;\n }\n}\n","/**\n * @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\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[], paddings: Array<[number, number]>,\n   constantValue: number) {\n   this.outputShape = paddings.map(\n   (p, i) => p[0] /* beforePad */ + xShape[i] +
 p[1] /* afterPad */);\n   const rank = xShape.length;\n   const dtype = getCoordsDataType(rank);\n\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\n   const componentSetup = [\n   `${dtype} rc = outputLoc;`, `${coords[rank - 1]} += 1;\n      if(${cLimit}) {\n      `,\n   rank === 1 ? '' : `}\n      rc = outputLoc;\n      ${coords[rank - 2]} += 1;\n      if(${coords[rank - 2]} < ${this.outputShape[rank - 2]}) {`,\n   rank === 1 ? '' : `  ${coords[rank - 1]} += 1;\n      if(${cLimit}) {`\n   ];\n\n   const paddingArea = rank === 1 ?\n   'rc < start || rc >= end' :\n   'any(lessThan(rc, start)) || any(greaterThanEqual(rc, end))';\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  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 * @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, KernelConfig, KernelFunc, PadV2, PadV2Attrs, PadV2Inputs, TensorInfo} from '@tensorflow/tfjs-core';\n\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 {paddings, constantValue} = attrs;\n\n const program = env().getBool('WEBGL_PACK_ARRAY_OPERATIONS') ?\n new PadPackedProgram(x.shape, paddings, constantValue) :\n new PadProgram(x.shape, paddings, 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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS 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\nimport {KernelConfig, KernelFunc, Pow} from '@tensorflow/tfjs-core';\n\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 ` +\n  CHECK_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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {MathBackendWebGL} from '../backend_webgl';\nimport {rangeImplCPU} from '../kernel_utils/shared';\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\nexport const rangeConfig: KernelConfig = {\n kernelName: Range,\n backendName: 'webgl',\n kernelFunc: range 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, Reciprocal} from '@tensorflow/tfjs-core';\nimport {unaryKernelFunc} from '../kernel_utils/kernel_funcs_utils';\n\nconst RECIPROCAL = `return 1.0 / x;`;\n\nexport const reciprocal = unaryKernelFunc({opSnippet: RECIPROCAL});\n\nexport const reciprocalConfig: KernelConfig = {\n kernelName: Reciprocal,\n backendName: 'webgl',\n kernelFunc: reciprocal,\n};\n","/**\n
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==========\n */\n\nimport {KernelConfig, KernelFunc, Relu} from '@tensorflow/tfjs-core';\nimport {unaryKernelFunc} from '../kernel_utils/kernel_funcs_utils';\nimport {CHECK_NAN_SNIPPET} from '../unaryop_gpu';\n\nconst RELU = CHECK_NAN_SNIPPET + `\n return (x < 0.0) ? 0.0 : x;\n`;\n\nconst RELU_PACKED
= `\n vec4 result = x * vec4(greaterThanEqual(x, vec4(0.0)));\n bvec4 isNaN = isnan(x);\n\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\n return result;\n`;\n\nexport const relu =\n unaryKernelFunc({opSnippet: RELU, packedOpSnippet: RELU_PACKED});\n\nexport const reluConfig: KernelConfig = {\n kernelName: Relu,\n backendName: 'webgl',\n kernelFunc: relu 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, Relu6} from '@tensorflow/tfjs-core';\nimport {unaryKernelFunc} from '../kernel_utils/kernel_funcs_utils';\nimport {CHECK_NAN_SNIPPET} from '../unaryop_gpu';\n\nconst RELU6 = CHECK_NAN_SNIPPET + `\n return (x < 0.0) ? 0.0 : min(6.0, x);\n`;\n\nconst RELU6_PACKED = `\n vec4 result = min(x, vec4(6.)) * vec4(greaterThanEqual(x, vec4(0.0)));\n bvec4 isNaN = isnan(x);\n\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\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 *\n ==\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) ? newHeight - 1 : newHeight,\n   (alignCorners && newWidth > 1) ? newWidth - 1 : newWidth\n   ];\n\n   let sourceFracIndexRC: string;\n   if (halfPixelCenters) {\n   sourceFracIndexRC =\n   `(vec2(yRC) + vec2(0.5)) * effectiveInputOverOutputRatioRC` +\n   ` - vec2(0.5)`;\n   } else {\n   sourceFracIndexRC = `vec2(yRC) * effectiveInputOverOutputRatioRC`;\n   }\n\n   this.userCode = `\n   const vec2 effectiveInputOverOutputRatioRC\n   = vec2(\n ${effectiveInSize[0] / effectiveOutSize[0]},\n ${effectiveInSize[1] / effectiveOutSize[1]});\n\n   const vec2 inputShapeRC = vec2(${oldHeight}.0, ${oldWidth}.0);\n\n   void main() {\n   ivec4 coords = 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\n   // Compute the four integer indices.\n   ivec2 sourceFloorRC = ivec2(max(sourceFracIndexRC, vec2(0.0)));\n   ivec2 sourceCeilRC = ivec2(\n   min(inputShapeRC - 1.0, ceil(sourceFracIndexRC)));\n\n   float topLeft = getA(b, 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, sourceCeilRC.y, d);\n\n   vec2 fracRC = sourceFracIndexRC - vec2(sourceFloorRC);\n\n   float top = topLeft + (topRight - topLeft) * fracRC.y;\n   float bottom = bottomLeft + (bottomRight - bottomLeft) * fracRC.y;\n   float newValue = top + (bottom - top) * fracRC.x;\n\n   setOutput(newValue);\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 \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 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], 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,

(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 ${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\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
? 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.yyzz);\n vec4 bottom = mix(bottomLeft, bottomRight, fracRC.yyzz);\n vec4 newValue = mix(top, bottom, fracRC.x);\n\n setOutput(newValue);\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 \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY
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';\nimport {ResizeBilinearProgram} from '../resize_bilinear_gpu';\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} =

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 * @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 {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 ==

leftDxCIndex) {\n // topLeft\n accumulator +=\n getDy(b, dyR, dyC, d) * inverseDxRLerp * inverseDxCLerp;\n }\n\n if (r == topDxRIndex && c == rightDxCIndex) {\n // topRight\n accumulator += getDy(b, dyR, dyC, d) * inverseDxRLerp * dxCLerp;\n }\n\n if (r == bottomDxRIndex && c == leftDxCIndex) {\n // bottomLeft\n accumulator += getDy(b, dyR, dyC, d) * dxRLerp * inverseDxCLerp;\n }\n\n if (r == bottomDxRIndex && c == rightDxCIndex) {\n // bottomRight\n accumulator += getDy(b, dyR, dyC, d) * dxRLerp * dxCLerp;\n }\n }\n }\n // End loop over dy\n\n setOutput(accumulator);\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 \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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, ResizeBilinearGrad, ResizeBilinearGradAttrs, ResizeBilinearGradInputs, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {ResizeBilinearBackpropProgram} from '../resize_bilinear_backprop_gpu';\n\nexport function resizeBilinearGrad(args: {\n inputs: ResizeBilinearGradInputs,\n backend: MathBackendWebGL,\n attrs: ResizeBilinearGradAttrs\n}): TensorInfo {\n const {inputs, backend, attrs} = args;\n const {images, dy} = inputs;\n const {alignCorners} = attrs;\n\n const program = new ResizeBilinearBackpropProgram(\n dy.shape as [number, number, number, number],\n images.shape as [number, number, number, number], alignCorners);\n\n return backend.runWebGLProgram(program, [dy], dy.dtype);\n}\n\nexport const resizeBilinearGradConfig: KernelConfig = {\n kernelName: ResizeBilinearGrad,\n backendName: 'webgl',\n kernelFunc: resizeBilinearGrad 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 */\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class ResizeNearestNeighborProgram 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) ? newHeight - 1 : newHeight,\n (alignCorners && newWidth > 1) ? newWidth - 1 : newWidth\n];\n\n // When align corners is false,\n we rounds the value with floor.\n const roundBase = alignCorners ? '0.5' : '0.0';\n\n let sourceFracIndexRC:\n string;\n if (halfPixelCenters) {\n sourceFracIndexRC =\n `max((vec2(yRC) + vec2(0.5)) * effectiveInputOverOutputRatioRC` +\n `, vec2(0.0))`;\n } else {\n sourceFracIndexRC = `vec2(yRC) * effectiveInputOverOutputRatioRC`;\n }\n this.userCode = `\n const vec2 effectiveInputOverOutputRatioRC = 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 =

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\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\n setOutput(newValue);\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 \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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, ResizeNearestNeighbor, ResizeNearestNeighborAttrs, ResizeNearestNeighborInputs, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\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\n const [newHeight, newWidth] = size;\n\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 * @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 {GPGPUProgram} from './gpgpu_math';\n\nexport class ResizeNearestNeigborBackpropProgram 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(floor(startRLerp - float(winHeight / 2)));\n\n float startCLerp = floor(float(c) * invWidthScale);\n int startDyC = int(floor(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 >= ${yWidth}) {\n continue;\n }\n\n float sourceFracRow =\n float(${effectiveXSize[0]}) *\n (float(dyR) / float(${effectiveYSize[0]}));\n\n float sourceFracCol =\n float(${effectiveXSize[1]}) *\n (float(dyC) / float(${effectiveYSize[1]}));\n\n int sourceNearestRow = int(min(\n float(int(${xHeight}) - 1),\n ${alignCorners} ? float(round(sourceFracRow)) :\n float(floor(sourceFracRow))));\n\n int sourceNearestCol = int(min(\n float(int(${xWidth}) - 1),\n ${alignCorners} ? float(round(sourceFracCol)) :\n float(floor(sourceFracCol))));\n\n if (r == sourceNearestRow && c == sourceNearestCol) {\n accumulator += getDy(b, dyR, dyC, d);\n }\n }\n }\n // End loop over dy\n\n setOutput(accumulator);\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 \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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, ResizeNearestNeighborGrad, ResizeNearestNeighborGradAttrs, ResizeNearestNeighborGradInputs, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {ResizeNearestNeigborBackpropProgram} from '../resize_nearest_neighbor_backprop_gpu';\n\nexport function resizeNearestNeighborGrad(args: {\n inputs: ResizeNearestNeighborGradInputs,\n backend: MathBackendWebGL,\n attrs: ResizeNearestNeighborGradAttrs\n}): TensorInfo {\n const {inputs, backend, attrs} = args;\n const {images, dy} = inputs;\n const {alignCorners} = attrs;\n\n const program = new ResizeNearestNeigborBackpropProgram(\n dy.shape as [number, number, number, number],\n images.shape as [number, number, number, number], alignCorners);\n return backend.runWebGLProgram(program, [dy], dy.dtype);\n}\n\nexport const resizeNearestNeighborGradConfig: KernelConfig = {\n kernelName: ResizeNearestNeighborGrad,\n backendName: 'webgl',\n kernelFunc: resizeNearestNeighborGrad 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 *\n ==\n */\n\nimport {GPGPUProgram} from './gpgpu_math';\nimport {getCoordsDataType} from './shader_compiler';\n\nexport class ReverseProgram implements GPGPUProgram {\n variableNames = ['x'];\n outputShape: number[];\n userCode: string;\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-${rank} tensor is not yet supported`);\n }\n this.outputShape = xShape;\n\n if (rank === 1) {\n   this.userCode = `\n  void main() {\n    int coord = getOutputCoords();\n    setOutput(getX(${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 * @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 {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 < ${this.outputShape[rank - 1]}`;\n   const nextRow =\n   `${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 * @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 {env, KernelConfig, KernelFunc, Reverse, ReverseAttrs, ReverseInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {ReverseProgram} from '../reverse_gpu';\nimport {ReversePackedProgram} from '../reverse_packed_gpu';\n\nimport {identity} from './Identity';\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 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\nexport const reverseConfig: KernelConfig = {\n kernelName: Reverse,\n backendName: 'webgl',\n kernelFunc: reverse 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} from '@tensorflow/tfjs-core';\n\nimport {GPGPUProgram} from './gpgpu_math';\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}) * ${cosFactor} - (float(y) - ${centerYString}) * ${sinFactor};\n float coordYFloat = (float(x) - ${centerXString}) * ${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 < ${imageHeight}) {\n outputValue = getImage(coords[0], coordY, coordX, coords[3]);\n }\n setOutput(outputValue);\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 \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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, Tensor4D} from '@tensorflow/tfjs-core';\nimport {RotateWithOffset,

RotateWithOffsetAttrs, RotateWithOffsetInputs} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\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 * @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, Round} from '@tensorflow/tfjs-core';\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`;\n\nexport const round = unaryKernelFunc({opSnippet: ROUND});\n\nexport const roundConfig: KernelConfig = {\n kernelName: Round,\n backendName: 'webgl',\n kernelFunc: round,\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 {GPGPUProgram} from './gpgpu_math';\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 sum += ${updatesSnippet};\n found = true;\n }\n }\n setOutput(mix(getDefaultValue(), sum, float(found)));\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\nimport {backend_util, KernelConfig, KernelFunc, ScatterNd, ScatterNdAttrs, ScatterNdInputs, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {ScatterProgram} from '../scatter_gpu';\nimport {reshape} from './Reshape';\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\nexport const scatterNdConfig: KernelConfig = {\n kernelName: ScatterNd,\n backendName: 'webgl',\n kernelFunc: scatterNd 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 *
==========\n */\n\nimport {GPGPUProgram} from './gpgpu_math';\nimport {getCoordsDataType} from './shader_compiler';\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 License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the 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 {KernelConfig, KernelFunc, Select, SelectInputs, TensorInfo, upcastType} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {SelectProgram} from '../select_gpu';\n\nexport function select(args: {inputs: SelectInputs, backend: MathBackendWebGL}):\n TensorInfo {\n const {inputs, backend} = args;\n const {condition, t, e} = inputs;\n\n const program =\n   new SelectProgram(condition.shape.length,
 t.shape, t.shape.length);\n return backend.runWebGLProgram(\n   program, [condition, t, e], upcastType(t.dtype, e.dtype));\n}\n\nexport const selectConfig: KernelConfig = {\n kernelName: Select,\n backendName: 'webgl',\n kernelFunc: select 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 {backend_util, KernelConfig, Selu} from '@tensorflow/tfjs-core';\n\nimport {unaryKernelFunc} from '../kernel_utils/kernel_funcs_utils';\n\nconst SELU = `\n  // Stable and Attracting Fixed Point (0, 1) for Normalized Weights.\n  // see: https://arxiv.org/abs/1706.02515\n  float scaleAlpha = ${backend_util.SELU_SCALEALPHA};\n  float scale = ${backend_util.SELU_SCALE};\n  return (x >= 0.0) ? 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 * @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
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==========\n */\n\nimport {KernelConfig, Sigmoid} from '@tensorflow/tfjs-core';\nimport {unaryKernelFunc} from '../kernel_utils/kernel_funcs_utils';\n\nconst SIGMOID = `return 1.0 / (1.0 + exp(-1.0 * x));`;\n\nexport const sigmoid = unaryKernelFunc({opSnippet: SIGMOID});\n\nexport const sigmoidConfig: KernelConfig = {\n kernelName: Sigmoid,\n backendName: 'webgl',\n kernelFunc: sigmoid,\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
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==========\n */\n\nimport {KernelConfig, Sign} from '@tensorflow/tfjs-core';\n\nimport {unaryKernelFunc} from '../kernel_utils/kernel_funcs_utils';\n\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 *

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```
MathBackendWebGL,\n  attrs: SpaceToBatchNDAttrs\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 * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
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==========================================================================\n
*/\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
  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 * @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
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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 * @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, 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 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {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. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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, Step, StepAttrs, TensorInfo, UnaryInputs} from '@tensorflow/tfjs-core';\n\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

Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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';\nimport {getCoordsDataType} from './shader_compiler';\n\nexport class StridedSliceProgram implements GPGPUProgram {\n variableNames = ['x'];\n outputShape: number[];\n userCode: string;\n\n constructor(begin: number[], strides: number[], size: number[]) {\n this.outputShape = size;\n const rank = size.length;\n const inputDtype = getCoordsDataType(size.length);\n const dtype = getCoordsDataType(size.length);\n\n let newCoords = '';\n if (rank === 1) {\n newCoords = 'coords * strides + begin';\n } else {\n let outputAxis = 0;\n newCoords =\n size.map((_, i) => {\n outputAxis++;\n return size.length === 1 ?\n `coords * strides[${i}] + begin[${i}]` :\n `coords[${outputAxis - 1}] * strides[${i}] + begin[${i}]`;\n })\n .join(',');\n }\n\n this.userCode = `\n ${inputDtype} begin = ${inputDtype}(${begin});\n ${inputDtype} strides = ${inputDtype}(${strides});\n\n void main() {\n ${dtype} coords = getOutputCoords();\n setOutput(getX(${newCoords}));\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 \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {buffer, KernelConfig, KernelFunc, Rank, slice_util, StridedSlice, StridedSliceAttrs, StridedSliceInputs, TensorBuffer, TensorInfo, TypedArray} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {stridedSliceImplCPU} from '../kernel_utils/shared';\nimport {StridedSliceProgram} from '../strided_slice_gpu';\n\nimport {reshape} from './Reshape';\nimport {slice} from './Slice';\n\nexport function stridedSlice(args: {\n inputs: StridedSliceInputs,\n backend: MathBackendWebGL,\n attrs: StridedSliceAttrs\n}): TensorInfo {\n const {inputs, backend, 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 {nonStrided, $begin, $strides, size, newShape, outShape} =\n slice_util.sliceInfo(\n x.shape, begin, end, strides, beginMask, endMask, ellipsisMask,\n newAxisMask, shrinkAxisMask);\n\n const $x = reshape({inputs: {x}, backend, attrs: {shape: newShape}});\n\n let result;\n if (nonStrided) {\n const sliced =\n slice({inputs: {x: $x}, backend, attrs: {begin: $begin, size}});\n result = reshape({inputs: {x: sliced}, backend, attrs: {shape: outShape}});\n\n backend.disposeIntermediateTensorInfo(sliced);\n } else if (outShape.some(axis => axis === 0)) {\n result = backend.makeTensorInfo(outShape, x.dtype, []);\n } else {\n const shouldExecuteOnCPU = backend.shouldExecuteOnCPU([$x]);\n if (shouldExecuteOnCPU) {\n const xTexData = backend.texData.get($x.dataId);\n const values = xTexData.values as TypedArray;\n const xBuf = buffer($x.shape, $x.dtype, values) as TensorBuffer<Rank>;\n const resultValues =\n stridedSliceImplCPU(outShape, xBuf, $strides, $begin);\n result = backend.makeTensorInfo(outShape, $x.dtype, resultValues.values);\n } else {\n const program = new StridedSliceProgram($begin, $strides, outShape);\n result = backend.runWebGLProgram(program, [$x], $x.dtype);\n }\n }\n\n const resultReshaped =\n reshape({inputs: {x: result}, backend, attrs: {shape: outShape}});\n\n backend.disposeIntermediateTensorInfo($x);\n

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 License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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,\n Tan} from '@tensorflow/tfjs-core';\n\nimport {unaryKernelFunc} from '../kernel_utils/kernel_funcs_utils';\n\nconst TAN = `return tan(x);`;\n\nexport const tan = unaryKernelFunc({opSnippet: TAN});\n\nexport const tanConfig: KernelConfig = {\n kernelName: Tan,\n backendName: 'webgl',\n kernelFunc: tan,\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, Tanh} from '@tensorflow/tfjs-core';\nimport {unaryKernelFunc} from '../kernel_utils/kernel_funcs_utils';\n\nconst TANH = `\n float e2x = exp(-2.0 * abs(x));\n return sign(x) * (1.0 - e2x) / (1.0 + e2x);\n`;\n\nexport const tanh = unaryKernelFunc({opSnippet: TANH});\n\nexport const tanhConfig: KernelConfig = {\n kernelName: Tanh,\n backendName: 'webgl',\n kernelFunc: tanh,\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\n License for the specific language governing permissions and\n * limitations under the License.\n *\n ==\n */\n\nimport {GPGPUProgram} from './gpgpu_math';\nimport {getCoordsDataType} from './shader_compiler';\n\nexport class TileProgram implements GPGPUProgram {\n variableNames = ['A'];\n outputShape: number[];\n userCode: string;\n rank: number;\n\n constructor(aShape: number[], reps: number[]) {\n const outputShape: number[] = new Array(aShape.length);\n for (let i = 0; i < outputShape.length; i++) {\n outputShape[i] = aShape[i] * reps[i];\n }\n this.outputShape = outputShape;\n this.rank = outputShape.length;\n const dtype = getCoordsDataType(this.rank);\n const sourceCoords = getSourceCoords(aShape);\n\n this.userCode = `\n void main() {\n ${dtype} resRC = getOutputCoords();\n setOutput(getA(${sourceCoords}));\n }\n `;\n }\n}\n\nfunction getSourceCoords(aShape: number[]): string {\n const rank = aShape.length;\n if (rank > 5) {\n throw Error(`Tile for rank ${rank} is not yet supported`);\n }\n if (rank === 1) {\n return `imod(resRC, ${aShape[0]})`;\n }\n\n const currentCoords = ['resRC.x', 'resRC.y', 'resRC.z', 'resRC.w', 'resRC.u'];\n\n const sourceCoords = [];\n for (let i = 0; i < aShape.length; i++) {\n sourceCoords.push(`imod(${currentCoords[i]}, ${aShape[i]})`);\n }\n return sourceCoords.join();\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 {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 thought 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 Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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, 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 */\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, 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 kernelName: Unique,\n backendName: 'webgl',\n kernelFunc: unique 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, Unpack, UnpackAttrs, UnpackInputs} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\n\nimport {reshape} from './Reshape';\nimport {slice} from './Slice';\n\nexport function
 unpack(\n   args:\n   {inputs: UnpackInputs, backend: MathBackendWebGL, attrs: UnpackAttrs}):\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 x = value;\n const xRank = x.shape.length;\n\n const num = value.shape[axis];\n const outShape: number[] = new Array(xRank - 1);\n let outIndex = 0;\n for (let i = 0; i < xRank; i++) {\n   if (i !== axis) {\n   outShape[outIndex++] = x.shape[i];\n   }\n }\n\n const toDispose = [];\n\n const begin = new Array(xRank).fill(0);\n const size = x.shape.slice();\n size[axis] = 1;\n const res: TensorInfo[] = new Array(num);\n for (let i = 0; i < res.length; i++) {\n   begin[axis] = i;\n   const sliced = slice({inputs: {x}, backend, attrs: {begin, size}});\n   const reshaped =\n   reshape({inputs: {x: sliced}, backend, attrs: {shape: outShape}});\n   res[i] = reshaped;\n\n   toDispose.push(sliced);\n
  }\n\n toDispose.forEach(t => backend.disposeIntermediateTensorInfo(t));\n return res;\n}\n\nexport const unpackConfig: KernelConfig = {\n kernelName: Unpack,\n backendName: 'webgl',\n kernelFunc: unpack 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
*/\n\nimport {backend_util} from
 '@tensorflow/tfjs-core';\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class SegmentOpProgram implements GPGPUProgram {\n variableNames = ['x', 'segmentIds'];\n outputShape: number[];\n userCode: string;\n\n constructor(\n   segOpInfo: backend_util.segment_util.SegOpInfo,\n   segOpType: 'unsortedSegmentSum') {\n   const windowSize = segOpInfo.windowSize;\n   const batchSize = 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\n const initializationValue = '0.0';\n   const returnValue = `sumValue`;\n\n   const windowSizeNearestVec4 = Math.floor(windowSize / 4) * 4;\n   const windowSizeVec4Remainder = windowSize % 4;\n\n   const updateSnippet = `\n        sumValue += dot(values, segFilter);\n    `;\n\n   let checkValueOutOfBounds = '';\n   if (inSize % windowSize > 0) {\n   checkValueOutOfBounds
 = `\n        if (inIdx < 0 || inIdx >= ${inSize}) {\n          return initializationValue;\n        }\n      `;\n   }\n\n   let checkSegmentIdOutOfBounds = '';\n   if (inSize % windowSize > 0) {\n   checkSegmentIdOutOfBounds = `\n if (inIdx < 0 || inIdx >= ${inSize}) {\n          return -1.0;\n        }\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          ${updateSnippet}\n        }\n        setOutput(${returnValue});\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
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==========================================================================\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  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},
```

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 =\n backend_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   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},\n 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 * @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, 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}\n 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

'./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

'./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

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\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. */\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\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/** Properties
 of a SaverDef. */\nexport declare interface ISaverDef {\n  /** SaverDef filenameTensorName */\n
filenameTensorName?: (string|null);\n\n  /** SaverDef saveTensorName */\n  saveTensorName?: (string|null);\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\nexport namespace SaverDef {\n  /**
CheckpointFormatVersion enum. */\n  export enum CheckpointFormatVersion {'LEGACY' = 0, 'V1' = 1, 'V2' =
2}\n}\n\n/** Properties of a TensorInfo. */\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\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/** Properties of a SignatureDef. */\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/** Properties of an
AssetFileDef. */\nexport declare interface IAssetFileDef {\n  /** AssetFileDef tensorInfo */\n  tensorInfo?:
(ITensorInfo|null);\n\n  /** AssetFileDef filename */\n  filename?: (string|null);\n}\n\n/** Properties of an OpDef.
*/\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  /**
OpDef allowsUninitializedInput */\n  allowsUninitializedInput?: (boolean|null);\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  /** 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?:
```

(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\n/** Properties of an OpList. */\nexport declare interface IOpList {\n /** OpList op */\n op?: (IOpDef[]|null);\n}\n\n/** Properties of a MetaGraphDef. */\nexport 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\nexport 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. */\nexport 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. */\nexport 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. */\nexport 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. */\nexport 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, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {OpExecutor, OpMapper} from '../types';\n\nconst CUSTOM_OPS: {[key: string]: OpMapper} = {};\n\n/**\n * Register an Op for graph model executor. This allow you to register\n * TensorFlow custom op or override existing op.\n *\n * Here is an example of registering a new MatMul Op.\n * ```js\n * const customMatmul = (node) =>\n *   tf.matMul(\n *   node.inputs[0], node.inputs[1],\n *   node.attrs['transpose_a'], node.attrs['transpose_b']);\n *\n * tf.registerOp('MatMul', customMatmul);\n * ```\n * The inputs and attrs of the node object is based on the TensorFlow op\n * registry.\n *\n * @param name The Tensorflow Op name.\n * @param opFunc An op function which is called with the current graph node\n * during execution and needs to return a tensor or a list of tensors. The node\n * has the following attributes:\n *   - attr: A map from attribute name to its value\n *   - inputs: A list of input tensors\n *\n * @doc {heading: 'Models', subheading: 'Op Registry'}\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/**\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 */\nexport

```
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 * @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 {clone, Tensor, util} from '@tensorflow/tfjs-core';\n\nimport {NamedTensorsMap} from
'../../data/types';\nimport {ExecutionContext} from '../../executor/execution_context';\nimport {ResourceManager}
from '../../executor/resource_manager';\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\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 * @param name Node input name\n * @param tensorsMap Tensors map keyed
by the node\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 getTensor(\n    name:
string, tensorsMap: NamedTensorsMap, context: ExecutionContext,\n    resourceManager?: ResourceManager):
Tensor {\n  const [nodeName, index] = parseNodeName(name);\n\n  if (resourceManager != null) {\n    const tensor
= resourceManager.getHashTableHandleByName(nodeName);\n    if (tensor != null) {\n      return tensor;\n    }\n
}\n\n  const contextId = context.currentContextIds.find(contextId => {\n    return
!!tensorsMap[getNodeNameWithContextId(nodeName,
 contextId)];\n  });\n\n  return contextId !== undefined ?\n      tensorsMap[getNodeNameWithContextId(nodeName,
contextId)][index] :\n      undefined;\n}\n\n/**\n * Retrieve the tensors based on input name for current context.\n *
@param name Node input name\n * @param tensorsMap Tensors map keyed by the node\n */\nexport function
getTensorsForCurrentContenxt(\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 * @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
*/\nexport function getNodeNameAndIndex(\n    inputName: string, context?: ExecutionContext): [string, number]
{\n  const [nodeName, index] = parseNodeName(inputName);\n\n  return [\n
getNodeNameWithContextId(nodeName, context
 && context.currentContextId),\n    index\n  ];\n}\n\nfunction getNodeNameWithContextId(name: string,
contextId?: string): string {\n  return !!contextId ? `${name}-${contextId}` : name;\n}\n\nexport function
parseNodeName(name: string): [string, number] {\n  const parts = name.split(':');\n  if (parts.length === 1) {\n
```

return [name, 0];\n }\n\n const nodeName = parts[0];\n return [nodeName, Number(parts[parts.length - 1])];\n}\n\nexport function split(arr: number[], size: number) {\n const res = [];\n for (let i = 0; i < arr.length; i += size) {\n res.push(arr.slice(i, i + size));\n }\n return res;\n}\nexport function getPadding(\n node: Node, tensorMap: NamedTensorsMap,\n context: ExecutionContext): ValueType {\n let pad = getParamValue('pad', node, tensorMap, context);\n if (pad === 'explicit') {\n // This is 1d array, we need to convert it to 2d array\n pad = getParamValue('explicitPaddings', node, tensorMap, context);\n const explicitPadding: [\n [number, number], [number, number], [number, number], [number, number]\n] = [[0, 0], [0, 0], [0, 0], [0, 0]];\n for (let i = 0; i < 4; i++) {\n explicitPadding[i][0] = (pad as number[])[i * 2];\n explicitPadding[i][1] = (pad as number[])[i * 2 + 1];\n }\n return explicitPadding;\n }\n return pad;\n}\n\n/**\n * Reuse the tensor if it is marked as keep, otherwise clone the tensor to\n * avoid disposal. This is important for TensorArray and TensorList ops, since\n * internally they use a tensor as the id for TensorArray and TensorList, and\n * to simplify lookup, they also use Tensor.id as the key to the internal map.\n * These id tensors have been marked as kept in the backend, we need avoid clone\n * them in order to create new Tensor.id.\n * @param tensor\n */\nexport function cloneTensor(tensor: Tensor): Tensor {\n return tensor.kept ? tensor : clone(tensor);\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 {OpMapper} from '../types';\n\nexport const json: OpMapper[] = [\n {\n 'tfOpName': 'Add',\n 'category': 'arithmetic',\n 'inputs': [\n {'start': 0, 'name': 'a', 'type': 'tensor'},\n {'start': 1, 'name': 'b', 'type': 'tensor'},\n],\n 'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n]\n },\n {\n 'tfOpName': 'AddV2',\n 'category': 'arithmetic',\n 'inputs': [\n {'start': 0, 'name': 'a', 'type': 'tensor'},\n {'start': 1, 'name': 'b', 'type': 'tensor'},\n],\n 'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n]\n },\n {\n 'tfOpName': 'AddN',\n 'category': 'arithmetic',\n 'inputs': [{'start': 0, 'end': 0, 'name': 'tensors', 'type': 'tensors'}]\n },\n {\n 'tfOpName': 'BiasAdd',\n 'category': 'arithmetic',\n 'inputs': [\n {'start': 0, 'name': 'a', 'type': 'tensor'},\n {'start': 1, 'name': 'b', 'type': 'tensor'},\n],\n 'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}, {\n 'tfName': 'data_format',\n 'name': 'dataFormat',\n 'type': 'string',\n 'notSupported': true\n }\n]\n },\n {\n 'tfOpName': 'Sub',\n 'category': 'arithmetic',\n 'inputs': [\n {'start': 0, 'name': 'a', 'type': 'tensor'},\n {'start': 1, 'name': 'b', 'type': 'tensor'},\n],\n 'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n]\n },\n {\n 'tfOpName': 'RealDiv',\n 'category': 'arithmetic',\n 'inputs': [\n {'start': 0, 'name': 'a', 'type': 'tensor'},\n {'start': 1, 'name': 'b', 'type': 'tensor'},\n],\n 'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n]\n },\n {\n 'tfOpName': 'Div',\n 'category': 'arithmetic',\n 'inputs': [\n {'start': 0, 'name': 'a', 'type': 'tensor'},\n {'start': 1, 'name': 'b', 'type': 'tensor'},\n],\n 'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n]\n },\n {\n 'tfOpName': 'DivNoNan',\n 'category': 'arithmetic',\n 'inputs': [\n {'start': 0, 'name': 'a', 'type': 'tensor'},\n {'start': 1, 'name': 'b', 'type': 'tensor'},\n],\n 'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n]\n },\n {\n 'tfOpName': 'FloorDiv',\n 'category': 'arithmetic',\n 'inputs': [\n {'start': 0, 'name': 'a', 'type': 'tensor'},\n {'start': 1, 'name': 'b', 'type': 'tensor'},\n],\n 'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n]\n },\n {\n 'tfOpName': 'Mul',\n 'category': 'arithmetic',\n 'inputs': [\n {'start': 0, 'name': 'a', 'type': 'tensor'},\n {'start': 1, 'name': 'b', 'type': 'tensor'},\n],\n 'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n]\n },\n {\n 'tfOpName': 'Maximum',\n 'category': 'arithmetic',\n 'inputs': [\n {'start': 0, 'name': 'a', 'type': 'tensor'},\n {'start': 1, 'name': 'b', 'type': 'tensor'}\n],\n 'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype',

'notSupported': true}\n]\n },\n {\n 'tfOpName': 'Minimum',\n 'category': 'arithmetic',\n 'inputs': [\n {'start': 0, 'name': 'a', 'type': 'tensor'},\n {'start': 1, 'name': 'b', 'type': 'tensor'}\n],\n 'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n]\n },\n {\n 'tfOpName': 'Pow',\n 'category': 'arithmetic',\n 'inputs': [\n {'start': 0, 'name': 'a', 'type': 'tensor'},\n {'start': 1, 'name': 'b', 'type': 'tensor'},\n],\n 'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n]\n },\n {\n 'tfOpName': 'SquaredDifference',\n 'category': 'arithmetic',\n 'inputs': [\n {'start': 0, 'name': 'a', 'type': 'tensor'},\n {'start': 1, 'name': 'b', 'type': 'tensor'},\n],\n 'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n]\n },\n {\n 'tfOpName': 'Mod',\n 'category': 'arithmetic',\n 'inputs': [\n {'start': 0, 'name': 'a', 'type': 'tensor'},\n {'start': 1, 'name': 'b', 'type': 'tensor'},\n],\n 'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n]\n },\n {\n 'tfOpName': 'FloorMod',\n 'category': 'arithmetic',\n 'inputs': [\n {'start': 0, 'name': 'a', 'type': 'tensor'},\n {'start': 1, 'name': 'b', 'type': 'tensor'},\n],\n 'attrs': [{\n 'tfName': 'T',\n 'name': 'dtype',\n 'type': 'dtype',\n 'notSupported': true\n }]\n }\n];\n","import {OpMapper} from '../types';\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\nexport const json: OpMapper[] = [\n {\n 'tfOpName': 'Abs',\n 'category': 'basic_math',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n],\n 'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n]\n },\n {\n 'tfOpName': 'Acos',\n 'category': 'basic_math',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n],\n 'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n]\n },\n {\n 'tfOpName': 'Asin',\n 'category': 'basic_math',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n],\n 'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n]\n },\n {\n 'tfOpName': 'Atan',\n 'category': 'basic_math',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n],\n 'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n]\n },\n {\n 'tfOpName': 'Atan2',\n 'category': 'basic_math',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'y', 'type': 'tensor'},\n],\n 'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n]\n },\n {\n 'tfOpName': 'Ceil',\n 'category': 'basic_math',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n],\n 'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n]\n },\n {\n 'tfOpName': 'ClipByValue',\n 'category': 'basic_math',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'clipValueMin', 'type': 'number'},\n {'start': 2, 'name': 'clipValueMax', 'type': 'number'},\n],\n 'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n]\n },\n {\n 'tfOpName': 'Complex',\n 'category': 'basic_math',\n 'inputs': [\n {'start': 0, 'name': 'real', 'type': 'tensor'},\n {'start': 1, 'name': 'imag', 'type': 'tensor'},\n],\n 'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n]\n },\n {\n 'tfOpName': 'ComplexAbs',\n 'category': 'basic_math',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n],\n 'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n]\n },\n {\n 'tfOpName': 'Cos',\n 'category': 'basic_math',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n],\n 'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n]\n },\n {\n 'tfOpName': 'Cosh',\n 'category': 'basic_math',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n],\n 'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n]\n },\n {\n 'tfOpName': 'Elu',\n 'category': 'basic_math',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n],\n 'attrs': [\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n]\n },\n {\n 'tfOpName': 'Exp',\n 'category': 'basic_math',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n],\n 'attrs': [\n

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* limitations under the License.\n *\n ==\n */\n\nimport {OpMapper} from '../types';\n\nexport const json: OpMapper[] = [\n {\n 'tfOpName': 'AvgPool',\n 'category': 'convolution',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n],\n 'attrs': [\n {'tfName': 'strides', 'name': 'strides', 'type': 'number[]'},\n {'tfName': 'padding', 'name': 'pad', 'type': 'string'}, {\n 'tfName': 'data_format',\n 'name': 'dataFormat',\n 'type': 'string',\n 'notSupported': true\n },\n {'tfName': 'ksize', 'name': 'kernelSize', 'type': 'number[]'},\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n]\n },\n {\n 'tfOpName': 'MaxPool',\n 'category': 'convolution',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n],\n 'attrs': [\n {'tfName': 'strides', 'name': 'strides', 'type': 'number[]'},\n
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{OpMapper} from '../types';\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 *
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==========\n */\n\nexport const json: OpMapper[] = [\n {\n 'tfOpName': 'NonMaxSuppressionV2',\n 'category': 'dynamic',\n 'inputs': [\n {'start': 0, 'name': 'boxes', 'type': 'tensor'},\n {'start': 1, 'name': 'scores', 'type': 'tensor'},\n {'start': 2, 'name': 'maxOutputSize', 'type': 'number'},\n {'start': 3, 'name': 'iouThreshold', 'type': 'number'}\n]\n },\n {\n 'tfOpName': 'NonMaxSuppressionV3',\n 'category': 'dynamic',\n 'inputs': [\n {'start': 0, 'name': 'boxes', 'type': 'tensor'},\n {'start': 1, 'name': 'scores', 'type': 'tensor'},\n {'start': 2, 'name': 'maxOutputSize', 'type': 'number'},\n {'start': 3, 'name': 'iouThreshold', 'type': 'number'},\n {'start': 4, 'name': 'scoreThreshold', 'type': 'number'}\n]\n },\n {\n 'tfOpName': 'NonMaxSuppressionV4',\n 'category': 'dynamic',\n 'inputs': [\n {'start': 0, 'name': 'boxes', 'type': 'tensor'},\n {'start': 1, 'name': 'scores', 'type': 'tensor'},\n
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'number'},\n   ],\n },\n];\n","import {OpMapper} from '../types';\n\n/**\n * @license\n * Copyright 2018 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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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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'bool'\n   },\n   {'tfName': 'key_dtype', 'name': 'keyDType', 'type': 'dtype'},\n   {'tfName': 'value_dtype', 'name':
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[],\n 'attrs': [\n   {'tfName': 'shared_name', 'name': 'sharedName', 'type': 'string'},\n   {\n   'tfName': 'use_node_name_sharing',\n   'name': 'useNodeNameSharing',\n   'type': 'bool'\n   },\n   {'tfName': 'key_dtype', 'name': 'keyDType', 'type': 'dtype'},\n   {'tfName': 'value_dtype', 'name': 'valueDType', 'type': 'dtype'},\n]\n },\n {\n 'tfOpName': 'LookupTableImport',\n 'category': 'hash_table',\n 'inputs': [\n   {'start': 0, 'name': 'tableHandle', 'type': 'tensor'},\n   {'start': 1, 'name': 'keys', 'type': 'tensor'},\n   {'start': 2, 'name': 'values', 'type': 'tensor'}\n],\n 'attrs': [\n   {'tfName': 'Tin', 'name': 'tIn', 'type': 'dtype', 'notSupported': true}, {\n   'tfName': 'Tout',\n   'name': 'tOut',\n   'type': 'dtype',\n   'notSupported': true\n   }\n]\n },\n {\n 'tfOpName': 'LookupTableImportV2',\n 'category': 'hash_table',\n 'inputs': [\n   {'start': 0, 'name': 'tableHandle', 'type': 'tensor'},\n   {'start': 1, 'name': 'keys', 'type': 'tensor'},\n   {'start': 2, 'name': 'values', 'type': 'tensor'}\n],\n 'attrs': [\n   {'tfName': 'Tin', 'name': 'tIn', 'type': 'dtype', 'notSupported': true}, {\n   'tfName': 'Tout',\n   'name': 'tOut',\n   'type': 'dtype',\n   'notSupported': true\n   }\n]\n },\n {\n 'tfOpName': 'LookupTableFind',\n 'category': 'hash_table',\n 'inputs': [\n   {'start': 0, 'name': 'tableHandle', 'type': 'tensor'},\n   {'start': 1, 'name': 'keys', 'type': 'tensor'},\n   {'start': 2, 'name': 'defaultValue', 'type': 'tensor'}\n],\n 'attrs': [\n   {'tfName': 'Tin', 'name': 'tIn', 'type': 'dtype', 'notSupported': true}, {\n   'tfName': 'Tout',\n   'name': 'tOut',\n   'type': 'dtype',\n   'notSupported': true\n   }\n]\n },\n {\n 'tfOpName': 'LookupTableFindV2',\n 'category': 'hash_table',\n 'inputs': [\n   {'start': 0, 'name': 'tableHandle', 'type': 'tensor'},\n   {'start': 1, 'name': 'keys', 'type': 'tensor'},\n   {'start': 2, 'name': 'defaultValue', 'type': 'tensor'}\n],\n 'attrs': [\n   {'tfName': 'Tin', 'name': 'tIn', 'type': 'dtype', 'notSupported': true}, {\n   'tfName': 'Tout',\n   'name': 'tOut',\n   'type': 'dtype',\n   'notSupported': true\n   }\n]\n }\n];\n","import {OpMapper} from '../types';\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\nexport const json: OpMapper[] = [\n {\n   'tfOpName': 'ResizeBilinear',\n   'category': 'image',\n   'inputs': [\n   {'start': 0, 'name': 'images', 'type': 'tensor'},\n   {'start': 1, 'name': 'size', 'type': 'number[]'},\n   ],\n   'attrs': [\n   {'tfName': 'align_corners', 'name': 'alignCorners', 'type': 'bool'}, {\n   'tfName': 'half_pixel_centers',\n   'name': 'halfPixelCenters',\n   'type': 'bool'\n   },\n   {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n   ]\n },\n {\n   'tfOpName': 'ResizeNearestNeighbor',\n   'category': 'image',\n   'inputs': [\n   {'start': 0, 'name': 'images', 'type': 'tensor'},\n   {'start': 1, 'name': 'size', 'type': 'number[]'},\n   ],\n   'attrs': [\n   {'tfName': 'align_corners', 'name': 'alignCorners', 'type': 'bool'}, {\n   'tfName': 'half_pixel_centers',\n   'name': 'halfPixelCenters',\n   'type': 'bool'\n   },\n   {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n   ]\n },\n {\n   'tfOpName': 'CropAndResize',\n   'category': 'image',\n   'inputs': [\n   {'start': 0, 'name': 'image',\n   'type': 'tensor'},\n   {'start': 1, 'name': 'boxes', 'type': 'tensor'},\n   {'start': 2, 'name': 'boxInd', 'type': 'tensor'},\n   {'start': 3, 'name': 'cropSize', 'type': 'number[]'},\n   ],\n   'attrs': [\n   {'tfName': 'method', 'name': 'method', 'type': 'string'}, {\n   'tfName': 'extrapolation_value',\n   'name': 'extrapolationValue',\n   'type': 'number'\n   }\n   ]\n }\n];\n","import {OpMapper} from '../types';\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\nexport const json: OpMapper[] = [\n {\n   'tfOpName': 'Equal',\n   'category': 'logical',\n   'inputs': [\n   {'start': 0, 'name': 'a', 'type': 'tensor'},\n   {'start': 1, 'name': 'b', 'type': 'tensor'},\n   ],\n   'attrs': [\n   {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n   ]\n },\n {\n   'tfOpName': 'NotEqual',\n   'category': 'logical',\n   'inputs': [\n   {'start': 0, 'name': 'a', 'type': 'tensor'},\n   {'start': 1, 'name': 'b', 'type': 'tensor'},\n   ],\n   'attrs': [\n   {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n   ]\n },\n {\n   'tfOpName': 'Greater',\n   'category': 'logical',\n   'inputs': [\n   {'start': 0, 'name': 'a', 'type': 'tensor'},\n   {'start': 1, 'name': 'b', 'type': 'tensor'},\n   ],\n
    'attrs': [\n   {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n   ]\n },\n {\n   'tfOpName': 'GreaterEqual',\n   'category': 'logical',\n   'inputs': [\n   {'start': 0, 'name': 'a', 'type': 'tensor'},\n   {'start': 1, 'name': 'b', 'type': 'tensor'},\n   ],\n   'attrs': [\n   {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n   ]\n },\n {\n   'tfOpName': 'Less',\n   'category': 'logical',\n   'inputs': [\n   {'start': 0, 'name': 'a', 'type': 'tensor'},\n   {'start': 1, 'name': 'b', 'type': 'tensor'},\n   ],\n   'attrs': [\n   {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n   ]\n },\n {\n   'tfOpName': 'LessEqual',\n   'category': 'logical',\n   'inputs': [\n   {'start': 0, 'name': 'a', 'type': 'tensor'},\n   {'start': 1, 'name': 'b', 'type': 'tensor'},\n   ],\n   'attrs': [\n   {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n
  ]\n },\n {\n   'tfOpName': 'LogicalAnd',\n   'category': 'logical',\n   'inputs': [\n   {'start': 0, 'name': 'a', 'type': 'tensor'},\n   {'start': 1, 'name': 'b', 'type': 'tensor'},\n   ],\n   'attrs': [\n   {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n   ]\n },\n {\n   'tfOpName': 'LogicalNot',\n   'category': 'logical',\n   'inputs': [\n   {'start': 0, 'name': 'a', 'type': 'tensor'},\n   ],\n   'attrs': [\n   {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n   ]\n },\n {\n   'tfOpName': 'LogicalOr',\n   'category': 'logical',\n   'inputs': [\n   {'start': 0, 'name': 'a', 'type': 'tensor'},\n   {'start': 1, 'name': 'b', 'type': 'tensor'},\n   ],\n   'attrs': [\n   {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n   ]\n },\n {\n   'tfOpName': 'Select',\n   'category': 'logical',\n   'inputs': [\n   {'start': 0, 'name': 'condition', 'type': 'tensor'},\n
    {'start': 1, 'name': 'a', 'type': 'tensor'},\n   {'start': 2, 'name': 'b', 'type': 'tensor'},\n   ],\n   'attrs': [\n   {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n   ]\n },\n {\n   'tfOpName': 'SelectV2',\n   'category': 'logical',\n   'inputs': [\n   {'start': 0, 'name': 'condition', 'type': 'tensor'},\n   {'start': 1, 'name': 'a', 'type': 'tensor'},\n
    {'start': 2, 'name': 'b', 'type': 'tensor'},\n   ],\n   'attrs': [{\n   'tfName': 'T',\n   'name': 'dtype',\n   'type': 'dtype',\n   'notSupported': true\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
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*/\n\nimport {OpMapper} from '../types';\n\nexport const json: OpMapper[] = [\n {\n   'tfOpName': '_FusedMatMul',\n   'category': 'matrices',\n   'inputs': [\n   {'start': 0, 'name': 'a', 'type': 'tensor'},\n   {'start': 1, 'name': 'b', 'type': 'tensor'},\n   {'start': 2, end: 0, 'name': 'args', 'type': 'tensors'},\n   ],\n   'attrs': [\n   {'tfName': 'num_args', 'name': 'numArgs', 'type': 'number'}, {\n   'tfName': 'fused_ops',\n   'name': 'fusedOps',\n   'type': 'string[]',\n   'defaultValue': []\n   },\n   {\n   'tfName': 'epsilon',\n   'name': 'epsilon',\n   'type': 'number',\n   'defaultValue': 0.0001\n
      },\n   {\n   'tfName': 'transpose_a',\n   'name': 'transposeA',\n   'type': 'bool',\n   'defaultValue': false\n   },\n   {\n   'tfName': 'transpose_b',\n   'name': 'transposeB',\n   'type': 'bool',\n   'defaultValue': false\n   },\n   {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n   ]\n },\n {\n   'tfOpName': 'MatMul',\n   'category': 'matrices',\n   'inputs': [\n   {'start': 0, 'name': 'a', 'type': 'tensor'},\n   {'start': 1, 'name': 'b', 'type': 'tensor'},\n   ],\n   'attrs': [\n   {\n   'tfName': 'transpose_a',\n   'name': 'transposeA',\n   'type': 'bool',\n   'defaultValue': false\n   },\n   {\n   'tfName': 'transpose_b',\n   'name': 'transposeB',\n

'type': 'bool',\n 'defaultValue': false\n },\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n]\n },\n {\n 'tfOpName': 'BatchMatMul',\n 'category': 'matrices',\n 'inputs': [\n {'start': 0, 'name': 'a', 'type': 'tensor'},\n {'start': 1, 'name': 'b', 'type': 'tensor'},\n],\n 'attrs': [\n {\n 'tfName': 'adj_x',\n 'name': 'transposeA',\n 'type': 'bool',\n 'defaultValue': false\n },\n {\n 'tfName': 'adj_y',\n 'name': 'transposeB',\n 'type': 'bool',\n 'defaultValue': false\n },\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n]\n },\n {\n 'tfOpName': 'BatchMatMulV2',\n 'category': 'matrices',\n 'inputs': [\n {'start': 0, 'name': 'a', 'type': 'tensor'},\n {'start': 1, 'name': 'b', 'type': 'tensor'},\n],\n 'attrs': [\n {\n 'tfName': 'adj_x',\n 'name': 'transposeA',\n 'type': 'bool',\n 'defaultValue': false\n },\n {\n 'tfName': 'adj_y',\n 'name': 'transposeB',\n 'type': 'bool',\n 'defaultValue': false\n },\n {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n]\n },\n {\n 'tfOpName': 'Transpose',\n 'category': 'matrices',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'perm', 'type': 'number[]'},\n],\n 'attrs': [{\n 'tfName': 'T',\n 'name': 'dtype',\n 'type': 'dtype',\n 'notSupported': true\n }]\n }\n];\n","import {OpMapper} from '../types';\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 json: OpMapper[] = [\n {\n 'tfOpName': 'FusedBatchNorm',\n 'category': 'normalization',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'scale', 'type': 'tensor'},\n {'start': 2, 'name': 'offset', 'type': 'tensor'},\n {'start': 3, 'name': 'mean', 'type': 'tensor'},\n {'start': 4, 'name': 'variance', 'type': 'tensor'},\n],\n 'attrs': [\n {\n 'tfName': 'epsilon',\n 'name': 'epsilon',\n 'type': 'number',\n 'defaultValue': 0.001\n },\n {\n 'tfName': 'data_format',\n 'name': 'dataFormat',\n 'type': 'string',\n 'notSupported': true\n }\n]\n },\n {\n 'tfOpName': 'FusedBatchNormV2',\n 'category': 'normalization',\n 'inputs':\n [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'scale', 'type': 'tensor'},\n {'start': 2, 'name': 'offset', 'type': 'tensor'},\n {'start': 3, 'name': 'mean', 'type': 'tensor'},\n {'start': 4, 'name': 'variance', 'type': 'tensor'},\n],\n 'attrs': [\n {\n 'tfName': 'epsilon',\n 'name': 'epsilon',\n 'type': 'number',\n 'defaultValue': 0.001\n },\n {\n 'tfName': 'data_format',\n 'name': 'dataFormat',\n 'type': 'string',\n 'notSupported': true\n }\n]\n },\n {\n 'tfOpName': 'FusedBatchNormV3',\n 'category': 'normalization',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'scale', 'type': 'tensor'},\n {'start': 2, 'name': 'offset', 'type': 'tensor'},\n {'start': 3, 'name': 'mean', 'type': 'tensor'},\n {'start': 4, 'name': 'variance', 'type': 'tensor'},\n],\n 'attrs': [\n {\n 'tfName': 'epsilon',\n 'name': 'epsilon',\n 'type': 'number',\n 'defaultValue': 0.001\n },\n {\n 'tfName': 'data_format',\n 'name': 'dataFormat',\n 'type': 'string',\n 'notSupported': true\n }\n]\n },\n {\n 'tfOpName': 'LRN',\n 'category': 'normalization',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n],\n 'attrs': [\n {\n 'tfName': 'depth_radius',\n 'name': 'radius',\n 'type': 'number',\n 'defaultValue': 5\n },\n {'tfName': 'bias', 'name': 'bias', 'type': 'number', 'defaultValue': 1.0},\n {\n 'tfName': 'alpha',\n 'name': 'alpha',\n 'type': 'number',\n 'defaultValue': 1.0\n },\n {\n 'tfName': 'beta',\n 'name': 'beta',\n 'type': 'number',\n 'defaultValue': 0.5\n }\n]\n },\n {\n 'tfOpName': 'Softmax',\n 'category': 'normalization',\n 'inputs':\n [{'start': 0, 'name': 'x', 'type': 'tensor'}]\n },\n {\n 'tfOpName': 'LogSoftmax',\n 'category': 'normalization',\n 'inputs': [{'start': 0, 'name': 'x', 'type': 'tensor'}]\n },\n {\n 'tfOpName': 'SparseToDense',\n 'category': 'normalization',\n 'inputs': [\n {'start': 0, 'name': 'sparseIndices', 'type': 'tensor'},\n {'start': 1, 'name': 'outputShape', 'type': 'number[]'},\n {'start': 2, 'name': 'sparseValues', 'type': 'tensor'},\n {'start': 3, 'name':

'defaultValue', 'type': 'tensor'},\n],\n 'attrs': [{\n 'tfName': 'validate_indices',\n 'name': 'validateIndices',\n 'type': 'bool',\n 'defaultValue': true,\n 'notSupported': true\n }]\n }\n];\n","import {OpMapper} from '../types';\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
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*/\n\nexport const json: OpMapper[] = [\n {\n 'tfOpName': 'Bincount',\n 'category': 'reduction',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'size', 'type': 'number'},\n {'start': 2, 'name': 'weights', 'type': 'tensor'}\n]\n },\n {\n 'tfOpName': 'DenseBincount',\n 'category': 'reduction',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'size', 'type': 'number'},\n {'start':
2, 'name': 'weights', 'type': 'tensor'}\n],\n 'attrs':\n [{'tfName': 'binary_output', 'name': 'binaryOutput', 'type': 'bool'}]\n },\n {\n 'tfOpName': 'Max',\n 'category': 'reduction',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'axis', 'type': 'number[]'},\n],\n 'attrs': [{'tfName': 'keep_dims', 'name': 'keepDims', 'type': 'bool'}]\n },\n {\n 'tfOpName': 'Mean',\n 'category': 'reduction',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'axis', 'type': 'number[]'},\n],\n 'attrs': [{'tfName': 'keep_dims', 'name': 'keepDims', 'type': 'bool'}]\n },\n {\n 'tfOpName': 'Min',\n 'category': 'reduction',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'axis', 'type': 'number[]'},\n],\n 'attrs': [{'tfName': 'keep_dims', 'name': 'keepDims', 'type': 'bool'}]\n },\n {\n 'tfOpName': 'Sum',\n
'category': 'reduction',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'axis', 'type': 'number[]'},\n],\n 'attrs': [{'tfName': 'keep_dims', 'name': 'keepDims', 'type': 'bool'}]\n },\n {\n 'tfOpName': 'All',\n 'category': 'reduction',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'axis', 'type': 'number[]'},\n],\n 'attrs': [{'tfName': 'keep_dims', 'name': 'keepDims', 'type': 'bool'}]\n },\n {\n 'tfOpName': 'Any',\n 'category': 'reduction',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'axis', 'type': 'number[]'},\n],\n 'attrs': [{'tfName': 'keep_dims', 'name': 'keepDims', 'type': 'bool'}]\n },\n {\n 'tfOpName': 'ArgMax',\n 'category': 'reduction',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'axis', 'type': 'number'}\n]\n },\n
{\n 'tfOpName': 'ArgMin',\n 'category': 'reduction',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'axis', 'type': 'number'}\n]\n },\n {\n 'tfOpName': 'Prod',\n 'category': 'reduction',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'axis', 'type': 'number[]'},\n],\n 'attrs': [{'tfName': 'keep_dims', 'name': 'keepDims', 'type': 'bool'}]\n },\n {\n 'tfOpName': 'Cumsum',\n 'category': 'reduction',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'axis', 'type': 'number'},\n],\n 'attrs': [\n {'tfName': 'exclusive', 'name': 'exclusive', 'type': 'bool'},\n {'tfName': 'reverse', 'name': 'reverse', 'type': 'bool'}\n]\n }\n];\n","import {OpMapper} from '../types';\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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*/\n\nexport const json: OpMapper[] = [\n {\n 'tfOpName': 'ConcatV2',\n 'category': 'slice_join',\n 'inputs': [\n {'start': 0, 'end': -1, 'name': 'tensors', 'type': 'tensors'},\n {'start': -1, 'name': 'axis', 'type': 'number'}\n],\n 'attrs':\n [{'tfName': 'N', 'name': 'n', 'type': 'number', 'defaultValue': 2}]\n },\n {\n 'tfOpName': 'Concat',\n 'category': 'slice_join',\n

'inputs': [\n {'start': 1, 'end': 0, 'name': 'tensors', 'type': 'tensors'},\n {'start': 0, 'name': 'axis', 'type': 'number'}\n],\n 'attrs': [{'tfName': 'N', 'name': 'n', 'type': 'number', 'defaultValue': 2}]\n\n },\n {\n 'tfOpName': 'GatherV2',\n 'category': 'slice_join',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'indices', 'type': 'tensor'},\n {'start': 2, 'name': 'axis', 'type': 'number', 'defaultValue': 0}\n],\n 'attrs': [{\n 'tfName': 'batch_dims',\n 'name': 'batchDims',\n 'type': 'number',\n 'defaultValue': 0\n }]\n },\n {\n 'tfOpName': 'Gather',\n 'category': 'slice_join',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'indices', 'type': 'tensor'},\n],\n 'attrs': [{\n 'tfName': 'validate_indices',\n 'name': 'validateIndices',\n 'type': 'bool',\n 'notSupported': true\n }]\n },\n {\n 'tfOpName': 'Reverse',\n 'category': 'slice_join',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'dims', 'type': 'bool[]'}\n]\n },\n {\n 'tfOpName': 'ReverseV2',\n 'category': 'slice_join',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'axis', 'type': 'number[]'}\n]\n },\n {\n 'tfOpName': 'Slice',\n 'category': 'slice_join',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'begin', 'type': 'number[]'},\n {'start': 2, 'name': 'size', 'type': 'number[]'}\n]\n },\n {\n 'tfOpName': 'StridedSlice',\n 'category': 'slice_join',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'begin', 'type': 'number[]'},\n {'start': 2, 'name': 'end', 'type': 'number[]'},\n {'start': 3, 'name': 'strides', 'type': 'number[]'},\n],\n 'attrs': [\n {\n 'tfName': 'begin_mask',\n 'name': 'beginMask',\n 'type': 'number',\n 'defaultValue': 0\n },\n {\n 'tfName': 'end_mask',\n 'name': 'endMask',\n 'type': 'number',\n 'defaultValue': 0\n },\n {\n 'tfName': 'new_axis_mask',\n 'name': 'newAxisMask',\n 'type': 'number',\n 'defaultValue': 0\n },\n {\n 'tfName': 'ellipsis_mask',\n 'name': 'ellipsisMask',\n 'type': 'number',\n 'defaultValue': 0\n },\n {\n 'tfName': 'shrink_axis_mask',\n 'name': 'shrinkAxisMask',\n 'type': 'number',\n 'defaultValue': 0\n }\n]\n },\n {\n 'tfOpName': 'Pack',\n 'category': 'slice_join',\n 'inputs': [\n {'start': 0, 'end': 0, 'name': 'tensors', 'type': 'tensors'},\n],\n 'attrs': [\n {'tfName': 'axis', 'name': 'axis', 'type': 'number', 'defaultValue': 0}\n]\n },\n {\n 'tfOpName': 'Unpack',\n 'category': 'slice_join',\n 'inputs': [\n {'start': 0, 'name': 'tensor', 'type': 'tensor'},\n],\n 'attrs': [\n {'tfName': 'axis', 'name': 'axis', 'type': 'number', 'defaultValue': 0}, {\n 'tfName': 'num',\n 'name': 'num',\n 'type': 'number',\n 'defaultValue': 0,\n 'notSupported': true\n }\n]\n },\n {\n 'tfOpName': 'Tile',\n 'category': 'slice_join',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'reps', 'type': 'number[]'}\n]\n },\n {\n 'tfOpName': 'Split',\n 'category': 'slice_join',\n 'inputs': [\n {'start': 0, 'name': 'axis', 'type': 'number', 'defaultValue': 0},\n {'start': 1, 'name': 'x', 'type': 'tensor'},\n],\n 'attrs': [{\n 'tfName': 'num_split',\n 'name': 'numOrSizeSplits',\n 'type': 'number',\n 'defaultValue': 1\n }]\n },\n {\n 'tfOpName': 'SplitV',\n 'category': 'slice_join',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'numOrSizeSplits', 'type': 'number[]'},\n {'start': 2, 'name': 'axis', 'type': 'number', 'defaultValue': 0}\n]\n },\n {\n 'tfOpName': 'ScatterNd',\n 'category': 'slice_join',\n 'inputs': [\n {'start': 0, 'name': 'indices', 'type': 'tensor'},\n {'start': 1, 'name': 'values', 'type': 'tensor'},\n {'start': 2, 'name': 'shape', 'type': 'number[]'}\n]\n },\n {\n 'tfOpName': 'GatherNd',\n 'category': 'slice_join',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'indices', 'type': 'tensor'}\n]\n },\n {\n 'tfOpName': 'SparseToDense',\n 'category': 'slice_join',\n 'inputs': [\n {'start': 0, 'name': 'sparseIndices', 'type': 'tensor'},\n {'start': 1, 'name': 'outputShape', 'type': 'number[]'},\n {'start': 2, 'name': 'sparseValues', 'type': 'tensor'},\n {'start': 3, 'name': 'defaultValue', 'type': 'tensor'},\n],\n 'attrs': [{\n 'tfName': 'validate_indices',\n 'name': 'validateIndices',\n 'type': 'bool',\n 'defaultValue': false,\n 'notSupported': true\n }]\n }\n];\n","import {OpMapper} from '../types';\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\nexport
const json: OpMapper[] = [\n {\n 'tfOpName': 'FFT',\n 'category': 'spectral',\n 'inputs': [{'start': 0, 'name': 'x', 'type': 'tensor'}]\n },\n {\n 'tfOpName': 'IFFT',\n 'category': 'spectral',\n 'inputs': [{'start': 0, 'name': 'x', 'type': 'tensor'}]\n },\n {\n 'tfOpName': 'RFFT',\n 'category': 'spectral',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'}, {\n 'start': 1,\n 'name': 'fft_length',\n 'type': 'number',\n 'notSupported': true\n }\n]\n },\n {\n 'tfOpName': 'IRFFT',\n 'category': 'spectral',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'}, {\n '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 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,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY 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': 'Cast',\n 'category': 'transformation',\n 'inputs': [\n
{'start': 0, 'name': 'x', 'type': 'tensor'},\n],\n 'attrs': [\n {\n 'tfName': 'SrcT',\n 'name': 'sdtype',\n
'type': 'dtype',\n 'notSupported': true\n },\n {'tfName': 'DstT', 'name': 'dtype', 'type': 'dtype'}\n]\n },\n
{\n 'tfOpName': 'ExpandDims',\n
'category': 'transformation',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'axis',
'type': 'number'}\n]\n },\n {\n 'tfOpName': 'MirrorPad',\n 'category': 'transformation',\n 'inputs': [\n
{'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'padding', 'type': 'number[]'},\n],\n 'attrs': [{'tfName':
'mode', 'name': 'mode', 'type': 'string'}]\n },\n {\n 'tfOpName': 'Pad',\n 'category': 'transformation',\n 'inputs':
[\n {'start': 0, 'name': 'x', 'type': 'tensor'},\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 'tfOpName': 'PadV2',\n 'category': 'transformation',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n
{'start': 1, 'name': 'padding', 'type': 'number[]'},
{\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 {'start': 0, 'name': 'x', 'type':
'tensor'},\n {'start': 1, 'name': 'shape', 'type': 'number[]'}\n]\n },\n {\n 'tfOpName': 'Squeeze',\n 'category':
'transformation',\n 'inputs': [\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 {\n 'tfOpName':
'SpaceToBatchND',\n 'category': 'transformation',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n
{'start': 1, 'name': 'blockShape', 'type': 'number[]'},\n {'start': 2, 'name': 'paddings', 'type': 'number[]'}\n]\n },\n
{\n 'tfOpName': 'BatchToSpaceND',\n 'category': 'transformation',\n 'inputs':
[\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'blockShape', 'type': 'number[]'},\n {'start': 2,
'name': 'crops', 'type': 'number[]'}\n]\n },\n {\n 'tfOpName': 'DepthToSpace',\n 'category': 'transformation',\n
'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n],\n 'attrs': [\n {'tfName': 'block_size', 'name':
'blockSize', 'type': 'number'},\n {'tfName': 'data_format', 'name': 'dataFormat', 'type': 'string'}\n]\n },\n {\n
'tfOpName': 'BroadcastTo',\n 'category': 'transformation',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n
{'start': 1, 'name': 'shape', 'type': 'number[]'},\n],\n 'attrs': []\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
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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

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language governing permissions and\n * limitations under the License.\n *
==========================================================================\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\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\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    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\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\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.defaultValue as DataType);\n              if (value === undefined && !!param.tfDeprecatedName) {\n
 value = getDtypeParam(\n                  node.attr, param.tfDeprecatedName,\n                  param.defaultValue
 as DataType);\n              }\n              break;\n            case 'dtype[]':\n              value = getDtypeArrayParam(\n
          node.attr, param.tfName, param.defaultValue as DataType[]);\n              if (value === undefined &&
!!param.tfDeprecatedName) {\n                value = getDtypeArrayParam(\n                  node.attr,
param.tfDeprecatedName,\n                  param.defaultValue as DataType[]);\n              }\n              break;\n
   case 'func':\n              value = getFuncParam(\n                  node.attr, param.tfName, param.defaultValue as
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:
${node.op}`);\n            }\n            map[param.name] = {value, type};\n            return map;\n          }, {});\n    }\n
return newNode;\n  }\n\n  // map the TFunctionDef to TFJS graph object\n  private mapFunction(functionDef:
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 =
tfNodes.reduce<{[key: string]: Node}>((map, node) => {\n        map[node.name] = this.mapNode(node);\n        if
(node.op === 'Const') {\n          weights.push(map[node.name]);\n        }\n        return map;\n      }, {});\n    }\n
const inputs: Node[] = [];\n    const outputs: Node[] = [];\n\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:
'dtype'}},\n        children: []\n      };\n      node.signatureKey = arg.name;\n      inputs.push(node);\n
nodes[nodeName] = node;\n    });\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    const returnNodeMap = functionDef.ret;\n\n
functionDef.signature.outputArg.forEach(output => {\n      const [nodeName, index] =
getNodeNameAndIndex(returnNodeMap[output.name]);\n      const node = nodes[nodeName];\n      if (node != null)
{\n        node.defaultOutput
 = index;\n        outputs.push(node);\n      }\n    });\n\n    const signature = this.mapArgsToSignature(functionDef);\n
 return {nodes, inputs, outputs, weights, placeholders, signature};\n  }\n\n  private
mapArgsToSignature(functionDef: tensorflow.IFunctionDef):\n      tensorflow.ISignatureDef {\n    return {\n
methodName: functionDef.signature.name,\n      inputs: functionDef.signature.inputArg.reduce(\n          (map, arg)
=> {\n            map[arg.name] = this.mapArgToTensorInfo(arg);\n            return map;\n          },\n          {} as {[key:
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
{[key: string]: tensorflow.ITensorInfo}),\n    };\n  }\n\n  private mapArgToTensorInfo(\n      arg:
tensorflow.OpDef.IArgDef,\n      nameMap?: {[key: string]: string}): tensorflow.ITensorInfo
 {\n    let name = arg.name;\n    if (nameMap != null) {\n      name = nameMap[name];\n    }\n    return {name,
dtype: arg.type};\n  }\n}\n\nexport function decodeBase64(text: string): string {\n  const global = env().global;\n  if
(typeof global.atob !== 'undefined') {\n    return global.atob(text);\n  } else if (typeof Buffer !== 'undefined') {\n
return new Buffer(text, 'base64').toString();\n  } else {\n    throw new Error(\n        'Unable to decode base64 in this
environment. ' +\n        'Missing built-in atob() or Buffer()');\n  }\n}\n\nexport function parseStringParam(s: []|string,
keepCase: boolean): string {\n  const value =\n      Array.isArray(s) ? String.fromCharCode.apply(null, s) :
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
= attrs[name];\n  if (param != null) {\n    return
```

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 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 * @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, 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,\n  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 * @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 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 * @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 '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 *
==========================================================================\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';\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 'Expm1': {\n return [tfOps.expm1(\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\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
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};\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 * This differs from util.assertShapesMatch in that it allows values of\n * negative one, an undefined size of a dimensinon, in a shape to match\n * anything.\n */\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 dim shape.\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' || typeof shapeB === 'number') {\n    return;\n  }\n  util.assert(\n      shapeA.length === shapeB.length,\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' || elementShape.some(dim => dim < 0)) {\n    return false;\n  }\n  return true;\n}\n/**\n * Generate the output element shape from the list elementShape, list tensors\n * and input param.\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 = mergeElementShape(listElementShape, elementShape);\n  const notfullDefinedShape = !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 = 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\n  if (elementShapeA.length !== elementShapeB.length) {\n    throw new Error(`Incompatible ranks during merge: ${elementShapeA} vs. ${\n        elementShapeB}`);\n  }\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. ${\n          elementShapeB}`);\n    }\n    result[i] = dim0 >= 0 ? dim0 : dim1;\n  }\n  return result;\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 {concat, DataType, keep, reshape, scalar, slice, stack, Tensor, tensor, tidy, unstack} from '@tensorflow/tfjs-core';\n\nimport {assertShapesMatchAllowUndefinedSize} from './tensor_utils';\n\nexport
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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,
  readonly clearAfterRead: boolean) {\n    this.idTensor = scalar(0);\n    keep(this.idTensor);\n  }\n\n  get id() {\n    return this.idTensor.id;\n  }\n\n  get closed() {\n    return this.closed_;\n  }\n\n  /**\n   * Dispose the tensors and idTensor and mark the TensoryArray 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\n  size(): number {\n    return this.tensors.length;\n  }\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\n    if (index < 0 || index >= this.size()) {\n      throw new Error(`Tried to read from index
  ${index}, but array size is: ${\n          this.size()}`);\n    }\n\n    const tensorWithState = this.tensors[index];\n    if (tensorWithState.cleared) {\n      throw new Error(\n          `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\n    if (this.clearAfterRead) {\n      tensorWithState.cleared = true;\n    }\n\n    tensorWithState.read = true;\n    return tensorWithState.tensor;\n  }\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  /**\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\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\n    const t = this.tensors[index] || {};\n\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\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\n    assertShapesMatchAllowUndefinedSize(\n        this.elementShape, tensor.shape,\n        `TensorArray ${this.name}: Could not write to TensorArray index ${\n          index}.`);\n\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\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\n    t.tensor = tensor;\n    keep(tensor);\n    t.written = true;\n\n    this.tensors[index] = t;\n  }\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\n    indices.forEach((i, index) => this.write(i, tensors[index]));\n  }\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\n    if (!indices) {\n      indices = [];\n      for (let i = 0; i < this.size(); i++) {\n        indices.push(i);\n      }\n    } else {\n
```

indices = indices.slice(0, this.size());\n }\n\n if (indices.length === 0) {\n   return tensor([], [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\n return stack(tensors, 0);\n }\n\n /**\n * Return the values in the TensorArray as a concatenated Tensor.\n */\n concat(dtype?: DataType): Tensor {\n if (!!dtype && dtype !== this.dtype) {\n   throw new Error(`TensorArray dtype is ${\n        this.dtype} but concat requested dtype ${dtype}`);\n }\n\n if (this.size() === 0) {\n   return tensor([], [0].concat(this.elementShape));\n }\n\n const indices = [];\n for (let i = 0; i < this.size(); i++) {\n   indices.push(i);\n }\n // Collect all the tensors from the tensors array.\n const tensors = this.readMany(indices);\n\n assertShapesMatchAllowUndefinedSize(\n   this.elementShape, tensors[0].shape,\n   `TensorArray shape mismatch: tensor array shape (${\n        this.elementShape}) vs first tensor shape (${tensors[0].shape})`);\n\n return concat(tensors,\n 0);\n }\n\n /**\n * Scatter the values of a Tensor in specific indices of a TensorArray.\n * @param indices nummber[] 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 ${\n        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: ${\n        indices.length} vs. ${tensor.shape[0]}`);\n }\n\n const maxIndex = Math.max(...indices);\n\n if (!this.dynamicSize && maxIndex >= this.maxSize) {\n   throw new Error(\n   `Max index must be < array size (${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 * @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 ${\n        this.dtype} but tensor has dtype ${tensor.dtype}`);\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: ${tensor.shape}`);\n }\n\n if (!this.dynamicSize && length.length !== this.maxSize) {\n throw new Error(\n   `TensorArray's size is not equal to the size of lengths (${\n        this.maxSize} vs. ${length.length}), ` +\n   'and the TensorArray is\n not marked as dynamically resizeable');\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 this.writeMany(indices, tensors);\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\nimport {concat, DataType, keep, reshape, scalar, slice, stack, Tensor, tensor, tidy, unstack} from '@tensorflow/tfjs-core';\n\nimport {assertShapesMatchAllowUndefinedSize, inferElementShape, mergeElementShape} from './tensor_utils';\n\n/**\n * TensorList stores a container of `tf.Tensor` objects, which are accessible\n * via tensors field.\n *\n * In order to get a copy of the underlying list, use the copy method:\n * ```\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 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        if (elementDtype !== tensor.dtype) {\n          throw new Error(`Invalid
 data types; op elements ${\n              elementDtype}, but list elements ${tensor.dtype}`);\n        }\n
assertShapesMatchAllowUndefinedSize(\n            elementShape, tensor.shape, 'TensorList shape mismatch: ');\n\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,
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 ||
!keepIds.has(tensor.id)) {\n        tensor.dispose();\n      }\n    });\n    this.tensors.length = 0;\n
this.idTensor.dispose();\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
one rank-(R+1)\n   * tf.Tensor.\n   * @param elementShape shape of each tensor\n   * @param elementDtype data
type of each tensor\n   * @param numElements the number of elements to stack\n   */\n  stack(elementShape:
number[], elementDtype: DataType, numElements = -1):\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 (numElements !== -1 && this.tensors.length !== numElements) {\n      throw
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,
this.elementShape, 'TensorList shape mismatch: ');\n    const outputElementShape =\n
inferElementShape(this.elementShape,
 this.tensors, elementShape);\n    return tidy(() => {\n      const reshapedTensors =\n          this.tensors.map(tensor =>
reshape(tensor, outputElementShape));\n      return stack(reshapedTensors, 0);\n    });\n  }\n\n  /**\n   * Pop a tensor
from the end of the list.\n   * @param elementShape shape of the tensor\n   * @param elementDtype data type of the
tensor\n   */\n  popBack(elementShape: number[], elementDtype: DataType): 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    if (this.size() === 0) {\n      throw new Error('Trying to pop from an
empty list.');\n    }\n    const outputElementShape =\n        inferElementShape(this.elementShape, this.tensors,
elementShape);\n    const tensor = this.tensors.pop();\n\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   *
@param tensor Tensor to be pushed.\n   */\n  pushBack(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    assertShapesMatchAllowUndefinedSize(\n        tensor.shape,
this.elementShape, 'TensorList shape mismatch: ');\n\n    if (this.maxNumElements === this.size()) {\n      throw
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
(size < 0) {\n      throw new Error(\n          `TensorListResize expects size to be non-negative. Got: ${size}`);\n
}\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      throw new Error(`element at index ${elementIndex} is null.`);\n    }\n\n
assertShapesMatchAllowUndefinedSize(\n
      this.tensors[elementIndex].shape, elementShape,\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    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 */\nexport 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/**\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 elementDtype the desired type of elements in the list\n * @param numElements the number of elements to reserve\n */\nexport function reserve(\n    elementShape: number[], elementDtype: DataType, numElements: number) {\n  return new TensorList([], elementShape, elementDtype, numElements);\n}\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. ${tensor.shape[0]}`);\n  }\n\n  const maxIndex = Math.max(...indices);\n\n  if (numElements != null && numElements !== -1 && maxIndex >= numElements) {\n    throw new Error(\n        `Max index must be < array size (${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/**\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\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.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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';\n\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';\n\nimport {cloneTensor, getParamValue, getTensor} from './utils';\n\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      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(\n
args, 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 =\n
getParamValue('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\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\n      let result: Tensor[] = args;\n\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\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 &&\n
resultIds.indexOf(tensor.id)
 === -1) {\n            tensor.dispose();\n          }\n        });\n\n        // Recalcuate 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 =\n
getParamValue('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\n
boolean;\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\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);\n context.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 DataType;\n let numElementsParam;\n\n if (node.op === 'TensorListReserve') {\n numElementsParam = 'numElements';\n } else {\n numElementsParam = 'maxNumElements';\n }\n\n const numElements =\n getParamValue(numElementsParam, node, tensorMap, context) as number;\n\n const tensorList = reserve(elementShape, elementDtype, numElements);\n context.addTensorList(tensorList);\n return [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 = context.getTensorList(gatherId.id);\n return [tensorList.gather(gatherIndices, elementDtype, elementShape)];\n }\n case 'TensorListStack': {\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 DataType;\n const numElements =\n getParamValue('numElements', node, tensorMap, context) as number;\n const\n tensorList = context.getTensorList(idTensor.id);\n return [tensorList.stack(elementShape, elementDtype, numElements)];\n }\n case 'TensorListFromTensor': {\n const tensor =\n getParamValue('tensor', 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 DataType;\n const tensorList = fromTensor(tensor, elementShape, elementDtype);\n context.addTensorList(tensorList);\n return [tensorList.idTensor];\n }\n case 'TensorListConcat': {\n const concatId =\n getParamValue('tensorListId', node, tensorMap, context) as Tensor;\n const tensorList = context.getTensorList(concatId.id);\n const concatDtype =\n getParamValue('dtype', node, tensorMap, context) as DataType;\n const elementShape =\n getParamValue('elementShape',\n node, tensorMap, context) as number[];\n return [tensorList.concat(concatDtype, elementShape)];\n }\n case 'TensorListPushBack': {\n const idTensor =\n getParamValue('tensorListId', node, tensorMap, context) as Tensor;\n const writeTensor =\n getParamValue('tensor', node, tensorMap, context) as Tensor;\n const tensorList = context.getTensorList(idTensor.id);\n tensorList.pushBack(writeTensor);\n return [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 DataType;\n const tensorList = context.getTensorList(idTensor.id);\n return [tensorList.popBack(elementShape, elementDType)];\n }\n case 'TensorListSplit':\n {\n const splitTensor =\n getParamValue('tensor', node, tensorMap, context) as Tensor;\n const elementShape =\n getParamValue('elementShape', node, tensorMap, context) as number[];\n const lengths =\n getParamValue('lengths', node, tensorMap, context) as number[];\n\n const tensorList = split(splitTensor, lengths, elementShape);\n context.addTensorList(tensorList);\n return [tensorList.idTensor];\n }\n default:\n throw TypeError(`Node type ${node.op} is not implemented`);\n }\n};\n\nexport const CATEGORY = 'control';\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

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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 */\n\nimport {Rank, Tensor, Tensor3D, Tensor4D, Tensor5D} 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 {getPadding, getParamValue} from './utils';\n\nfunction fusedConvAndDepthWiseParams(\n    node: Node, tensorMap: NamedTensorsMap, context: ExecutionContext) {\n  const [extraOp, activationFunc] =\n      (getParamValue('fusedOps', node, tensorMap, context) as string[]);\n\n  const isBiasAdd
 = extraOp === 'biasadd';\n  const isPrelu = activationFunc === 'prelu';\n  const isBatchNorm = extraOp ===
'fusedbatchnorm';\n\n  const numArgs =\n      (getParamValue('numArgs', node, tensorMap, context) as number);\n  if (isBiasAdd) {\n    if (isPrelu && numArgs !== 2) {\n      throw new Error(\n          'FusedConv2d and DepthwiseConv2d with BiasAdd and Prelu ' +\n          'must have two extra arguments: bias and alpha.');\n    }\n    if (!isPrelu && numArgs !== 1) {\n      throw new Error(\n          'FusedConv2d and DepthwiseConv2d with BiasAdd must have ' +\n          'one extra argument: bias.');\n    }\n  }\n  if (isBatchNorm) {\n    throw new Error(\n        'FusedConv2d and DepthwiseConv2d with FusedBatchNorm is not supported.');\n  }\n  const stride =
getParamValue('strides', node, tensorMap, context) as number[];\n  const pad = getPadding(node, tensorMap, context);\n  const dataFormat =\n      (getParamValue('dataFormat', node, tensorMap, context) as string)\n          .toUpperCase();\n  const dilations =\n      getParamValue('dilations', node, tensorMap, context) as number[];\n  const [biasArg, preluArg] =\n      getParamValue('args', node, tensorMap, context) as Tensor[];\n  const leakyreluAlpha =\n      getParamValue('leakyreluAlpha', node, tensorMap, context) as number;\n\n  return {\n    stride,\n    pad,\n    dataFormat,\n    dilations,\n    biasArg,\n    preluArg,\n    activationFunc,\n    leakyreluAlpha\n  };\n}\n\nexport const executeOp: InternalOpExecutor =\n    (node: Node, tensorMap: NamedTensorsMap,\n     context: ExecutionContext): Tensor[] => {\n      switch (node.op) {\n        case 'Conv1D': {\n          const stride =\n              getParamValue('stride', node, tensorMap, context) as number;\n          const pad = getParamValue('pad', node, tensorMap, context);\n          const dataFormat =\n              (getParamValue('dataFormat', node, tensorMap, context)
as string)\n                  .toUpperCase();\n          const dilation
 =\n              getParamValue('dilation', node, tensorMap, context) as number;\n          return [tfOps.conv1d(\n              getParamValue('x', node, tensorMap, context) as Tensor3D,\n              getParamValue('filter', node, tensorMap,
context) as Tensor3D,\n              stride, pad as 'valid' | 'same', dataFormat as 'NWC' | 'NCW',\n              dilation)];\n
        }\n        case 'Conv2D': {\n          const stride =\n              getParamValue('strides', node, tensorMap, context) as
number[];\n          const pad = getPadding(node, tensorMap, context);\n          const dataFormat =\n
(getParamValue('dataFormat', node, tensorMap, context) as string)\n                  .toUpperCase();\n          const
dilations =\n              getParamValue('dilations', node, tensorMap, context) as number[];\n          return
[tfOps.conv2d(\n              getParamValue('x', node, tensorMap, context) as Tensor3D |\n                  Tensor4D,\n
    getParamValue('filter',
 node, tensorMap, context) as Tensor4D,\n              [stride[1], stride[2]], pad as 'valid' | 'same',\n              dataFormat
as 'NHWC' | 'NCHW', [dilations[1], dilations[2]])];\n        }\n        case '_FusedConv2D': {\n          const {\n
stride,\n            pad,\n            dataFormat,\n            dilations,\n            biasArg,\n            preluArg,\n
activationFunc,\n            leakyreluAlpha\n          } = fusedConvAndDepthWiseParams(node, tensorMap,
context);\n\n          return [tfOps.fused.conv2d({\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' | 'NCHW',\n            dilations: [dilations[1], dilations[2]],\n            bias: biasArg,\n
activation:
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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\n return
[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' |
'NCHW',\n dilations: [dilations[1], dilations[2]],\n bias: biasArg,\n activation: activationFunc
as tfOps.fused.Activation,\n preluActivationWeights: preluArg,\n leakyreluAlpha\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,
context) as number[];\n const pad = getPadding(node, tensorMap, context);\n return
[tfOps.conv2dTranspose(\n getParamValue('x', node, tensorMap, context) as Tensor3D |\n
Tensor4D,\n getParamValue('filter', node, tensorMap, context) as Tensor4D,\n shape, [stride[1],
stride[2]], pad as 'valid' | 'same')];\n }\n case 'DepthwiseConv2dNative':\n case 'DepthwiseConv2d': {\n
const stride =\n
getParamValue('strides', node, tensorMap, context) as number[];\n const pad = getPadding(node,
tensorMap, context);\n const dilations =\n getParamValue('dilations', node, tensorMap, context) as
number[];\n const dataFormat =\n (getParamValue('dataFormat', node, tensorMap, context) as string)\n
.toUpperCase();\n\n return [tfOps.depthwiseConv2d(\n getParamValue('input', node,
tensorMap, context) as Tensor3D |\n Tensor4D,\n getParamValue('filter', node, tensorMap,
context) as Tensor4D,\n [stride[1], stride[2]], pad as 'valid' | 'same',\n dataFormat as 'NHWC' |
'NCHW', [dilations[1], dilations[2]])];\n }\n case 'Conv3D': {\n const stride =\n
getParamValue('strides', node, tensorMap, context) as number[];\n const pad = getParamValue('pad', node,
tensorMap, context);\n const dataFormat
=\n (getParamValue('dataFormat', node, tensorMap, context) as string)\n .toUpperCase();\n
const dilations =\n getParamValue('dilations', node, tensorMap, context) as number[];\n return
[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 case 'AvgPool': {\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\n return
[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 case
'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\n return [tfOps.maxPool(\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 case 'MaxPoolWithArgmax':
{\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 const includeBatchInIndex =\n getParamValue('includeBatchInIndex', node,
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\n return [tfOps.avgPool3d(\n getParamValue('x',
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\n case 'MaxPool3D': {\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\n return [tfOps.maxPool3d(\n getParamValue('x', 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\n case 'Dilation2D': {\n const strides =\n getParamValue('strides', node, tensorMap, context) as number[];\n const pad = getParamValue('pad', node, tensorMap, context);\n const dilations
=\n getParamValue('dilations', node, tensorMap, context) as number[];\n\n // strides: [1, stride_height, stride_width, 1].\n const strideHeight = strides[1];\n const strideWidth = strides[2];\n\n // dilations: [1, dilation_height, dilation_width, 1].\n const dilationHeight = dilations[1];\n const dilationWidth = dilations[2];\n\n return [tfOps.dilation2d(\n getParamValue('x', node, tensorMap, context) as Tensor3D |\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 * @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 {DataType, Tensor, Tensor1D} 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 'Fill': {\n const shape =\n getParamValue('shape', node, tensorMap, context) as number[];\n const dtype =\n getParamValue('dtype', node, tensorMap, context) as DataType;\n const value =\n getParamValue('value', node, tensorMap, context) as number;\n return [tfOps.fill(shape, value, dtype)];\n }\n case 'LinSpace': {\n const start =\n getParamValue('start', node, tensorMap, context) as number;\n const stop =\n getParamValue('stop', node, tensorMap, context) as number;\n const num = getParamValue('num', node, tensorMap, context) as number;\n return [tfOps.linspace(start, stop, num)];\n }\n case 'Multinomial': {\n const logits =\n getParamValue('logits', node, tensorMap, context) as Tensor1D;\n const numSamples =\n getParamValue('numSamples', node, tensorMap, context) as number;\n const seed =\n getParamValue('seed', node, tensorMap, context) as number;\n return [tfOps.multinomial(logits, numSamples, seed)];\n }\n case 'OneHot': {\n const indices =\n getParamValue('indices', node, tensorMap, context) as Tensor1D;\n const depth =\n

getParamValue('depth', node, tensorMap, context) as number;\n const onValue =\n getParamValue('onValue', node, tensorMap, context) as number;\n const offValue =\n getParamValue('offValue', node, tensorMap, context) as number;\n return [tfOps.oneHot(indices, depth, onValue, 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 * @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} 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 {InternalOpAsyncExecutor, Node} from '../types';\n\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,\n 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\n const result = await tfOps.image.nonMaxSuppressionWithScoreAsync(\n boxes as Tensor2D, scores as Tensor1D, maxOutputSize, iouThreshold,\n scoreThreshold, softNmsSigma);\n\n return [result.selectedIndices, result.selectedScores];\n
}\n case 'NonMaxSuppressionV4': {\n const {boxes, scores, maxOutputSize, iouThreshold, scoreThreshold} =\n nmsParams(node, tensorMap, context);\n\n const padToMaxOutputSize =\n getParamValue('padToMaxOutputSize', node, tensorMap, context) as\n boolean;\n\n const result = await tfOps.image.nonMaxSuppressionPaddedAsync(\n boxes as Tensor2D, scores as Tensor1D, maxOutputSize, iouThreshold,\n scoreThreshold, padToMaxOutputSize);\n\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\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 * @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} 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\nexport const CATEGORY = 'evaluation';\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 {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 =\n getParamValue('default', node, tensorMap, context) as Tensor;\n          return [getTensor(node.name, tensorMap, context) || def];\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',\n node, tensorMap, context) as Tensor[])\n              .map((t: Tensor) => cloneTensor(t));\n        case 'Snapshot':\n          const snapshot =\n              (getParamValue('x', node, tensorMap, context) as Tensor);\n          return [cloneTensor(snapshot)];\n        case 'Shape':\n          return [tfOps.tensor1d(\n              (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(\n              (getParamValue('x', node, tensorMap, context) as Tensor).size,\n              'int32')];\n        case 'Rank':\n          return [tfOps.scalar(\n              (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 =\n getParamValue('data', node, tensorMap, context) as Tensor[];\n          const message =\n getParamValue('message', node, tensorMap, context) as string;\n          const summarize =\n getParamValue('summarize', node, tensorMap, context) as number;\n          console.warn(\n              '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\n        default:\n          throw TypeError(`Node type ${node.op} is not implemented`);\n      }\n};\n\nexport const CATEGORY = 'graph';\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 {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   *\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\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\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\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\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 * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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, 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\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

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 *
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*/\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\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 *
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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          {\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
 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\n              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 const leakyreluAlpha =\n getParamValue('leakyreluAlpha', node, tensorMap, context) as\n number;\n\n if (isBiasAdd) {\n if (isPrelu && numArgs !== 2) {\n throw new Error(\n 'Fused MatMul with BiasAdd and Prelu must have two ' +\n 'extra arguments: bias and alpha.');\n }\n if (!isPrelu && numArgs !== 1) {\n throw new Error(\n 'Fused MatMul with BiasAdd must have one extra argument: bias.');\n }\n }\n const [biasArg, preluArg] =\n getParamValue('args',
node, tensorMap, context) as Tensor[];\n return [tfOps.fused.matMul({\n a: getParamValue('a', node, tensorMap, context) as Tensor2D,\n b: getParamValue('b', node, tensorMap, context) as Tensor2D,\n transposeA: getParamValue('transposeA', node, tensorMap, context) as\n boolean,\n transposeB: 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 default:\n throw TypeError(`Node type ${node.op} is not implemented`);\n }\n };\n\nexport const CATEGORY = 'matrices';\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 {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';\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 'FusedBatchNorm':\n case 'FusedBatchNormV2': {\n return [tfOps.batchNorm(\n getParamValue('x', node, tensorMap, context) as Tensor,\n getParamValue('mean', node, tensorMap, context) as Tensor,\n getParamValue('variance', node, tensorMap, context) as Tensor,\n getParamValue('offset', node, tensorMap, context) as Tensor,\n getParamValue('scale', node, tensorMap, context) as Tensor,\n getParamValue('epsilon', node, tensorMap, context) as number)];\n }\n case 'FusedBatchNormV3': {\n return [tfOps.batchNorm(\n getParamValue('x', node, tensorMap, context) as Tensor,\n getParamValue('mean', node, tensorMap, context) as Tensor,\n getParamValue('variance', node, tensorMap, context) as Tensor,\n getParamValue('offset',
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 [tfOps.localResponseNormalization(\n getParamValue('x', node, tensorMap, context) as Tensor3D |\n Tensor4D,\n getParamValue('radius', node, tensorMap, context) as number,\n getParamValue('bias', node, tensorMap, context) as number,\n getParamValue('alpha', node, tensorMap, context) as number,\n getParamValue('beta', node, tensorMap, context) as number)];\n }\n case '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, context) as Tensor)];\n }\n case
'SparseToDense': {\n return [tfOps.sparseToDense(\n getParamValue('sparseIndices', node, tensorMap, context) as\n Tensor,\n getParamValue('outputShape', node, tensorMap, context) as 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
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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 {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',
 node, tensorMap, context) as number[];\n          const keepDims =\n              getParamValue('keepDims', node,
tensorMap, context) as boolean;\n          return [tfOps.max(\n              getParamValue('x', node, tensorMap, context)
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,
 axis,\n              keepDims)];\n        }\n        case 'Sum': {\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.sum(\n              getParamValue('x', node, tensorMap, context) as Tensor,
axis,\n              keepDims)];\n        }\n        case 'All': {\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.all(\n              getParamValue('x', node, tensorMap, context) as Tensor,
axis,\n              keepDims)];\n        }\n        case 'Any': {\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.any(\n              getParamValue('x', node, tensorMap, context) as Tensor,
axis,\n              keepDims)];\n        }\n        case 'ArgMax': {\n          const axis =\n              getParamValue('axis',
node, tensorMap, context) as number;\n          return [tfOps.argMax(\n              getParamValue('x', node, tensorMap,
context) as Tensor, axis)];\n        }\n        case 'ArgMin': {\n          const axis =\n              getParamValue('axis', node,
tensorMap, context) as number;\n          return [tfOps.argMin(\n              getParamValue('x', node, tensorMap,
context) as Tensor, axis)];\n        }\n        case 'Prod': {\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.prod(\n              getParamValue('x', node, tensorMap, context) as Tensor,
axis,\n
            keepDims)];\n        }\n        case 'Cumsum': {\n          const axis =\n              getParamValue('axis', node,
tensorMap, context) as number;\n          const exclusive =\n              getParamValue('exclusive', node, tensorMap,
context) as boolean;\n          const reverse =\n              getParamValue('reverse', node, tensorMap, context) as
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,
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\n
return [tfOps.bincount(x, weights, size)];\n case 'DenseBincount': {\n const x = getParamValue('x', node,
tensorMap, context)
 as Tensor1D |\n Tensor2D;\n const weights =\n getParamValue('weights', node, tensorMap,
context) as Tensor1D |\n Tensor2D;\n const size =\n getParamValue('size', node, tensorMap,
context) as number;\n\n const binaryOutput =\n getParamValue('binaryOutput', node, tensorMap,
context) as\n boolean;\n\n return [tfOps.denseBincount(x, weights, size, binaryOutput)];\n }\n
default:\n throw TypeError(`Node type ${node.op} is not implemented`);\n }\n };\n\nexport const
CATEGORY = 'reduction';\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 *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
 software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY 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, Tensor, Tensor1D, tidy, util} 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 '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',
node, tensorMap, context) as Tensor[];\n inputs = inputs.slice(0, n);\n return [tfOps.concat(inputs,
axis)];\n }\n case 'Gather': {\n const input = getParamValue('x', node, tensorMap, context) as
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,
tensorMap, context) as Tensor;\n
 const indices =\n getParamValue('indices', node, tensorMap, context) as Tensor1D;\n return
[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
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
number[];\n const input = getParamValue('x', node, tensorMap, context) as Tensor;\n return
[tfOps.reverse(input, axis)];\n }\n case 'Slice': {\n // tslint:disable-next-line:no-any\n const
 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 const begin =\n getParamValue('begin', node, tensorMap, context) as number[];\n const end
=\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 const shrinkAxisMask =\n getParamValue('shrinkAxisMask', node, tensorMap, context) as\n number;\n const tensor = getParamValue('x', node, tensorMap, context) as Tensor;\n\n return [tfOps.stridedSlice(\n tensor, begin, end, strides, beginMask, endMask, ellipsisMask,\n newAxisMask, shrinkAxisMask)];\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 shape if they don't\n // match.\n const shape = tensors[0].shape;\n const squeezedShape = tfOps.squeeze(tensors[0]).shape;\n const mapped = tensors.map(tensor => {\n const sameShape = util.arraysEqual(tensor.shape, shape);\n if (!sameShape &&\n !util.arraysEqual(\n tfOps.squeeze(tensor).shape, squeezedShape)) {\n throw new Error('the input tensors shape does not match');\n }\n return sameShape ? tensor : tfOps.reshape(tensor, shape);\n });\n return [tfOps.stack(mapped, axis)];\n });\n }\n case 'Unpack': {\n const axis =\n getParamValue('axis', node, tensorMap, context) as number;\n const tensor =\n getParamValue('tensor', node, tensorMap, context) as Tensor;\n return tfOps.unstack(tensor, axis);\n }\n case 'Tile': {\n const reps =\n getParamValue('reps', node, tensorMap, context) as number[];\n return [tfOps.tile(\n getParamValue('x', node, tensorMap, context) as Tensor, reps)];\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\n number |\n number[];\n const tensor = getParamValue('x', node, tensorMap, context) as Tensor;\n\n return tfOps.split(tensor, numOrSizeSplits, axis);\n }\n case 'ScatterNd': {\n const indices =\n getParamValue('indices', node, tensorMap, context) as Tensor;\n const values =\n getParamValue('values', node, tensorMap, context) as Tensor;\n const shape =\n getParamValue('shape', node, tensorMap, context) as number[];\n return [tfOps.scatterND(indices, values, shape)];\n }\n case 'GatherNd': {\n const x = getParamValue('x', node, tensorMap, context)\n as Tensor;\n const indices =\n getParamValue('indices', node, tensorMap, context) as Tensor;\n return [tfOps.gatherND(x, indices)];\n }\n case 'SparseToDense': {\n const indices =\n getParamValue('sparseIndices', node, tensorMap, context) as\n Tensor;\n const shape =\n getParamValue('outputShape', node, tensorMap, context) as\n number[];\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(\n indices, sparseValues, shape,\n sparseValues.dtype === defaultValue.dtype ?\n defaultValue :\n tfOps.cast(defaultValue, sparseValues.dtype))];\n }\n default:\n throw TypeError(`Node type ${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 \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {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, context: ExecutionContext):\n Tensor[] => {\n switch (node.op) {\n case 'FFT': {\n return
```

[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 * ==========\n */\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';\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 'Cast': {\n return [tfOps.cast(\n getParamValue('x', node, tensorMap, context) as Tensor,\n getParamValue('dtype', node, tensorMap, context) as 'int32' |\n '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, 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\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' |\n 'symmetric')];\n }\n case 'PadV2':\n case 'Pad': {\n return [tfOps.pad(\n getParamValue('x', node, tensorMap, context) as Tensor,\n getParamValue('padding',\n node, tensorMap, context) as\n Array<[number, number]>,\n getParamValue('constantValue',\n node, tensorMap, context) as\n number)];\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, 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',\n node, tensorMap, context) as number;\n const dataFormat =\n (getParamValue('dataFormat', node,\n tensorMap, context) as\n string).toUpperCase() as 'NHWC' |\n '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',

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 const 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 *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 tfc from '@tensorflow/tfjs-core';\n\nimport {NamedTensorsMap} from '../data/types';\nimport {ExecutionContext} from '../executor/execution_context';\nimport {ResourceManager} from '../executor/resource_manager';\n\nimport {NodeValueImpl} from './custom_op/node_value_impl';\nimport {getRegisteredOp} from './custom_op/register';\nimport * as arithmetic from './executors/arithmetic_executor';\nimport * as basicMath from './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 {Node} from './types';\n\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(\n () => arithmetic.executeOp(node, tensorMap, context));\n case 'basic_math':\n return tfc.tidy(\n () => basicMath.executeOp(node, tensorMap, context));\n case 'control':\n return control.executeOp(node, tensorMap, context);\n case 'convolution':\n return tfc.tidy(\n () => 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(\n () => 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(\n () => normalization.executeOp(node,\n tensorMap, context));\n case 'reduction':\n return tfc.tidy(\n () => reduction.executeOp(node, tensorMap, context));\n case 'slice_join':\n return tfc.tidy(\n () => sliceJoin.executeOp(node, tensorMap, context));\n case 'spectral':\n return tfc.tidy(() => spectral.executeOp(node, tensorMap, context));\n case 'transformation':\n return tfc.tidy(\n () => transformation.executeOp(node, tensorMap, context));\n case 'hash_table':\n return hashTable.executeOp(\n node, tensorMap,

context, resourceManager);\n case 'custom':\n const opMapper = getRegisteredOp(node.op);\n if (opMapper && opMapper.customExecutor) {\n return opMapper.customExecutor(\n new NodeValueImpl(node, tensorMap, context));\n } else {\n throw TypeError(`Custom op ${node.op} is not registered.`);\n }\n default:\n throw TypeError(\n `Unknown op '${node.op}'. File an issue at ` +\n `https://github.com/tensorflow/tfjs/issues so we can add it` +\n `, or register a custom execution with tf.registerOp()`);\n }\n })(node, tensorMap, context);\n if (tfc.util.isPromise(value)) {\n return (value as Promise<tfc.Tensor>).then((data) => [].concat(data));\n }\n return [].concat(value);\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 {Tensor} from '@tensorflow/tfjs-core';\n\nimport {NamedTensorsMap, TensorArrayMap, TensorListMap} from '../data/types';\n\nimport {TensorArray} from './tensor_array';\nimport {TensorList} from './tensor_list';\nimport {FunctionExecutor} from './types';\n\nexport interface ExecutionContextInfo {\n id: number; // 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/**\n * ExecutionContext captures the runtime environment of the node. It keeps\n * track of the current frame and iteration for the control flow ops.\n *\n * For example, typical Dynamic RNN model may contain loops, for which\n * TensorFlow will generate graphs with Enter/Exit nodes to control the\n * current execution frame, and NextIteration Nodes for iteration id increment.\n * For model with branch logic, TensorFLow will generate Switch/Merge ops.\n */\nexport class ExecutionContext {\n private rootContext = {id: 0, frameName: '', iterationId: 0};\n private contexts: ExecutionContextInfo[] = [this.rootContext];\n private lastId = 0;\n private _currentContextIds: string[];\n\n constructor(\n readonly weightMap: NamedTensorsMap = {},\n readonly tensorArrayMap: TensorArrayMap = {},\n readonly tensorListMap: TensorListMap = {},\n readonly functionMap: {[key: string]: FunctionExecutor} = {}) {\n this.generateCurrentContextIds();\n }\n\n private newFrame(id: number, frameName: string) {\n return {id, frameName, iterationId: 0};\n }\n\n /**\n * Set the 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 = 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(): string {\n return this._currentContextIds[0];\n }\n\n /**\n * Returns the current context and all parent contexts in string format.\n * This allow access to the nodes in the current and parent frames.\n */\n get 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, this.contexts.length - i);\n names.push(this.contextIdforContexts(contexts));\n }\n names.push('');\n this._currentContextIds = names;\n }\n\n private contextIdforContexts(contexts: ExecutionContextInfo[]) {\n return contexts ?\n contexts\n .map(\n context => (context.id === 0 && context.iterationId === 0) ?\n '' :\n `${context.frameName}-${context.iterationId}`)\n .join('/') :\n '';\n }\n\n /**\n * Enter a new frame, a new context is pushed on the current context list.\n * @param frameId new frame id\n */\n enterFrame(frameId: string) {\n if (this.contexts) {\n this.lastId++;\n this.contexts = this.contexts.slice();\n this.contexts.push(this.newFrame(this.lastId, frameId));\n this._currentContextIds.unshift(this.contextIdforContexts(this.contexts));\n }\n }\n\n /**\n * Exit the current 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\n * increased.\n */\n nextIteration() {\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\n getWeight(name: string): Tensor[] {\n return this.weightMap[name];\n }\n\n addTensorArray(tensorArray: TensorArray) {\n this.tensorArrayMap[tensorArray.id] = tensorArray;\n }\n\n getTensorArray(id:
number): TensorArray {\n return this.tensorArrayMap[id];\n }\n\n addTensorList(tensorList: TensorList) {\n this.tensorListMap[tensorList.id] = tensorList;\n }\n\n getTensorList(id: number): TensorList {\n return this.tensorListMap[id];\n }\n\n dispose(keepIds: Set<number>) {\n for (const key in this.tensorArrayMap) {\n this.tensorArrayMap[key].clearAndClose(keepIds);\n }\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, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY 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 {NamedTensorMap} from '@tensorflow/tfjs-core';\n\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 */\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 // 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 // This node is a dead end since it doesn't have any inputs.\n if (initNodeNames.indexOf(node.name) !== -1) {\n continue;\n }\n if (node.inputs.length === 0) {\n missingInputs.push(node.name);\n continue;\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 return {inputs, outputs, usedNodes, missingInputs, dynamicNode, syncInputs};\n}\n\n/**\n

```
 * Given the execution info, return a list of nodes in topological order that\n * need to be executed to compute the output.\n */\nexport function getNodesInTopologicalOrder(\n    graph: Graph, weightMap: NamedTensorsMap,\n executionInfo: ExecutionInfo): Node[] {\n  const {usedNodes, inputs} = executionInfo;\n  const frontier: Node[] = [];\n  const inputNodes = Object.keys(inputs)\n                           .map(name => parseNodeName(name)[0])\n        .map(name => graph.nodes[name]);\n  const initNodes = graph.initNodes;\n\n  inputNodes.forEach(input => {\n    if (usedNodes.has(input.name)) {\n      frontier.push(input);\n    }\n  });\n  graph.weights.forEach(weight => {\n    if (usedNodes.has(weight.name)) {\n      frontier.push(weight);\n    }\n  });\n  if (initNodes != null) {\n initNodes.forEach(node => {\n      if (usedNodes.has(node.name)) {\n        frontier.push(node);\n      }\n    });\n  }\n const seen = new Set<string>();\n  const orderedNodes:
 Node[] = [];\n  while (frontier.length > 0) {\n    const node = frontier.pop();\n    seen.add(node.name);\n    if (!weightMap[node.name]) {\n      orderedNodes.push(node);\n    }\n    node.children.forEach(child => {\n      if (!seen.has(child.name) && usedNodes.has(child.name) &&\n          child.inputs.every(input => seen.has(input.name))) {\n        frontier.push(child);\n      }\n    });\n  }\n  return orderedNodes;\n}\n\nconst CONTROL_FLOW_OPS = [\n  'Switch', 'Merge', 'Enter', 'Exit', 'NextIteration', 'StatelessIf',\n  'StatelessWhile', 'if', 'While'\n];\nconst DYNAMIC_SHAPE_OPS = [\n  'NonMaxSuppressionV2', 'NonMaxSuppressionV3', 'NonMaxSuppressionV5', 'Where'\n];\nconst HASH_TABLE_OPS = [\n  'HashTable', 'HashTableV2', 'LookupTableImport', 'LookupTableImportV2',\n  'LookupTableFind', 'LookupTableFindV2'\n];\n\nexport function isControlFlow(node: Node) {\n  return CONTROL_FLOW_OPS.indexOf(node.op) >= 0;\n}\n\nexport function isDynamicShape(node: Node) {\n  return DYNAMIC_SHAPE_OPS.indexOf(node.op)
 >= 0;\n}\n\nexport function isHashTable(node: Node) {\n  return HASH_TABLE_OPS.indexOf(node.op) >= 0;\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 {DataType, NamedTensorMap, Tensor, tidy, util} from '@tensorflow/tfjs-core';\n\nimport {ISignatureDef} from '../data/compiled_api';\nimport
 {NamedTensorsMap, TensorArrayMap, TensorInfo, TensorListMap} from '../data/types';\nimport {getNodeNameAndIndex, getParamValue, getTensor, getTensorsForCurrentContenxt, parseNodeName} from '../operations/executors/utils';\nimport {executeOp} from '../operations/operation_executor';\nimport {Graph, Node} from '../operations/types';\n\nimport {ExecutionContext, ExecutionContextInfo} from './execution_context';\nimport {getExecutionSubgraph, getNodesInTopologicalOrder, isControlFlow} from './model_analysis';\nimport {ResourceManager} from './resource_manager';\nimport {FunctionExecutor} from './types';\n\ninterface NodeWithContexts {\n  contexts: ExecutionContextInfo[];\n  node: Node;\n}\n\nexport class GraphExecutor implements FunctionExecutor {\n  private compiledMap: Map<string, Node[]> = new Map();\n  private _weightMap: NamedTensorsMap = {};\n  private _weightIds: number[];\n  private _signature: ISignatureDef;\n private _inputs: Node[];\n  private _outputs: Node[];\n  private _initNodes:
 Node[];  // Internal init nodes to start initialization.\n  private SEPERATOR = ',';\n  private _functions: {[key: string]: Graph} = {};\n  private _functionExecutorMap: {[key: string]: FunctionExecutor} = {};\n  private _resourceManager: ResourceManager;\n\n  get weightIds(): number[] {\n    return this.parent ? this.parent.weightIds : this._weightIds;\n  }\n\n  get functionExecutorMap(): {[key: string]: FunctionExecutor} {\n    return this.parent ? this.parent.functionExecutorMap :\n                         this._functionExecutorMap;\n  }\n\n  get weightMap(): NamedTensorsMap {\n    return this.parent ? this.parent.weightMap : this._weightMap;\n  }\n\n  set weightMap(weightMap: NamedTensorsMap) {\n    const weightIds = Object.keys(weightMap).map(\n        key => weightMap[key].map(tensor => tensor.id));\n    this._weightIds = [].concat(...weightIds);\n    this._weightMap = weightMap;\n  }\n\n  /**\n   * Set `ResourceManager` shared by executors of a model.\n   * @param
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resourceManager:
 `ResourceManager` of the `GraphModel`.\n   */\n  set resourceManager(resourceManager: ResourceManager) {\n
this._resourceManager = resourceManager;\n  }\n\n  get inputs(): TensorInfo[] {\n    return this._inputs.map(node
=> {\n      return {\n        name: node.name,\n        shape: node.attrParams['shape'] ?\n
node.attrParams['shape'].value as number[] :\n            undefined,\n        dtype: node.attrParams['dtype'] ?\n
node.attrParams['dtype'].value as DataType :\n            undefined\n      };\n    });\n  }\n\n  get outputs(): TensorInfo[]
{\n    return this._outputs.map(node => {\n      return {\n        name: node.name,\n        shape:
node.attrParams['shape'] ?\n            node.attrParams['shape'].value as number[] :\n            undefined,\n        dtype:
node.attrParams['dtype'] ?\n            node.attrParams['dtype'].value as DataType :\n            undefined\n      };\n    });\n
}\n\n  get inputNodes(): string[] {\n    return this._inputs.map(node
 => node.signatureKey || node.name);\n  }\n\n  get outputNodes(): string[] {\n    return this._outputs.map((node) =>
{\n      const name = node.signatureKey || node.name;\n      return node.defaultOutput ?
(`${name}:${node.defaultOutput}`) : name;\n    });\n  }\n\n  get functions(): {[key: string]: ISignatureDef} {\n
return Object.keys(this._functions).reduce((map, key) => {\n      map[key] = this._functions[key].signature;\n
return map;\n    }, {} as {[key: string]: ISignatureDef});\n  }\n\n  /**\n   *\n   * @param graph Graph the model or
function graph to be executed.\n   * @param parent When building function exector you need to set the parent\n   *
executor. Since the weights and function executor maps are set at parant\n   * level, that function executor can
access the function maps and weight maps\n   * through the parent.\n   */\n  constructor(private graph: Graph,
private parent?: GraphExecutor) {\n    this._outputs = graph.outputs;\n    this._inputs = graph.inputs;\n
    this._initNodes = graph.initNodes;\n    this._signature = graph.signature;\n    this._functions = graph.functions;\n
// create sub-graph executors\n    if (graph.functions != null) {\n      Object.keys(graph.functions).forEach(name =>
{\n        this._functionExecutorMap[name] =\n            new GraphExecutor(graph.functions[name], this);\n      });\n
}\n  }\n\n  private getCompilationKey(inputs: Node[], outputs: Node[]): string {\n    const sortedInputs =
inputs.map(node => node.name).sort();\n    const sortedOutputs = outputs.map(node => node.name).sort();\n
return sortedInputs.join(this.SEPERATOR) + '--' +\n        sortedOutputs.join(this.SEPERATOR);\n  }\n\n  /**\n   *
Compiles the inference graph and returns the minimal set of nodes that are\n   * required for execution, in the correct
execution order.\n   */\n  private compile(inputs: NamedTensorMap, outputs: Node[]): Node[] {\n    const
executionInfo =\n        getExecutionSubgraph(inputs, outputs, this.weightMap,
 this._initNodes);\n    const {missingInputs, dynamicNode, syncInputs} = executionInfo;\n    if (dynamicNode !=
null) {\n      throw new Error(\n          `This execution contains the node '${dynamicNode.name}', which has ` +\n
  `the dynamic op '${dynamicNode.op}'. Please use ` +\n          `model.executeAsync() instead. Alternatively, to
avoid the ` +\n          `dynamic ops, specify the inputs [${syncInputs}]`);\n    }\n\n    if (missingInputs.length > 0) {\n
    const outNames = outputs.map(n => n.name);\n      const inNames = Object.keys(inputs);\n      throw new Error(\n
        `Cannot compute the outputs [${outNames}] from the provided inputs ` +\n          `[${inNames}]. Missing the
following inputs: [${missingInputs}]`);\n    }\n\n    return getNodesInTopologicalOrder(\n        this.graph,
this.weightMap, executionInfo);\n  }\n\n  /**\n   * Executes the inference for given input tensors.\n   * @param
inputs Tensor map for the model inputs, keyed by the input
 node\n   * names.\n   * @param outputs Optional. output node name from the Tensorflow model, if\n   * no 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  execute(inputs: NamedTensorMap, outputs?: string[]): Tensor[]
{\n    inputs = this.mapInputs(inputs);\n    const names = Object.keys(inputs).sort();\n    this.checkInputs(inputs);\n
this.checkInputShapeAndType(inputs);\n    outputs = this.mapOutputs(outputs);\n    this.checkOutputs(outputs);\n
const inputNodes =\n        names.map(name => this.graph.nodes[parseNodeName(name)[0]]);\n    const
outputNodeNames = outputs.map(name => parseNodeName(name)[0]);\n    let outputNodes =
outputNodeNames.map(name => this.graph.nodes[name]);\n\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\n    const
compilationKey
```

```
= this.getCompilationKey(inputNodes, outputNodes);\n\n    // Do nothing if the compiled graph cache contains the input.\n    let orderedNodes = this.compiledMap.get(compilationKey);\n    if (orderedNodes == null) {\n orderedNodes = this.compile(inputs, outputNodes);\n      this.compiledMap.set(compilationKey, orderedNodes);\n }\n\n    const tensorArrayMap: TensorArrayMap = {};\n    const tensorListMap: TensorListMap = {};\n\n    return tidy(() => {\n      const context = new ExecutionContext(\n          this.weightMap, tensorArrayMap, tensorListMap,\n          this.functionExecutorMap);\n      const tensorsMap: NamedTensorsMap = {...this.weightMap};\n\n Object.keys(inputs).forEach(name => {\n        const [nodeName, index] = parseNodeName(name);\n        const tensors: Tensor[] = [];\n        tensors[index] = inputs[name];\n        tensorsMap[nodeName] = tensors;\n      });\n\n const tensorsToKeep = this.getFrozenTensorIds(tensorsMap);\n      const intermediateTensorConsumerCount: {[key: number]: number} = {};\n      for (let i = 0; i < orderedNodes.length; i++) {\n        const node = orderedNodes[i];\n        if (!tensorsMap[node.name]) {\n          const tensors =\n              executeOp(node, tensorsMap, context, this._resourceManager) as\n              Tensor[];\n          if (util.isPromise(tensors)) {\n            throw new Error(\n                `The execution of the op '${node.op}' returned a promise. ` +\n                `Please use model.executeAsync() instead.`);\n          }\n          tensorsMap[node.name] = tensors;\n          this.checkTensorForDisposal(\n              node.name, node, tensorsMap, context, tensorsToKeep,\n              outputNodeNames, intermediateTensorConsumerCount);\n        }\n      }\n      // dispose the context for the root executor\n      if (this.parent == null) {\n        context.dispose(tensorsToKeep);\n      }\n      return outputs.map(name => getTensor(name, tensorsMap, context));\n    });\n  }\n\n  private getFrozenTensorIds(tensorMap: NamedTensorsMap): Set<number> {\n    const ids = [].concat.apply(\n        [],\n        Object.keys(tensorMap)\n            .map(key => tensorMap[key])\n            .map(tensors => tensors.map(tensor => tensor.id)));\n    return new Set(ids);\n  }\n  private checkTensorForDisposal(\n      nodeName: string, node: Node, tensorMap: NamedTensorsMap,\n      context: ExecutionContext, tensorsToKeep: Set<number>,\n      outputNames: string[],\n      intermediateTensorConsumerCount: {[key: string]: number}) {\n    // Skip output nodes and any control flow nodes, since its dependency is\n    // tricky to track correctly.\n    if (node.category === 'control' || outputNames.indexOf(nodeName) !== -1) {\n      return;\n    }\n\n    tensorMap[nodeName].forEach(tensor => {\n      if (tensor != null) {\n        intermediateTensorConsumerCount[tensor.id] =\n            (intermediateTensorConsumerCount[tensor.id] || 0) +\n            node.children.length;\n      }\n    });\n    node.inputs.forEach(input => {\n      // Skip any control flow nodes, since its dependency is tricky to track\n      // correctly.\n      if (input.category !== 'control') {\n        const tensors =\n            getTensorsForCurrentContenxt(input.name, tensorMap, context);\n        if (tensors != null) {\n          tensors.forEach(tensor => {\n            if (tensor && !tensorsToKeep.has(tensor.id)) {\n              const count = intermediateTensorConsumerCount[tensor.id];\n              if (count === 1) {\n                tensor.dispose();\n                delete intermediateTensorConsumerCount[tensor.id];\n              } else if (count != null) {\n                // only intermediate nodes has count set, inputs and weights are\n                // not.\n                intermediateTensorConsumerCount[tensor.id]--;\n              }\n            }\n          });\n        }\n      }\n    });\n  }\n\n  /**\n   * Executes the inference for given input tensors in Async fashion.\n   * @param inputs Tensor map for the model inputs, keyed by the input node\n   * 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  async executeAsync(inputs: NamedTensorMap, outputs?: string[]):\n      Promise<Tensor[]> {\n    return this._executeAsync(inputs, outputs);\n  }\n\n  /**\n   * Executes the inference for given input tensors in Async fashion.\n   * @param inputs Tensor map for the model inputs, keyed by the input node\n   * names.\n   * @param outputs Optional. output node name from the Tensorflow model,\n   * if no outputs are specified, the default outputs of the model would be\n   * used. You can inspect intermediate nodes of the model by adding them to the\n   * outputs array.\n   * @param isFunctionExecution Optional. Flag for executing a function.\n   * @param tensorArrayMap Optional, global TensorArray map by id. Used for\n   * function execution.\n   * @param tensorArrayMap Optinal global TensorList map by id. Used for\n   * function execution.\n   */\n  private
```

```
async _executeAsync(\n      inputs: NamedTensorMap, outputs?: string[], isFunctionExecution = false,\n tensorArrayMap: TensorArrayMap = {},\n      tensorListMap: TensorListMap = {}): Promise<Tensor[]> {\n    if (!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\n    const context = new ExecutionContext(\n        this.weightMap, tensorArrayMap, tensorListMap,\n this.functionExecutorMap);\n\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\n    // dispose all the intermediate 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      context.dispose(keepIds);\n    }\n\n    return results;\n  }\n\n  async executeFunctionAsync(\n      inputs: Tensor[], tensorArrayMap: TensorArrayMap,\n      tensorListMap: TensorListMap): Promise<Tensor[]> {\n    const mappedInputs = inputs.reduce((map, tensor, index) => {\n      map[this.inputs[index].name] = tensor;\n      return map;\n    }, {} as NamedTensorMap);\n\n    return this._executeAsync(\n        mappedInputs, this.outputNodes, true, tensorArrayMap, tensorListMap);\n  }\n  /**\n   * When there are control flow nodes in the graph, the graph execution use\n   * ExecutionContext to keep track of the frames and loop iterators.\n   * @param 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, the default outputs of the model would be\n   * used. You can inspect intermediate nodes of the model by adding them to the\n   * outputs array.\n   * @param isFunctionExecution Flag for executing a function.\n   */\n  private async executeWithControlFlow(\n      inputs: NamedTensorMap, context: ExecutionContext,\n      outputNames?: string[],\n      isFunctionExecution?: boolean): Promise<NamedTensorsMap> {\n    const names = Object.keys(inputs);\n    const inputNodes =\n        names.map(name => this.graph.nodes[parseNodeName(name)[0]]);\n    const outputNodeNames = outputNames.map(name => parseNodeName(name)[0]);\n    let outputNodes = outputNodeNames.map(name => this.graph.nodes[name]);\n\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\n    const {usedNodes, missingInputs, dynamicNode, syncInputs} =\n        getExecutionSubgraph(\n            inputs, outputNodes, this.weightMap, this._initNodes);\n\n    // First nodes to execute include inputNodes, weights, and initNodes.\n    const stack: NodeWithContexts[] = [\n      ...inputNodes, ...this.graph.weights, ...(this._initNodes || [])\n    ].map(node => {\n      return {node, contexts: context.currentContext};\n    });\n    const tensorsMap: NamedTensorsMap = {...this.weightMap};\n    Object.keys(inputs).forEach(name => {\n      const [nodeName, index] = parseNodeName(name);\n      const tensors: Tensor[] = [];\n      tensors[index] = inputs[name];\n tensorsMap[nodeName] = tensors;\n    });\n    const intermediateTensorConsumerCount: {[key: number]: number} = {};\n    const tensorsToKeep = this.getFrozenTensorIds(tensorsMap);\n    const added: {[key: string]: boolean} = {};\n    while (stack.length > 0) {\n      const promises = this.processStack(\n          inputNodes, stack, context, 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 can use model.execute() instead.`);\n    }\n    const missingOutputs =\n        outputNodes\n            .filter(\n                node => !isControlFlow(node) &&\n                    !getTensor(node.name, tensorsMap, 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 model.execute() ` +\n            `and specify the inputs [${syncInputs}]`;\n      }\n      throw new Error(\n          `Cannot
```

```
compute the outputs [${missingOutputs}] from the provided ` +\n `inputs [${names}]. Consider providing the following inputs: ` +\n `[${missingInputs}]. ${alternativeMsg}`);\n }\n return tensorsMap;\n }\n\n private processStack(\n inputNodes: Node[], stack: NodeWithContexts[], context: ExecutionContext,\n tensorMap: NamedTensorsMap, added: {[key: string]: boolean},\n tensorsToKeep: Set<number>, outputNames: string[],\n intermediateTensorConsumerCount:
 {[key: number]: number},\n usedNodes: Set<string>) {\n const promises: Array<Promise<Tensor[]>> = [];\n while (stack.length > 0) {\n const item = stack.pop();\n context.currentContext = item.contexts;\n let nodeName = '';\n // The tensor of the Enter op with isConstant set should be set\n // in the parent scope, so it will be available as constant for the\n // whole loop.\n if (item.node.op === 'Enter' &&\n getParamValue('isConstant', item.node, tensorMap, context)) {\n [nodeName] = getNodeNameAndIndex(item.node.name, context);\n }\n\n // only process nodes that are not in the tensorMap yet, this include\n // inputNodes and internal initNodes.\n if (tensorMap[item.node.name] == null) {\n const tensors =\n executeOp(item.node, tensorMap, context, this._resourceManager);\n if (!nodeName) {\n [nodeName] = getNodeNameAndIndex(item.node.name, context);\n }\n const currentContext = context.currentContext;\n if (util.isPromise(tensors)) {\n promises.push((tensors as Promise<Tensor[]>).then(t => {\n tensorMap[nodeName] = t;\n context.currentContext = currentContext;\n this.checkTensorForDisposal(\n nodeName, item.node, tensorMap, context, tensorsToKeep,\n outputNames, intermediateTensorConsumerCount);\n this.processChildNodes(\n item.node, stack, context, tensorMap, added, usedNodes);\n return t;\n }));\n } else {\n tensorMap[nodeName] = tensors as Tensor[];\n this.checkTensorForDisposal(\n nodeName, item.node, tensorMap, context, tensorsToKeep,\n outputNames, intermediateTensorConsumerCount);\n this.processChildNodes(\n item.node, stack, context, tensorMap, added, usedNodes);\n }\n } else {\n this.processChildNodes(\n item.node,
 stack, context, tensorMap, added, usedNodes);\n }\n }\n return promises;\n }\n\n private processChildNodes(\n node: Node, stack: NodeWithContexts[], context: ExecutionContext,\n tensorMap: NamedTensorsMap, added: {[key: string]: boolean},\n usedNodes: Set<string>) {\n node.children.forEach((childNode) => {\n const [nodeName, ] = getNodeNameAndIndex(childNode.name, context);\n if (added[nodeName] || !usedNodes.has(childNode.name)) {\n return;\n }\n // Merge op can be pushed if any of its inputs has value.\n if (childNode.op === 'Merge') {\n if (childNode.inputNames.some(name => {\n return !!getTensor(name, tensorMap, context);\n })) {\n added[nodeName] = true;\n stack.push({contexts: context.currentContext, node: childNode});\n }\n } else  // Otherwise all inputs must to have value.\n if (childNode.inputNames.every(name => {\n return
 !!getTensor(name, tensorMap, context);\n })) {\n added[nodeName] = true;\n stack.push({contexts: context.currentContext, node: childNode});\n }\n });\n }\n\n /**\n * Releases the memory used by the weight tensors.\n */\n dispose() {\n Object.keys(this.weightMap)\n .forEach(\n key => this.weightMap[key].forEach(tensor => tensor.dispose()));\n }\n\n private checkInputShapeAndType(inputs: NamedTensorMap) {\n Object.keys(inputs).forEach(name => {\n const input = inputs[name];\n const [nodeName, ] = parseNodeName(name);\n const node = this.graph.nodes[nodeName];\n if (node.attrParams['shape'] && node.attrParams['shape'].value) {\n const shape = node.attrParams['shape'].value as number[];\n const match = shape.length === input.shape.length &&\n input.shape.every(\n (dim, index) => shape[index] === -1 || shape[index] === dim);\n util.assert(\n match,\n () => `The shape of dict['${node.name}'] provided in ` +\n `model.execute(dict) must be [${shape}], but was ` +\n `[${input.shape}]`);\n }\n if (node.attrParams['dtype'] && node.attrParams['dtype'].value) {\n util.assert(\n input.dtype === node.attrParams['dtype'].value as string,\n () => `The dtype of dict['${node.name}'] provided in ` +\n `model.execute(dict) must be ` +\n `${node.attrParams['dtype'].value}, but was ${input.dtype}`);\n }\n });\n }\n\n private
```

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 * @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 {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 * 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\n 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 * @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\n IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY 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 {InferenceModel, io, ModelPredictConfig, NamedTensorMap, Tensor} from '@tensorflow/tfjs-core';\n\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 * 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    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 requestOption 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    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\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 = new GraphExecutor(initializer);\n this.initializer.weightMap = this.executor.weightMap;\n // Attach a model-level resourceManager to the initializer, the\n // hashTables created from when executing the initializer will be stored\n // in the resourceManager.\n this.initializer.resourceManager = this.resourceManager;\n this.initializer.executeAsync({}, []);\n }\n\n return true;\n }\n\n /**\n * Save the configuration and/or weights of the GraphModel.\n *\n * An `IOHandler` is an object that has a `save` method of the proper\n * signature defined. The `save` method manages the storing or\n * transmission of serialized data (\"artifacts\") that represent the\n * model's topology and weights onto or via a specific medium, such as\n * file downloads, local storage, IndexedDB in the web browser and HTTP\n * requests to a server. TensorFlow.js provides `IOHandler`\n * implementations for a number of frequently used saving mediums, such as\n * `tf.io.browserDownloads` and `tf.io.browserLocalStorage`. See `tf.io`\n * for more details.\n *\n * This method also allows you to refer to certain types of `IOHandler`s\n * as URL-like string shortcuts, such as 'localstorage://' and\n * 'indexeddb://'.\n *\n * Example 1: Save `model`'s topology and weights to browser [local\n * storage](https://developer.mozilla.org/en-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 = 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 loaded model:');\n * model.predict(zeros).print();\n * ```\n *\n * @param handlerOrURL An instance of `IOHandler` or a URL-like,\n * scheme-based string shortcut for `IOHandler`.\n * @param config Options for saving the model.\n * @returns A `Promise` of `SaveResult`, which summarizes the result of\n * the saving, such as byte sizes of the saved artifacts for the model's\n * topology and weight values.\n *\n * @doc {heading: 'Models', subheading: 'Classes', ignoreCI: true}\n */\n async save(handlerOrURL: io.IOHandler|string, config?: io.SaveConfig):\n Promise<io.SaveResult> {\n if (typeof handlerOrURL === 'string') {\n const handlers = io.getSaveHandlers(handlerOrURL);\n if (handlers.length === 0) {\n throw new Error(\n `Cannot find 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` attribute defined.');\n }\n\n return handlerOrURL.save(this.artifacts);\n }\n\n /**\n * Execute the inference for the input tensors.\n *\n * @param input The input tensors, when there is single input for the model,\n * inputs param should be a `tf.Tensor`. For models with mutliple inputs,\n * inputs params should be in either `tf.Tensor`[] if the input order is\n * fixed, or otherwise NamedTensorMap format.\n *\n * For model with multiple inputs, we recommend you use NamedTensorMap as the\n * input type, if you use `tf.Tensor`[], the order of the array needs to\n * follow the\n * order of inputNodes array. @see {@link GraphModel.inputNodes}\n *\n * You can also feed any intermediate nodes using the NamedTensorMap as the\n * input type. For example, given the graph\n * InputNode => Intermediate => OutputNode,\n * you can execute the subgraph Intermediate => OutputNode by calling\n * model.execute('IntermediateNode' : tf.tensor(...));\n *\n * This is useful for models that uses tf.dynamic_rnn, where the intermediate\n * state needs to be fed manually.\n *\n * For batch inference execution, the tensors for each input need to be\n * concatenated together. For example with mobilenet, the required input shape\n * is [1, 244, 244, 3], which represents the [batch, height, width, channel].\n * If we are provide a batched data of 100 images, the input tensor should be\n * in the shape of [100, 244, 244, 3].\n *\n * @param config Prediction configuration for specifying the batch size and\n * output node names. Currently the batch size option is ignored for graph\n * model.\n *\n * @returns Inference result tensors. The output would be single `tf.Tensor`\n * if model has single output node, otherwise Tensor[] or NamedTensorMap[]\n * will be returned for model with multiple outputs.\n *\n * @doc {heading: 'Models',

subheading: 'Classes'}\n */\n predict(inputs: Tensor|Tensor[]|NamedTensorMap,
config?: ModelPredictConfig):\n Tensor|Tensor[]|NamedTensorMap {\n return this.execute(inputs, this.outputNodes);\n }\n\n private normalizeInputs(inputs: Tensor|Tensor[]|\n 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\n private normalizeOutputs(outputs: string|string[]): string[] {\n outputs = outputs || this.outputNodes;\n return !Array.isArray(outputs) ? [outputs] : outputs;\n }\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(\n inputs:
Tensor|Tensor[]|NamedTensorMap,\n 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\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 /**\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\n if (this.initializer) {\n this.initializer.dispose();\n }\n\n this.resourceManager.dispose();\n }\n}\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
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 * @param modelUrl The url or an `io.IOHandler` that loads the model.\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 */\nexport async function loadGraphModel(\n modelUrl: string|io.IOHandler,\n 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\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,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';\n\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';\n\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 === 'HSVA_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\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};\n\nexport default Common;\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 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])([A-F0-9])([A-F0-9])$/i);\n if (test === null) {\n return false;\n }\n\n return {\n space: 'HEX',\n hex: parseInt(\n '0x' +\n test[1].toString() + test[1].toString() +\n test[2].toString() + test[2].toString() +\n test[3].toString() + test[3].toString(),\n 0)\n };\n },\n\n write: toString\n },\n\n SIX_CHAR_HEX: {\n read: function(original) {\n const test = original.match(/^#([A-F0-9]{6})$/i);\n if (test === null) {\n return false;\n }\n\n return {\n space: 'HEX',\n hex: parseInt('0x' + test[1].toString(), 0)\n };\n },\n\n write: toString\n },\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\n return {\n space: 'RGB',\n r: parseFloat(test[1]),\n g: parseFloat(test[2]),\n b: parseFloat(test[3])\n };\n },\n\n write: toString\n },\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\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 },\n\n write:

toString\n }\n }\n },\n\n // Numbers\n {\n litmus: common.isNumber,\n\n conversions: {\n\n HEX: {\n read: function(original) {\n return {\n space: 'HEX',\n hex: original,\n conversionName: 'HEX'\n };\n },\n\n write: function(color) {\n return color.hex;\n }\n }\n\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\n return {\n space: 'RGB',\n r: original[0],\n g: original[1],\n b: original[2]\n };\n },\n\n write: function(color) {\n return [color.r, color.g, color.b];\n }\n },\n\n RGBA_ARRAY: {\n read: function(original) {\n if (original.length !== 4) return false;\n return {\n space: 'RGB',\n r: original[0],\n g: original[1],\n b: original[2],\n a: original[3]\n };\n },\n\n write: function(color) {\n return [color.r, color.g, color.b, color.a];\n }\n }\n }\n },\n\n // Objects\n {\n litmus: common.isObject,\n conversions: {\n\n RGBA_OBJ: {\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: 'RGB',\n r: original.r,\n g: original.g,\n b: original.b,\n a: original.a\n };\n }\n return false;\n },\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\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\n write: function(color) {\n return {\n r: color.r,\n g: color.g,\n b: color.b\n };\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: 'HSV',\n h: original.h,\n s: original.s,\n v: original.v,\n a: original.a\n };\n }\n return false;\n },\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\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\n write: function(color) {\n return {\n h: color.h,\n s: color.s,\n v: color.v\n };\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 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 return common.BREAK;\n }\n });\n\n return toReturn;\n};\n\nexport default interpret;\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\nlet tmpComponent;\n\nconst ColorMath = {\n hsv_to_rgb: function(h, s, v) {\n const hi = Math.floor(h / 60) % 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\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

= 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 *\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 {\n   s: result.s,\n   v: result.v\n }\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);\ndefineRGBComponent(Color.prototype, 'g', 1);\ndefineRGBComponent(Color.prototype, 'b', 0);\n\ndefineHSVComponent(Color.prototype, 'h');\ndefineHSVComponent(Color.prototype, 's');\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 *\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/**\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 * @type {DOMElement}\n */\n this.domElement = document.createElement('div');\n\n /**\n * The object to manipulate\n * @type {Object}\n */\n this.object = object;\n\n /**\n * The name of the property to manipulate\n * @type {String}\n */\n this.property = property;\n\n /**\n * The function to be called on change.\n * @type {Function}\n * @ignore\n */\n this.__onChange = undefined;\n\n /**\n * The function to be called on finishing change.\n * @type {Function}\n * @ignore\n */\n this.__onFinishChange = undefined;\n }\n\n /**\n * Specify that a function fire every time someone changes the value with\n * this Controller.\n *\n * @param {Function} fnc This function will be called whenever the value\n * is modified via this Controller.\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 wih 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 * @returns {Controller} this\n */\n onFinishChange(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 * @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 * 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 = {};\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\n return 0;\n}\n\n/**\n * @namespace\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 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 ' +

```
eventType + ' not supported.');\n    }\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,\n
params.cancelable || true, window, params.clickCount || 1,\n            0, // screen X\n            0, // screen Y\n
clientX, // client X\n            clientY, // client
 Y\n            false, 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,\n            ctrlKey: false,\n            altKey: false,\n            shiftKey: false,\n            metaKey: false,\n
      keyCode: undefined,\n            charCode: undefined\n          });\n          init(eventType, params.bubbles || false,\n
          params.cancelable, window,\n            params.ctrlKey, params.altKey,\n            params.shiftKey,
params.metaKey,\n            params.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   *\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   *\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   *\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+$/,
'');\n      }\n    }\n    return dom;\n  },\n\n  /**\n   *\n   * @param elem\n   * @param className\n   */\n
removeClass: function(elem, className) {\n    if (className) {\n      if (elem.className === className) {\n
elem.removeAttribute('class');\n      } else {\n        const classes = elem.className.split(/ +/);\n        const index =
classes.indexOf(className);\n        if (index !== -1) {\n          classes.splice(index, 1);\n          elem.className =
classes.join(' ');\n        }\n      }\n    } else {\n      elem.className = undefined;\n    }\n    return dom;\n  },\n\n
hasClass: function(elem, className) {\n    return new RegExp('(?:^|\\\\s+)' + className +
'(?:\\\\s+|$)').test(elem.className) || false;\n  },\n\n  /**\n   *\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   *\n   * @param elem\n   */\n  getHeight: function(elem) {\n    const
style = getComputedStyle(elem);\n\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   *\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   *\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 * 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
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*/\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 * @param {string} property The name of the property to be manipulated\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 * 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 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 * list of accepted values.\n *\n * @extends dat.controllers.Controller\n *\n * @param {Object} object The object to be manipulated\n * @param {string} property The name of the property to be manipulated\n * @param {Object|string[]} options A map of labels to acceptable values, or\n * a list of acceptable string values.\n */\nclass OptionController extends Controller {\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 * @ignore\n */\n this.__select = document.createElement('select');\n\n if (common.isArray(options)) {\n const map = {};\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 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 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 * 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 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 * @param {string} property The name of the property to be manipulated\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 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)

{\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 * @param {string} property The name of the property to be manipulated\n * @param {Object} [params] Optional parameters\n * @param {Number} [params.min] Minimum allowed value\n * @param {Number} [params.max] Maximum allowed value\n * @param {Number} [params.step] Increment by which to change value\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} minValue The minimum value for\n * <code>object[property]</code>\n * @returns {dat.controllers.NumberController} this\n */\n min(minValue) {\n this.__min = minValue;\n return this;\n }\n\n /**\n * Specify a maximum value for <code>object[property]</code>.\n *\n * @param {Number} maxValue The maximum value for\n * <code>object[property]</code>\n * @returns {dat.controllers.NumberController} this\n */\n max(maxValue) {\n this.__max = maxValue;\n return this;\n }\n\n /**\n * Specify a step value that dat.controllers.NumberController\n * increments by.\n *\n * @param {Number} stepValue 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\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 * @extends dat.controllers.NumberController\n *\n * @param {Object} object The object to be manipulated\n * @param {string} property The name of the property to be manipulated\n * @param {Object} [params] Optional parameters\n * @param {Number} [params.min] Minimum allowed value\n * @param {Number} [params.max] Maximum allowed value\n * @param {Number} [params.step] Increment by which to change value\n */\nclass NumberControllerBox extends NumberController {\n constructor(object, property, params) {\n super(object,

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 _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 dom.bind(this.__input, 'blur', onBlur);\n dom.bind(this.__input, 'mousedown', onMouseDown);\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\nexport default NumberControllerBox;\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';\n\nfunction 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 * @extends dat.controllers.NumberController\n *\n * @param {Object} object The object to be manipulated\n * @param {string} property The name of the property to be manipulated\n * @param {Number} minValue Minimum allowed value\n * @param {Number} maxValue Maximum allowed value\n * @param {Number} stepValue Increment by which to change value\n */\nclass 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 dom.bind(this.__background, 'touchstart', onTouchStart);\n\n dom.addClass(this.__background, 'slider');\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 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 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 dom.bind(window, 'touchmove', onTouchMove);\n dom.bind(window, 'touchend', onTouchEnd);\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 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 *\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 * @param {string} property The name of the property to be manipulated\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 * 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 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 * @param {Object} object\n * @param {string} property\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 this.__selector.className = 'selector';\n\n this.__saturation_field = document.createElement('div');\n this.__saturation_field.className = 'saturation-field';\n\n this.__field_knob = document.createElement('div');\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\n dom.bind(this.__field_knob, 'mousedown', fieldDown);\n dom.bind(this.__field_knob, 'touchstart', fieldDown);\n\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\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\n updateDisplay() {\n const i = interpret(this.getValue());\n\n if (i !== false) {\n let mismatch = false;\n\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])
 &&\n i[component] !== this.__color.__state[component]) {\n mismatch = true;\n return {}; // break\n }\n }, this);\n\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\n common.extend(this.__temp.__state, this.__color.__state);\n\n this.__temp.a = 1;\n\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\nconst vendors = ['-moz-', '-o-', '-webkit-', '-ms-', ''];\n\nfunction 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\nfunction 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\nexport 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\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) { // Unable to inject CSS, probably because of a Content Security Policy\n }\n }\n};\n\nexport default css;\n","const saveDialogContents = `<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\">The values saved to <code>localStorage</code> will\n override those passed to <code>dat.GUI</code>'s constructor. This makes it\n easier to work incrementally, but <code>localStorage</code> is fragile,\n and your friends may not see the same values you do.\n\n \n\n \n\n `;\n\nexport default saveDialogContents;\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 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]) &&

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])) { // 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 *\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\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 *\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 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\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\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// 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 /**\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// 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\nexport default CenteredDiv;\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 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\ncss.inject(styleSheet);\n\n/** @ignore Outer-most className for GUI's */\nconst CSS_NAMESPACE = 'dg';\n\nconst HIDE_KEY_CODE = 72;\n\n/** @ignore The only value shared between the JS and SCSS. Use caution. */\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? */\nlet autoPlaceVirgin = true;\n\n/** @ignore Fixed position div that auto place GUI's go inside */\nlet autoPlaceContainer;\n\n/** @ignore Are we hiding the GUI's ? */\nlet hide = false;\n\n/** @private GUI's which should be hidden */\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 */\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 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//   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

```
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\n      scrollable: {\n        get: function() {\n          return params.scrollable;\n        }\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      /**\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      /**\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\n          return params.load.preset;\n        },\n\n        set: function(v) {\n          if
(_this.parent) {\n            _this.getRoot().preset = v;\n          } else {\n            params.load.preset = v;\n          }\n
setPresetSelectIndex(this);\n          _this.revert();\n        }\n      },\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      /**\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      /**\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          // 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\n      /**\n       * Contains all presets\n       *
@type Object\n       */\n      load: {\n        get: function() {\n          return params.load;\n        }\n      },\n\n      /**\n
       * Determines whether or not to use <a
href=\"https://developer.mozilla.org/en/DOM/Storage#localStorage\">localStorage</a> as the means for\n       *
<code>remember</code>ing\n       * @type Boolean\n       */\n      useLocalStorage: {\n\n        get: function() {\n
          return useLocalStorage;\n
        },\n        set: function(bool) {\n          if (SUPPORTS_LOCAL_STORAGE) {\n            useLocalStorage =
bool;\n            if (bool) {\n              dom.bind(window, 'unload', saveToLocalStorage);\n            } else {\n
dom.unbind(window, 'unload', saveToLocalStorage);\n            }\n
localStorage.setItem(getLocalStorageHash(_this, 'isLocal'), bool);\n          }\n        }\n      }\n    });\n\n  // Are we a
root level GUI?\n  if (common.isUndefined(params.parent)) {\n    this.closed = params.closed || false;\n\n
dom.addClass(this.domElement, GUI.CLASS_MAIN);\n    dom.makeSelectable(this.domElement, false);\n\n    //
Are we supposed to be loading locally?\n    if (SUPPORTS_LOCAL_STORAGE) {\n      if (useLocalStorage) {\n
  _this.useLocalStorage = true;\n\n        const savedGui = localStorage.getItem(getLocalStorageHash(this, 'gui'));\n\n
      if (savedGui) {\n          params.load = JSON.parse(savedGui);\n        }\n      }\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
this.domElement.insertBefore(this.__closeButton, this.domElement.childNodes[0]);\n    } else {\n
dom.addClass(this.__closeButton, GUI.CLASS_CLOSE_BOTTOM);\n
this.domElement.appendChild(this.__closeButton);\n    }\n\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)
```

{\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 onClickTitle = function(e) {\n e.preventDefault();\n _this.closed = !_this.closed;\n return false;\n };\n\n dom.addClass(this.__ul, GUI.CLASS_CLOSED);\n\n dom.addClass(titleRow, 'title');\n dom.bind(titleRow, 'click', onClickTitle);\n\n if (!params.closed) {\n this.closed = false;\n }\n }\n\n if (params.autoPlace) {\n if (common.isUndefined(params.parent)) {\n if (autoPlaceVirgin) {\n autoPlaceContainer = document.createElement('div');\n dom.addClass(autoPlaceContainer, 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 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\n // Make it not elastic.\n if (!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', this.__resizeHandler);\n dom.bind(this.__ul, 'transitionend', this.__resizeHandler);\n dom.bind(this.__ul, 'oTransitionEnd', this.__resizeHandler);\n this.onResize();\n\n if (params.resizable) {\n addResizeHandle(this);\n }\n\n saveToLocalStorage = function() {\n if (SUPPORTS_LOCAL_STORAGE && localStorage.getItem(getLocalStorageHash(_this, 'isLocal')) === 'true') {\n localStorage.setItem(getLocalStorageHash(_this, 'gui'), JSON.stringify(_this.getSaveObject()));\n }\n };\n\n // expose this method publicly\n this.saveToLocalStorageIfPossible = saveToLocalStorage;\n\n function resetWidth() {\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\nGUI.toggleHide = function() {\n hide = !hide;\n common.each(hideableGuis, function(gui)
{\n gui.domElement.style.display = hide ? 'none' : '';\n });\n};\n\nGUI.CLASS_AUTO_PLACE = 'a';\nGUI.CLASS_AUTO_PLACE_CONTAINER = 'ac';\nGUI.CLASS_MAIN = 'main';\nGUI.CLASS_CONTROLLER_ROW = 'cr';\nGUI.CLASS_TOO_TALL = 'taller-than-window';\nGUI.CLASS_CLOSED = 'closed';\nGUI.CLASS_CLOSE_BUTTON = 'close-button';\nGUI.CLASS_CLOSE_TOP = 'close-top';\nGUI.CLASS_CLOSE_BOTTOM = 'close-bottom';\nGUI.CLASS_DRAG = 'drag';\n\nGUI.DEFAULT_WIDTH = 245;\nGUI.TEXT_CLOSED = 'Close Controls';\nGUI.TEXT_OPEN = 'Open Controls';\n\nGUI._keydownHandler = function(e) {\n if (document.activeElement.type !== 'text' &&\n (e.which === HIDE_KEY_CODE || e.keyCode === HIDE_KEY_CODE)) {\n GUI.toggleHide();\n }\n};\ndom.bind(window, 'keydown', GUI._keydownHandler, false);\n\ncommon.extend(\n GUI.prototype,\n\n /** @lends GUI.prototype */\n {\n\n /**\n * Adds a new {@link Controller} to the GUI. The type of controller created\n * is inferred from the initial value of <code>object[property]</code>.
For\n * color properties, see {@link addColor}.\n *\n * @param {Object} object The object to be manipulated\n * @param {String} property The name of the property to be manipulated\n * @param {Number} [min] Minimum allowed value\n * @param {Number} [max] Maximum allowed value\n * @param {Number} [step] Increment by which to change value\n * @returns {Controller} The controller that was added to the GUI.\n * @instance\n *\n * @example\n * // Add a string controller.\n * var person = {name: 'Sam'};\n * gui.add(person, 'name');\n *\n * @example\n * // Add a number controller slider.\n * var person = {age: 45};\n * gui.add(person, 'age', 0, 100);\n */\n add: function(object, property) {\n return add(\n this,\n object,\n property,\n {\n factoryArgs: Array.prototype.slice.call(arguments, 2)\n }\n);\n },\n\n /**\n * Adds a new color controller to the GUI.\n *\n * @param object\n * @param property\n * @returns {Controller} The controller that was added to the GUI.\n * @instance\n *\n * @example\n * var palette = {\n * color1: '#FF0000', // 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 *

```
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   /**\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

    this.__controllers.splice(this.__controllers.indexOf(controller), 1);\n     const _this = this;\n
common.defer(function() {\n       _this.onResize();\n     });\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\n     if (this.autoPlace) {\n       autoPlaceContainer.removeChild(this.domElement);\n     }\n\n     const _this =
this;\n     common.each(this.__folders, function(subfolder) {\n       _this.removeFolder(subfolder);\n     });\n\n
dom.unbind(window, 'keydown', GUI._keydownHandler, false);\n\n     removeListeners(this);\n   },\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\n     const newGuiParams = { name: name,
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\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]) { // Did daddy remember me?\n       // Start me closed if I was closed\n
newGuiParams.closed = this.load.folders[name].closed;\n\n       // Pass down the loaded data\n
newGuiParams.load = this.load.folders[name];\n     }\n\n     const gui = new GUI(newGuiParams);\n
this.__folders[name] = gui;\n\n     const li = addRow(this, gui.domElement);\n     dom.addClass(li, 'folder');\n
return gui;\n   },\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\n     delete this.__folders[folder.name];\n\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\n     removeListeners(folder);\n\n     const _this = this;\n\n     common.each(folder.__folders,
function(subfolder) {\n       folder.removeFolder(subfolder);\n     });\n\n     common.defer(function() {\n
_this.onResize();\n     });\n   },\n\n   /**\n    * Opens the GUI.\n    */\n   open: function() {\n     this.closed =
false;\n   },\n\n   /**\n    * Closes the GUI.\n    */\n   close: function() {\n     this.closed = true;\n   },\n\n   /**\n
* Hides the GUI.\n    */\n   hide: function() {\n     this.domElement.style.display = 'none';\n   },\n\n   /**\n    *
Shows the GUI.\n    */\n   show: function() {\n     this.domElement.style.display = '';\n   },\n\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\n       common.each(root.__ul.childNodes,
 function(node) {\n         if (!(root.autoPlace && node === root.__save_row)) {\n           h +=
dom.getHeight(node);\n         }\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
}\n\n     if (root.__resize_handle) {\n       common.defer(function() {\n         root.__resize_handle.style.height =
root.__ul.offsetHeight + 'px';\n       });\n     }\n\n     if (root.__closeButton) {\n       root.__closeButton.style.width
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= root.width + 'px';\n      }\n    },\n\n    onResizeDebounced: 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     *\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\n      if
(this.parent) {\n        throw new Error('You can only call remember on a top level GUI.');\n      }\n\n      const _this =
this;\n\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     * @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\n      // Am I remembering any values?\n      if (this.__rememberedObjects.length >
0) {\n        toReturn.preset = this.preset;\n\n        if (!toReturn.remembered) {\n          toReturn.remembered = {};\n
    }\n\n        toReturn.remembered[this.preset] = getCurrentPreset(this);\n      }\n\n      toReturn.folders = {};\n
common.each(this.__folders, function(element, key) {\n        toReturn.folders[key] = element.getSaveObject();\n
});\n\n      return
toReturn;\n    },\n\n    save: function() {\n      if (!this.load.remembered) {\n        this.load.remembered = {};\n
}\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\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
} else {\n          recallSavedValue(gui || this.getRoot(), controller);\n        }\n\n        // fire onFinishChange
callback\n        if (controller.__onFinishChange) {\n          controller.__onFinishChange.call(controller,
controller.getValue());\n        }\n      }, this);\n\n      common.each(this.__folders, function(folder) {\n
folder.revert(folder);\n      });\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/**\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 *\n * @ignore\n */\nfunction addRow(gui,
newDom, liBefore) {\n  const li = document.createElement('li');\n  if (newDom) {\n    li.appendChild(newDom);\n
}\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\nfunction removeListeners(gui) {\n  dom.unbind(window, 'resize',
gui.__resizeHandler);\n\n  if (gui.saveToLocalStorageIfPossible) {\n    dom.unbind(window, 'unload',
gui.saveToLocalStorageIfPossible);\n  }\n}\n\nfunction markPresetModified(gui, modified) {\n  const opt =
gui.__preset_select[gui.__preset_select.selectedIndex];\n\n  if (modified) {\n    opt.innerHTML = opt.value + '*';\n
} else {\n    opt.innerHTML = opt.value;\n  }\n}\n\nfunction 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.firstElementChild.firstElementChild.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.firstElementChild);\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.firstElementChild.firstElementChild.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        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.borderLeftColor = 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 thcommon.isObject.\n let controllerMap = root.__rememberedObjectIndecesToControllers[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\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\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.firstElementChild);\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\nexport default GUI;\n","// stats.js - http://github.com/mrdoob/stats.js\n(function(f,e){\"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=(performance||Date).now()},end:function(){a++;var c=(performance||Date).now();h.update(c-

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,setMode: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\";var 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.fillStyle=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 ==\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.numberOfElements)},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
l}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+=s),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+\".json\";return
4==t?RESNET50_BASE_URL+\"float/\"+r:RESNET50_BASE_URL+\"quant\"+t+\"/\"+r}function
mobileNetCheckpoint(e,t,r){var n={1:\"100\",.75:\"075\",.5:\"050\"},o=\"model-stride\"+e+\".json\";return
4==r?MOBILENET_BASE_URL+\"float/\"+n[t]+\"/\"+o:MOBILENET_BASE_URL+\"quant\"+r+\"/\"+n[t]+\"/\"+
o}function toFloatIfInt$1(e){return
tidy(function(){\"int32\"===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 architecutre
\"+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

\"+VALID_MULTIPLIER[e.architecture]+\" for architecutre
\"+e.architecture+\".\");if(null==e.quantBytes&&(e.quantBytes=4),VALID_QUANT_BYTES.indexOf(e.quantBytes)<0)throw
new Error(\"Invalid quantBytes \"+e.quantBytes+\". Should be one of \"+VALID_QUANT_BYTES+\" for architecutre \"+e.architecture+\".\");return e}var
SINGLE_PERSON_INFERENCE_CONFIG={flipHorizontal:!1},MULTI_PERSON_INFERENCE_CONFIG={flipHorizontal:!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=getInputTensorDimensions(e),s=i[0],a=i[1],u=padAndResizeTo(e,[o,o]),l=u.resized,f=u.padding,c=this.baseModel.predict(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.nmsRadius)];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.dispose(),[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.inputResolution,assertValidOutputStride(n),assertValidResolution(o,n),i=getInputTensorDimensions(e),s=i[0],a=i[1],u=padAndResizeTo(e,[o,o]),l=u.resized,f=u.padding,c=this.baseModel.predict(l),d=c.heatmapScores,p=c.offsets,h=c.displacementFwd,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.dispose(),[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}();function 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 *\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\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF 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 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(\n      TRY_RESNET_BUTTON_TEXT,
TRY_RESNET_BUTTON_BACKGROUND_CSS,\n      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 =\n      posenet.getAdjacentKeyPoints(keypoints, minConfidence);\n\n  function toTuple({y, x}) {\n    return [y, x];\n  }\n\n  adjacentKeyPoints.forEach((keypoints) => {\n    drawSegment(\n        toTuple(keypoints[0].position), toTuple(keypoints[1].position), COLOR,\n        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(\n      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\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\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 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\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS
OF ANY 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// 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 * @license\n * Copyright 2019 Google Inc. All Rights

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Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * 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\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF 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 '@tensorflow/tfjs-backend-webgl';\nimport * as bodyPix from '@tensorflow-models/body-pix';\nimport dat from 'dat.gui';\nimport Stats from 'stats.js';\n\nimport {drawKeypoints, drawSkeleton, toggleLoadingUI, TRY_RESNET_BUTTON_NAME, TRY_RESNET_BUTTON_TEXT, updateTryResNetButtonDatGuiCss} from './demo_util';\nimport * as partColorScales from './part_color_scales';\n\n\nconst stats = new Stats();\n\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|iPad|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\n  const videoDevices = devices.filter(device => device.kind === 'videoinput');\n\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\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\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  } else {\n    return 'user';\n  }\n}\n\nasync function getConstraints(cameraLabel) {\n  let deviceId;\n  let facingMode;\n\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(\n        'Browser API navigator.mediaDevices.getUserMedia not available');\n  }\n\n  const videoElement = document.getElementById('video');\n\n  stopExistingVideoCapture();\n\n  const videoConstraints = await getConstraints(cameraLabel);\n\n  const stream = await navigator.mediaDevices.getUserMedia(\n      {'audio': false, 'video': videoConstraints});\n  videoElement.srcObject = stream;\n\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\n  state.video.play();\n}\n\nconst defaultQuantBytes = 2;\n\nconst defaultMobileNetMultiplier = isMobile() ? 0.50 : 0.75;\nconst defaultMobileNetStride = 16;\nconst defaultMobileNetInternalResolution = 'medium';\n\nconst defaultResNetMultiplier = 1.0;\nconst defaultResNetStride = 16;\nconst defaultResNetInternalResolution = 'low';\n\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\n
cameras.forEach(camera => {\n    result[camera.label] = camera.label;\n  })\n\n  return result;\n}\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\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\n  gui.add(guiState, 'camera', toCameraOptions(cameras))\n
.onChange(async function(cameraLabel) {\n        state.changingCamera = true;\n\n        await
loadVideo(cameraLabel);\n\n
        state.changingCamera = false;\n      });\n\n  gui.add(guiState, 'flipHorizontal');\n\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\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\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\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\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\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
shorter the loading time but\n  // lower the accuracy.\n  let quantBytesController = null;\n  function
updateGuiQuantBytes(quantBytes, quantBytesArray) {\n    if (quantBytesController) {\n
quantBytesController.remove();\n    }\n    guiState.quantBytes = +quantBytes;\n    guiState.input.quantBytes =
+quantBytes;\n    quantBytesController
  =\n        input.add(guiState.input, 'quantBytes', quantBytesArray);\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}\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\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(${partColor[0]},${\n        partColor[1]},${partColor[2]})' ></div>\n
${partNames[i]}`;\n\n    colors.appendChild(child);\n  }\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}\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:\n            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:\n            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 * Feeds an image to BodyPix to estimate segmentation - this is where the\n * magic happens. This function loops with a requestAnimationFrame method.\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 ||\n 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 * Kicks off the demo.\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\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\nbindPage();\n"]}

Found in path(s):
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/demos/dist/demos.ab0c720b.js.map

1.226 chardet 3.0.4

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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
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Section 6 states terms for distribution of such executables.

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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

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to use the modified definitions.)

b) Use a suitable shared library mechanism for linking with the
Library. A suitable mechanism is one that (1) uses at run time a
copy of the library already present on the user's computer system,
rather than copying library functions into the executable, and (2)
will operate properly with a modified version of the library, if
the user
installs one, as long as the modified version is
interface-compatible with the version that the work was made with.

c) Accompany the work with a written offer, valid for at
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1.227 jansi-osx 1.8

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* /opt/cola/permits/1257860178_1643019491.32/0/jansi-osx-1-8-sources-jar/org/fusesource/jansi/internal/Kernel32.java
* /opt/cola/permits/1257860178_1643019491.32/0/jansi-osx-1-8-sources-jar/org/fusesource/jansi/internal/WindowsSupport.java
* /opt/cola/permits/1257860178_1643019491.32/0/jansi-osx-1-8-sources-jar/org/fusesource/jansi/internal/CLibrary.java

1.228 jansi-native 1.8

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* /opt/cola/permits/1257860186_1643019499.32/0/jansi-native-1-8-sources-jar/org/fusesource/jansi/internal/WindowsSupport.java
* /opt/cola/permits/1257860186_1643019499.32/0/jansi-native-1-8-sources-jar/org/fusesource/jansi/internal/CLibrary.java
* /opt/cola/permits/1257860186_1643019499.32/0/jansi-native-1-8-sources-jar/org/fusesource/jansi/internal/Kernel32.java

1.229 sequence-generator 5.7.3

1.229.1 Available under license :

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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.t
erracotta.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):
* /opt/cola/permits/1258059180_1643027223.49/0/sequence-generator-5-7-3-jar/META-INF/MANIFEST.MF

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Found in path(s):
* /opt/cola/permits/1258059180_1643027223.49/0/sequence-generator-5-7-3-jar/META-INF/maven/org.terracotta.management/sequence-generator/pom.xml

1.230 management-model 5.7.3

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Found in path(s):
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-jar/org/terracotta/management/model/message/DefaultManagementCallMessage.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-jar/org/terracotta/management/model/stats/Sample.java

* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-jar/org/terracotta/management/model/call/ContextualCall.java
*
/opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-jar/org/terracotta/management/model/stats/DelegatingStatistic.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-jar/org/terracotta/management/model/capabilities/descriptors/Descriptor.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-jar/org/terracotta/management/model/stats/Statistic.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-jar/org/terracotta/management/model/capabilities/context/CapabilityContext.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-jar/org/terracotta/management/model/call/Parameter.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-jar/org/terracotta/management/model/capabilities/descriptors/CallDescriptor.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-jar/org/terracotta/management/model/stats/ContextualStatistics.java
*
/opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-jar/org/terracotta/management/model/capabilities/descriptors/StatisticDescriptor.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-jar/org/terracotta/management/model/capabilities/DefaultCapability.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-jar/org/terracotta/management/model/context/ContextContainer.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-jar/org/terracotta/management/model/context/Context.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-jar/org/terracotta/management/model/capabilities/Capability.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-jar/org/terracotta/management/model/message/ManagementCallMessage.java
*
/opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-jar/org/terracotta/management/model/stats/StatisticRegistry.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-jar/org/terracotta/management/model/message/DefaultMessage.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-jar/org/terracotta/management/model/call/ContextualReturn.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-jar/org/terracotta/management/model/message/Message.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-jar/org/terracotta/management/model/cluster/ClientIdentifier.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-jar/org/terracotta/management/model/capabilities/descriptors/Settings.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-jar/org/terracotta/management/model/notification/ContextualNotification.java
*
/opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-jar/org/terracotta/management/model/context/Contextual.java

* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-jar/org/terracotta/management/model/stats/StatisticType.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-jar/org/terracotta/management/model/stats/DelegatingSample.java

1.231 nio-stream-storage 1.1.3

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* /opt/cola/permits/1258195506_1643041713.35/0/nio-stream-storage-1-1-3-sources-jar/org/synchronoss/cloud/nio/stream/storage/StreamStorageFactory.java
* /opt/cola/permits/1258195506_1643041713.35/0/nio-stream-storage-1-1-3-sources-jar/org/synchronoss/cloud/nio/stream/storage/DeferredFileStreamStorageFactory.java
*
/opt/cola/permits/1258195506_1643041713.35/0/nio-stream-storage-1-1-3-sources-jar/org/synchronoss/cloud/nio/stream/storage/Disposable.java
* /opt/cola/permits/1258195506_1643041713.35/0/nio-stream-storage-1-1-3-sources-jar/org/synchronoss/cloud/nio/stream/storage/FileStreamStorage.java
* /opt/cola/permits/1258195506_1643041713.35/0/nio-stream-storage-1-1-3-sources-jar/org/synchronoss/cloud/nio/stream/storage/StreamStorage.java
* /opt/cola/permits/1258195506_1643041713.35/0/nio-stream-storage-1-1-3-sources-jar/org/synchronoss/cloud/nio/stream/storage/NameAwarePurgableFileInputStream.java

1.232 webjars-locator-core 0.45

1.232.1 Available under license :

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1.233 golang 1.15.15

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1.234 jackson-dataformat-yaml 2.11.2

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1.236 cryptsetup 2.3.6

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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.

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b) Use a suitable shared library mechanism for linking with the Library. A suitable mechanism is one that (1) uses at run time a copy of the library already present on the user's computer system, rather than copying library functions into the executable, and (2) will operate
properly with a modified version of the library, if
the user installs one, as long as the modified version is interface-compatible with the version that the work was made with.

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1.237 libnetfilter-conntrack 1.0.5

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```
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1.238 lvm2 2.02.79

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1.239 libatomic 10.3.0-1ubuntu1-20.04

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Julian Seward, jseward@bzip.org
bzip2/libbzip2 version 1.0.6 of 6 September 2010

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ftp://gcc.gnu.org/pub/gcc/releases/ (for full releases)
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git://git.savannah.gnu.org/gm2.git (for Modula-2)

The current gcc-10 source package is taken from the SVN gcc-10-branch.

Changes: See changelog.Debian.gz

Debian splits the GNU Compiler Collection into packages for each language,
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Language	Compiler package	Library package	Documentation
Ada	gnat-10	libgnat-10	gnat-10-doc
BRIG	gccbrig-10	libhsail-rt0	
C	gcc-10		gcc-10-doc
C++	g++-10	libstdc++6	libstdc++6-10-doc
D	gdc-10		
Fortran 95	gfortran-10	libgfortran5	gfortran-10-doc
Go	gccgo-10	libgo0	
Objective C	gobjc-10	libobjc4	
Objective C++	gobjc++-10		
Modula-2	gm2-10	libgm2	

For some language run-time libraries, Debian provides source files,
development files, debugging symbols and libraries containing position-
independent code in separate packages:

Language	Sources	Development	Debugging	Position-Independent
C++			libstdc++6-10-dbg	libstdc++6-10-pic
D	libphobos-10-dev			

Additional packages include:

All languages:
libgcc1,
libgcc2, libgcc4 GCC intrinsics (platform-dependent)
gcc-10-base Base files common to all compilers
gcc-10-soft-float Software floating point (ARM only)
gcc-10-source The sources with patches

Ada:

libgnat-util10-dev, libgnat-util10 GNAT version library

C:
cpp-10, cpp-10-doc GNU C Preprocessor
libssp0-dev, libssp0 GCC stack smashing protection library
libquadmath0 Math routines for the __float128 type
fixincludes Fix non-ANSI header files

C, C++ and Fortran 95:
libgomp1-dev, libgomp1 GCC OpenMP (GOMP) support library
libitm1-dev, libitm1 GNU Transactional Memory Library

Biarch support: On some 64-bit platforms which can also run 32-bit code, Debian provides additional packages containing 32-bit versions of some libraries. These packages have names beginning with 'lib32' instead of 'lib', for example lib32stdc++6. Similarly, on some 32-bit platforms which can
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- libstdc++-v3
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- The libgnat-10 Ada support library and libgnat-util10
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D:
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libphobos-10-dev D standard runtime library

The D source package is made up of the following components.

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========

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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.

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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.

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a. Accompany the combined library with a copy of the same work

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@enumerate 0
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it does not include the work's
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the same place at no
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that the user who changes the contents of definitions files in the
Library will not necessarily be able to recompile the application
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@item
Use a suitable shared library mechanism for linking with the Library. A
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library already present on the user's computer system, rather than
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<!-- 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, '&#10;'))"/>
  <xsl:text>&#10;</xsl:text>
  <xsl:variable name="rest" select="substring-after($text, '&#10;')"/>
  <xsl:if test="translate($rest, '&#9;&#32;', '')">
    <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="db:book/db:info/db:copyright | db:refentry/db:docinfo/db:copyright">
  <xsl:text>Copyright (C) </xsl:text>
  <xsl:call-template name="copyright.years">
   <xsl:with-param name="years" select="db:year"/>
  </xsl:call-template>
  <xsl:text> </xsl:text>
```

```
  <xsl:value-of select="db: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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"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.

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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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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

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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.

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b) Accompany
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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
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1.244 lvm2 2.02.162

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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

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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.

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Library refers to a function or a
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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
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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
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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.

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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

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6. As an exception to the Sections above, you may also combine or
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copy of the library already present on the user's computer system,
rather than copying library functions into the executable, and (2)
will operate properly with a modified version of the library, if
the user
installs one, as long as the modified version is
interface-compatible with the version that the work was made with.

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passive OS fingerprinting

#
SYN signatures. Those signatures work for SYN packets only (duh!).
#
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#
#
# This fingerprint database is adapted from Michal Zalewski's p0f passive
# operating system package.  The last database sync was from a Nov 3 2003
# p0f.fp.
#
#
# Each line in this file specifies a single fingerprint. Please read the
# information below carefully before attempting to append any signatures
# reported as UNKNOWN to this file to avoid mistakes.
#
# We use the following set metrics for fingerprinting:
#
# - Window size (WSS) - a highly OS dependent setting used for TCP/IP
#   performance control (max. amount of data to be sent without ACK).
#   Some systems use a fixed value for initial packets. On other
#   systems, it is a multiple of MSS or MTU (MSS+40). In some rare
#   cases, the value is just arbitrary.
#
#   NEW SIGNATURE: if p0f reported a special value of 'Snn', the number
#   appears to be
 a multiple of MSS (MSS*nn); a special value of 'Tnn'
#   means it is a multiple of MTU ((MSS+40)*nn). Unless you notice the
#   value of nn is not fixed (unlikely), just copy the Snn or Tnn token
#   literally. If you know this device has a simple stack and a fixed
#   MTU, you can however multiply S value by MSS, or T value by MSS+40,
#   and put it instead of Snn or Tnn.
#
#   If WSS otherwise looks like a fixed value (for example a multiple
#   of two), or if you can confirm the value is fixed, please quote
#   it literally. If there's no apparent pattern in WSS chosen, you
#   should consider wildcarding this value.
#
# - Overall packet size - a function of all IP and TCP options and bugs.
#
#   NEW SIGNATURE: Copy this value literally.
#
# - Initial TTL - We check the actual TTL of a received packet. It can't
#   be higher than the initial TTL, and also shouldn't be dramatically
#   lower (maximum distance is defined as 40 hops).
#
#   NEW SIGNATURE: *Never* copy TTL from a p0f-reported
 signature literally.
#   You need to determine the initial TTL. The best way to do it is to
#   check the documentation for a remote system, or check its settings.
```

```
#   A fairly good method is to simply round the observed TTL up to
#   32, 64, 128, or 255, but it should be noted that some obscure devices
#   might not use round TTLs (in particular, some shoddy appliances use
#   "original" initial TTL settings). If not sure, you can see how many
#   hops you're away from the remote party with traceroute or mtr.
#
# - Don't fragment flag (DF) - some modern OSes set this to implement PMTU
#   discovery. Others do not bother.
#
#   NEW SIGNATURE: Copy this value literally.
#
# - Maximum segment size (MSS) - this setting is usually link-dependent. P0f
#   uses it to determine link type of the remote host.
#
#   NEW SIGNATURE: Always wildcard this value, except for rare cases when
#   you have an appliance with a fixed value, know the system supports only
#   a very limited number of
 network interface types, or know the system
#   is using a value it pulled out of nowhere.  Specific unique MSS
#   can be used to tell Google crawlbots from the rest of the population.
#
# - Window scaling (WSCALE) - this feature is used to scale WSS.
#   It extends the size of a TCP/IP window to 32 bits. Some modern
#   systems implement this feature.
#
#   NEW SIGNATURE: Observe several signatures. Initial WSCALE is often set
#   to zero or other low value. There's usually no need to wildcard this
#   parameter.
#
# - Timestamp - some systems that implement timestamps set them to
#   zero in the initial SYN. This case is detected and handled appropriately.
#
# - Selective ACK permitted - a flag set by systems that implement
#   selective ACK functionality.
#
# - The sequence of TCP all options (MSS, window scaling, selective ACK
#   permitted, timestamp, NOP). Other than the options previously
#   discussed, p0f also checks for timestamp option (a silly
#   extension to broadcast your
 uptime ;-), NOP options (used for
#   header padding) and sackOK option (selective ACK feature).
#
#   NEW SIGNATURE: Copy the sequence literally.
#
# To wildcard any value (except for initial TTL or TCP options), replace
# it with '*'. You can also use a modulo operator to match any values
# that divide by nnn - '%nnn'.
#
```

```
# Fingerprint entry format:
#
# wwww:ttt:D:ss:OOO...:OS:Version:Subtype:Details
#
# wwww     - window size (can be *, %nnn, Snn or Tnn).  The special values
#            "S" and "T" which are a multiple of MSS or a multiple of MTU
#            respectively.
# ttt      - initial TTL
# D        - don't fragment bit (0 - not set, 1 - set)
# ss       - overall SYN packet size
# OOO      - option value and order specification (see below)
# OS       - OS genre (Linux, Solaris, Windows)
# Version  - OS Version (2.0.27 on x86, etc)
# Subtype  - OS subtype or patchlevel (SP3, lo0)
# details  - Generic OS details
#
# If OS genre starts with '*', p0f will not show distance,
 link type
# and timestamp data. It is useful for userland TCP/IP stacks of
# network scanners and so on, where many settings are randomized or
# bogus.
#
# If OS genre starts with @, it denotes an approximate hit for a group
# of operating systems (signature reporting still enabled in this case).
# Use this feature at the end of this file to catch cases for which
# you don't have a precise match, but can tell it's Windows or FreeBSD
# or whatnot by looking at, say, flag layout alone.
#
# Option block description is a list of comma or space separated
# options in the order they appear in the packet:
#
# N    - NOP option
# Wnnn    - window scaling option, value nnn (or * or %nnn)
# Mnnn    - maximum segment size option, value nnn (or * or %nnn)
# S    - selective ACK OK
# T    - timestamp
# T0    - timestamp with a zero value
#
# To denote no TCP options, use a single '.'.
#
# Please report any additions to this file, or any inaccuracies or
# problems spotted, to the maintainers: lcamtuf@coredump.cx,
#
 frantzen@openbsd.org and bugs@openbsd.org with a tcpdump packet
# capture of the relevant SYN packet(s)
#
# A test and submission page is available at
# http://lcamtuf.coredump.cx/p0f-help/
```

```
#
#
# WARNING WARNING WARNING
# ----------------------
#
# Do not add a system X as OS Y just because NMAP says so. It is often
# the case that X is a NAT firewall. While nmap is talking to the
# device itself, p0f is fingerprinting the guy behind the firewall
# instead.
#
# When in doubt, use common sense, don't add something that looks like
# a completely different system as Linux or FreeBSD or LinkSys router.
# Check DNS name, establish a connection to the remote host and look
# at SYN+ACK - does it look similar?
#
# Some users tweak their TCP/IP settings - enable or disable RFC1323
# functionality, enable or disable timestamps or selective ACK,
# disable PMTU discovery, change MTU and so on. Always compare a new rule
# to other fingerprints for this system, and verify the system
 isn't
# "customized" before adding it. It is OK to add signature variants
# caused by a commonly used software (personal firewalls, security
# packages, etc), but it makes no sense to try to add every single
# possible /proc/sys/net/ipv4 tweak on Linux or so.
#
# KEEP IN MIND: Some packet firewalls configured to normalize outgoing
# traffic (OpenBSD pf with "scrub" enabled, for example) will, well,
# normalize packets. Signatures will not correspond to the originating
# system (and probably not quite to the firewall either).
#
# NOTE: Try to keep this file in some reasonable order, from most to
# least likely systems. This will speed up operation. Also keep most
# generic and broad rules near the end.
#

############################
# Standard OS signatures #
############################

# ----------------- AIX ---------------------

# AIX is first because its signatures are close to NetBSD, MacOS X and
# Linux 2.0, but it uses a fairly rare MSSes, at least sometimes...
# This is a shoddy
 hack, though.

45046:64:0:44:M*:  AIX:4.3::AIX 4.3
16384:64:0:44:M512:  AIX:4.3:2-3:AIX 4.3.2 and earlier
```

```
16384:64:0:60:M512,N,W%2,N,N,T:  AIX:4.3:3:AIX 4.3.3-5.2
16384:64:0:60:M512,N,W%2,N,N,T:  AIX:5.1-5.2::AIX 4.3.3-5.2
32768:64:0:60:M512,N,W%2,N,N,T:  AIX:4.3:3:AIX 4.3.3-5.2
32768:64:0:60:M512,N,W%2,N,N,T:  AIX:5.1-5.2::AIX 4.3.3-5.2
65535:64:0:60:M512,N,W%2,N,N,T:  AIX:4.3:3:AIX 4.3.3-5.2
65535:64:0:60:M512,N,W%2,N,N,T:  AIX:5.1-5.2::AIX 4.3.3-5.2
65535:64:0:64:M*,N,W1,N,N,T,N,N,S: AIX:5.3:ML1:AIX 5.3 ML1

# ----------------- Linux -------------------

# S1:64:0:44:M*:A:  Linux:1.2::Linux 1.2.x (XXX quirks support)
512:64:0:44:M*:   Linux:2.0:3x:Linux 2.0.3x
16384:64:0:44:M*:  Linux:2.0:3x:Linux 2.0.3x

# Endian snafu! Nelson says "ha-ha":
2:64:0:44:M*:   Linux:2.0:3x:Linux 2.0.3x (MkLinux) on Mac
64:64:0:44:M*:   Linux:2.0:3x:Linux 2.0.3x (MkLinux) on Mac


S4:64:1:60:M1360,S,T,N,W0: Linux:google::Linux (Google crawlbot)

S2:64:1:60:M*,S,T,N,W0:  Linux:2.4::Linux 2.4 (big boy)
S3:64:1:60:M*,S,T,N,W0:  Linux:2.4:.18-21:Linux
 2.4.18 and newer
S4:64:1:60:M*,S,T,N,W0:  Linux:2.4::Linux 2.4/2.6 <= 2.6.7
S4:64:1:60:M*,S,T,N,W0:  Linux:2.6:.1-7:Linux 2.4/2.6 <= 2.6.7

S4:64:1:60:M*,S,T,N,W5:  Linux:2.6::Linux 2.6 (newer, 1)
S4:64:1:60:M*,S,T,N,W6:  Linux:2.6::Linux 2.6 (newer, 2)
S4:64:1:60:M*,S,T,N,W7:  Linux:2.6::Linux 2.6 (newer, 3)
T4:64:1:60:M*,S,T,N,W7:  Linux:2.6::Linux 2.6 (newer, 4)

S10:64:1:60:M*,S,T,N,W4: Linux:3.0::Linux 3.0

S3:64:1:60:M*,S,T,N,W1:  Linux:2.5::Linux 2.5 (sometimes 2.4)
S4:64:1:60:M*,S,T,N,W1:  Linux:2.5-2.6::Linux 2.5/2.6
S3:64:1:60:M*,S,T,N,W2:  Linux:2.5::Linux 2.5 (sometimes 2.4)
S4:64:1:60:M*,S,T,N,W2:  Linux:2.5::Linux 2.5 (sometimes 2.4)

S20:64:1:60:M*,S,T,N,W0: Linux:2.2:20-25:Linux 2.2.20 and newer
S22:64:1:60:M*,S,T,N,W0: Linux:2.2::Linux 2.2
S11:64:1:60:M*,S,T,N,W0: Linux:2.2::Linux 2.2

# Popular cluster config scripts disable timestamps and
# selective ACK:
S4:64:1:48:M1460,N,W0:  Linux:2.4:cluster:Linux 2.4 in cluster
```

```
#
 This needs to be investigated. On some systems, WSS
# is selected as a multiple of MTU instead of MSS. I got
# many submissions for this for many late versions of 2.4:
T4:64:1:60:M1412,S,T,N,W0: Linux:2.4::Linux 2.4 (late, uncommon)

# This happens only over loopback, but let's make folks happy:
32767:64:1:60:M16396,S,T,N,W0: Linux:2.4:lo0:Linux 2.4 (local)
S8:64:1:60:M3884,S,T,N,W0: Linux:2.2:lo0:Linux 2.2 (local)

# Opera visitors:
16384:64:1:60:M*,S,T,N,W0: Linux:2.2:Opera:Linux 2.2 (Opera?)
32767:64:1:60:M*,S,T,N,W0: Linux:2.4:Opera:Linux 2.4 (Opera?)

# Some fairly common mods:
S4:64:1:52:M*,N,N,S,N,W0: Linux:2.4:ts:Linux 2.4 w/o timestamps
S22:64:1:52:M*,N,N,S,N,W0: Linux:2.2:ts:Linux 2.2 w/o timestamps



# ----------------- FreeBSD -----------------

16384:64:1:44:M*:  FreeBSD:2.0-2.2::FreeBSD 2.0-4.2
16384:64:1:44:M*:  FreeBSD:3.0-3.5::FreeBSD 2.0-4.2
16384:64:1:44:M*:  FreeBSD:4.0-4.2::FreeBSD 2.0-4.2
16384:64:1:60:M*,N,W0,N,N,T: FreeBSD:4.4::FreeBSD 4.4

1024:64:1:60:M*,N,W0,N,N,T: FreeBSD:4.4::FreeBSD
 4.4

57344:64:1:44:M*:  FreeBSD:4.6-4.8:noRFC1323:FreeBSD 4.6-4.8 (no RFC1323)
57344:64:1:60:M*,N,W0,N,N,T: FreeBSD:4.6-4.9::FreeBSD 4.6-4.9

32768:64:1:60:M*,N,W0,N,N,T: FreeBSD:4.8-4.11::FreeBSD 4.8-5.1 (or MacOS X)
32768:64:1:60:M*,N,W0,N,N,T: FreeBSD:5.0-5.1::FreeBSD 4.8-5.1 (or MacOS X)
65535:64:1:60:M*,N,W0,N,N,T: FreeBSD:4.8-4.11::FreeBSD 4.8-5.2 (or MacOS X)
65535:64:1:60:M*,N,W0,N,N,T: FreeBSD:5.0-5.2::FreeBSD 4.8-5.2 (or MacOS X)
65535:64:1:60:M*,N,W1,N,N,T: FreeBSD:4.7-4.11::FreeBSD 4.7-5.2
65535:64:1:60:M*,N,W1,N,N,T: FreeBSD:5.0-5.2::FreeBSD 4.7-5.2

# XXX need quirks support
# 65535:64:1:60:M*,N,W0,N,N,T:Z:FreeBSD:5.1-5.4::5.1-current (1)
# 65535:64:1:60:M*,N,W1,N,N,T:Z:FreeBSD:5.1-5.4::5.1-current (2)
# 65535:64:1:60:M*,N,W2,N,N,T:Z:FreeBSD:5.1-5.4::5.1-current (3)
# 65535:64:1:44:M*:Z:FreeBSD:5.2::FreeBSD 5.2 (no RFC1323)

# 16384:64:1:60:M*,N,N,N,N,N,N,T:FreeBSD:4.4:noTS:FreeBSD 4.4 (w/o timestamps)

# ----------------- NetBSD -----------------
```

```
16384:64:0:60:M*,N,W0,N,N,T: NetBSD:1.3::NetBSD
 1.3
65535:64:0:60:M*,N,W0,N,N,T0: NetBSD:1.6:opera:NetBSD 1.6 (Opera)
16384:64:0:60:M*,N,W0,N,N,T0: NetBSD:1.6::NetBSD 1.6
16384:64:1:60:M*,N,W0,N,N,T0: NetBSD:1.6:df:NetBSD 1.6 (DF)
65535:64:1:60:M*,N,W1,N,N,T0: NetBSD:1.6::NetBSD 1.6W-current (DF)
65535:64:1:60:M*,N,W0,N,N,T0: NetBSD:1.6::NetBSD 1.6X (DF)
32768:64:1:60:M*,N,W0,N,N,T0: NetBSD:1.6:randomization:NetBSD 1.6ZH-current (w/ ip_id randomization)

# ----------------- OpenBSD -----------------

16384:64:0:60:M*,N,W0,N,N,T:  OpenBSD:2.6::NetBSD 1.3 (or OpenBSD 2.6)
16384:64:1:64:M*,N,N,S,N,W0,N,N,T: OpenBSD:3.0-4.8::OpenBSD 3.0-4.8
16384:64:0:64:M*,N,N,S,N,W0,N,N,T: OpenBSD:3.0-4.8:no-df:OpenBSD 3.0-4.8 (scrub no-df)
57344:64:1:64:M*,N,N,S,N,W0,N,N,T: OpenBSD:3.3-4.0::OpenBSD 3.3-4.0
57344:64:0:64:M*,N,N,S,N,W0,N,N,T: OpenBSD:3.3-4.0:no-df:OpenBSD 3.3-4.0 (scrub no-df)

65535:64:1:64:M*,N,N,S,N,W0,N,N,T: OpenBSD:3.0-4.0:opera:OpenBSD 3.0-4.0 (Opera)

16384:64:1:64:M*,N,N,S,N,W3,N,N,T: OpenBSD:4.9::OpenBSD
 4.9
16384:64:0:64:M*,N,N,S,N,W3,N,N,T: OpenBSD:4.9:no-df:OpenBSD 4.9 (scrub no-df)

16384:64:1:64:M*,N,N,S,N,W6,N,N,T:      OpenBSD:6.1::OpenBSD 6.1
16384:64:0:64:M*,N,N,S,N,W6,N,N,T:      OpenBSD:6.1:no-df:OpenBSD 6.1 (scrub no-df)

# ----------------- DragonFly BSD -----------------

57344:64:1:60:M*,N,W0,N,N,T:  DragonFly:1.0:A:DragonFly 1.0A
57344:64:0:64:M*,N,W0,N,N,S,N,N,T: DragonFly:1.2-1.12::DragonFly 1.2-1.12
5840:64:1:60:M*,S,T,N,W4:   DragonFly:2.0-2.1::DragonFly 2.0-2.1
57344:64:0:64:M*,N,W0,N,N,S,N,N,T: DragonFly:2.2-2.3::DragonFly 2.2-2.3
57344:64:0:64:M*,N,W5,N,N,S,N,N,T: DragonFly:2.4-2.7::DragonFly 2.4-2.7

# ----------------- Solaris -----------------

S17:64:1:64:N,W3,N,N,T0,N,N,S,M*: Solaris:8:RFC1323:Solaris 8 RFC1323
S17:64:1:48:N,N,S,M*:   Solaris:8::Solaris 8
S17:255:1:44:M*:   Solaris:2.5-2.7::Solaris 2.5 to 7

S6:255:1:44:M*:    Solaris:2.6-2.7::Solaris 2.6 to 7
S23:255:1:44:M*:   Solaris:2.5:1:Solaris 2.5.1
S34:64:1:48:M*,N,N,S:   Solaris:2.9::Solaris
 9
S44:255:1:44:M*:   Solaris:2.7::Solaris 7

4096:64:0:44:M1460:   SunOS:4.1::SunOS 4.1.x
```

```
S34:64:1:52:M*,N,W0,N,N,S:  Solaris:10:beta:Solaris 10 (beta)
32850:64:1:64:M*,N,N,T,N,W1,N,N,S: Solaris:10::Solaris 10 1203

# ----------------- IRIX --------------------

49152:64:0:44:M*:   IRIX:6.4::IRIX 6.4
61440:64:0:44:M*:   IRIX:6.2-6.5::IRIX 6.2-6.5
49152:64:0:52:M*,N,W2,N,N,S:  IRIX:6.5:RFC1323:IRIX 6.5 (RFC1323)
49152:64:0:52:M*,N,W3,N,N,S:  IRIX:6.5:RFC1323:IRIX 6.5 (RFC1323)

61440:64:0:48:M*,N,N,S:   IRIX:6.5:12-21:IRIX 6.5.12 - 6.5.21
49152:64:0:48:M*,N,N,S:   IRIX:6.5:15-21:IRIX 6.5.15 - 6.5.21

49152:60:0:64:M*,N,W2,N,N,T,N,N,S: IRIX:6.5:IP27:IRIX 6.5 IP27



# ----------------- Tru64 -------------------

32768:64:1:48:M*,N,W0:   Tru64:4.0::Tru64 4.0 (or OS/2 Warp 4)
32768:64:0:48:M*,N,W0:   Tru64:5.0::Tru64 5.0
8192:64:0:44:M1460:   Tru64:5.1:noRFC1323:Tru64 6.1 (no RFC1323) (or QNX 6)
61440:64:0:48:M*,N,W0:   Tru64:5.1a:JP4:Tru64 v5.1a JP4 (or OpenVMS
 7.x on Compaq 5.x stack)

# ----------------- OpenVMS -----------------

6144:64:1:60:M*,N,W0,N,N,T:  OpenVMS:7.2::OpenVMS 7.2 (Multinet 4.4 stack)

# ----------------- MacOS -------------------

# XXX Need EOL tcp opt support
# S2:255:1:48:M*,W0,E:.:MacOS:8.6 classic

# XXX some of these use EOL too
16616:255:1:48:M*,W0:   MacOS:7.3-7.6:OTTCP:MacOS 7.3-8.6 (OTTCP)
16616:255:1:48:M*,W0:   MacOS:8.0-8.6:OTTCP:MacOS 7.3-8.6 (OTTCP)
16616:255:1:48:M*,N,N,N:  MacOS:8.1-8.6:OTTCP:MacOS 8.1-8.6 (OTTCP)
32768:255:1:48:M*,W0,N:   MacOS:9.0-9.2::MacOS 9.0-9.2
65535:255:1:48:M*,N,N,N,N:  MacOS:9.1::MacOS 9.1 (OT 2.7.4)



# ----------------- Windows -----------------

# Windows TCP/IP stack is a mess. For most recent XP, 2000 and
# even 98, the patchlevel, not the actual OS version, is more
# relevant to the signature. They share the same code, so it would
# seem. Luckily for us, almost all Windows 9x boxes have an
```

```
# awkward MSS of 536, which I use to tell one from another
# in most difficult cases.

8192:32:1:44:M*:   Windows:3.11::Windows
 3.11 (Tucows)
S44:64:1:64:M*,N,W0,N,N,T0,N,N,S: Windows:95::Windows 95
8192:128:1:64:M*,N,W0,N,N,T0,N,N,S: Windows:95:b:Windows 95b

# There were so many tweaking tools and so many stack versions for
# Windows 98 it is no longer possible to tell them from each other
# without some very serious research. Until then, there's an insane
# number of signatures, for your amusement:

S44:32:1:48:M*,N,N,S:   Windows:98:lowTTL:Windows 98 (low TTL)
8192:32:1:48:M*,N,N,S:   Windows:98:lowTTL:Windows 98 (low TTL)
%8192:64:1:48:M536,N,N,S:  Windows:98::Windows 98
%8192:128:1:48:M536,N,N,S:  Windows:98::Windows 98
S4:64:1:48:M*,N,N,S:   Windows:98::Windows 98
S6:64:1:48:M*,N,N,S:   Windows:98::Windows 98
S12:64:1:48:M*,N,N,S:   Windows:98::Windows 98
T30:64:1:64:M1460,N,W0,N,N,T0,N,N,S: Windows:98::Windows 98
32767:64:1:48:M*,N,N,S:   Windows:98::Windows 98
37300:64:1:48:M*,N,N,S:   Windows:98::Windows 98
46080:64:1:52:M*,N,W3,N,N,S:  Windows:98:RFC1323:Windows
 98 (RFC1323)
65535:64:1:44:M*:   Windows:98:noSack:Windows 98 (no sack)
S16:128:1:48:M*,N,N,S:   Windows:98::Windows 98
S16:128:1:64:M*,N,W0,N,N,T0,N,N,S: Windows:98::Windows 98
S26:128:1:48:M*,N,N,S:   Windows:98::Windows 98
T30:128:1:48:M*,N,N,S:   Windows:98::Windows 98
32767:128:1:52:M*,N,W0,N,N,S:  Windows:98::Windows 98
60352:128:1:48:M*,N,N,S:  Windows:98::Windows 98
60352:128:1:64:M*,N,W2,N,N,T0,N,N,S: Windows:98::Windows 98

# What's with 1414 on NT?
T31:128:1:44:M1414:   Windows:NT:4.0:Windows NT 4.0 SP6a
64512:128:1:44:M1414:   Windows:NT:4.0:Windows NT 4.0 SP6a
8192:128:1:44:M*:   Windows:NT:4.0:Windows NT 4.0 (older)

# Windows XP and 2000. Most of the signatures that were
# either dubious or non-specific (no service pack data)
# were deleted and replaced with generics at the end.

65535:128:1:48:M*,N,N,S:  Windows:2000:SP4:Windows 2000 SP4, XP SP1
65535:128:1:48:M*,N,N,S:  Windows:XP:SP1:Windows 2000 SP4, XP SP1
%8192:128:1:48:M*,N,N,S:  Windows:2000:SP2+:Windows
 2000 SP2, XP SP1 (seldom 98 4.10.2222)
%8192:128:1:48:M*,N,N,S:  Windows:XP:SP1:Windows 2000 SP2, XP SP1 (seldom 98 4.10.2222)
```

```
S20:128:1:48:M*,N,N,S:   Windows:2000::Windows 2000/XP SP3
S20:128:1:48:M*,N,N,S:   Windows:XP:SP3:Windows 2000/XP SP3
S45:128:1:48:M*,N,N,S:   Windows:2000:SP4:Windows 2000 SP4, XP SP 1
S45:128:1:48:M*,N,N,S:   Windows:XP:SP1:Windows 2000 SP4, XP SP 1
40320:128:1:48:M*,N,N,S:  Windows:2000:SP4:Windows 2000 SP4

S6:128:1:48:M*,N,N,S:   Windows:2000:SP2:Windows XP, 2000 SP2+
S6:128:1:48:M*,N,N,S:   Windows:XP::Windows XP, 2000 SP2+
S12:128:1:48:M*,N,N,S:   Windows:XP:SP1:Windows XP SP1
S44:128:1:48:M*,N,N,S:   Windows:2000:SP3:Windows Pro SP1, 2000 SP3
S44:128:1:48:M*,N,N,S:   Windows:XP:SP1:Windows Pro SP1, 2000 SP3
64512:128:1:48:M*,N,N,S:  Windows:2000:SP3:Windows SP1, 2000 SP3
64512:128:1:48:M*,N,N,S:  Windows:XP:SP1:Windows SP1, 2000 SP3
32767:128:1:48:M*,N,N,S:  Windows:2000:SP4:Windows SP1, 2000 SP4
32767:128:1:48:M*,N,N,S:  Windows:XP:SP1:Windows SP1, 2000
 SP4

8192:128:1:52:M*,N,W2,N,N,S:  Windows:Vista::Windows Vista/7

# Odds, ends, mods:

S52:128:1:48:M1260,N,N,S:  Windows:2000:cisco:Windows XP/2000 via Cisco
S52:128:1:48:M1260,N,N,S:  Windows:XP:cisco:Windows XP/2000 via Cisco
65520:128:1:48:M*,N,N,S:  Windows:XP::Windows XP bare-bone
16384:128:1:52:M536,N,W0,N,N,S:  Windows:2000:ZoneAlarm:Windows 2000 w/ZoneAlarm?
2048:255:0:40:.:   Windows:.NET::Windows .NET Enterprise Server

44620:64:0:48:M*,N,N,S:   Windows:ME::Windows ME no SP (?)
S6:255:1:48:M536,N,N,S:   Windows:95:winsock2:Windows 95 winsock 2
32768:32:1:52:M1460,N,W0,N,N,S:  Windows:2003:AS:Windows 2003 AS



# No need to be more specific, it passes:
# *:128:1:48:M*,N,N,S:U:-Windows:XP/2000 while downloading (leak!) XXX quirk
# there is an equiv similar generic sig w/o the quirk

# ----------------- HP/UX -------------------

32768:64:1:44:M*:   HP-UX:B.10.20::HP-UX B.10.20
32768:64:0:48:M*,W0,N:   HP-UX:11.0::HP-UX 11.0
32768:64:1:48:M*,W0,N:   HP-UX:11.10::HP-UX 11.0
 or 11.11
32768:64:1:48:M*,W0,N:   HP-UX:11.11::HP-UX 11.0 or 11.11

# Whoa. Hardcore WSS.
0:64:0:48:M*,W0,N:   HP-UX:B.11.00:A:HP-UX B.11.00 A (RFC1323)

# ----------------- RiscOS ------------------
```

```
# We don't yet support the ?12 TCP option
#16384:64:1:68:M1460,N,W0,N,N,T,N,N,?12: RISCOS:3.70-4.36::RISC OS 3.70-4.36
12288:32:0:44:M536:    RISC OS:3.70:4.10:RISC OS 3.70 inet 4.10

# XXX quirk
# 4096:64:1:56:M1460,N,N,T:T:   RISC OS:3.70:freenet:RISC OS 3.70 freenet 2.00



# ---------- BSD/OS ----------

# Once again, power of two WSS is also shared by MacOS X with DF set
8192:64:1:60:M1460,N,W0,N,N,T:  BSD/OS:3.1::BSD/OS 3.1-4.3 (or MacOS X 10.2 w/DF)
8192:64:1:60:M1460,N,W0,N,N,T:  BSD/OS:4.0-4.3::BSD/OS 3.1-4.3 (or MacOS X 10.2)



# ---------- NewtonOS ----------

4096:64:0:44:M1420:  NewtonOS:2.1::NewtonOS 2.1

# ---------- NeXTSTEP ----------

S4:64:0:44:M1024:  NeXTSTEP:3.3::NeXTSTEP 3.3
S8:64:0:44:M512:  NeXTSTEP:3.3::NeXTSTEP 3.3

# ----------
 BeOS ----------

1024:255:0:48:M*,N,W0:  BeOS:5.0-5.1::BeOS 5.0-5.1
12288:255:0:44:M1402:  BeOS:5.0::BeOS 5.0.x

# ---------- OS/400 ----------

8192:64:1:60:M1440,N,W0,N,N,T: OS/400:VR4::OS/400 VR4/R5
8192:64:1:60:M1440,N,W0,N,N,T: OS/400:VR5::OS/400 VR4/R5
4096:64:1:60:M1440,N,W0,N,N,T: OS/400:V4R5:CF67032:OS/400 V4R5 + CF67032

# XXX quirk
# 28672:64:0:44:M1460:A:OS/390:?

# ---------- ULTRIX ----------

16384:64:0:40:.:  ULTRIX:4.5::ULTRIX 4.5

# ---------- QNX ----------

S16:64:0:44:M512:  QNX:::QNX demodisk
```

```
# ------------------ Novell -----------------

16384:128:1:44:M1460:  Novell:NetWare:5.0:Novel Netware 5.0
6144:128:1:44:M1460:  Novell:IntranetWare:4.11:Novell IntranetWare 4.11
6144:128:1:44:M1368:  Novell:BorderManager::Novell BorderManager ?

6144:128:1:52:M*,W0,N,S,N,N: Novell:Netware:6:Novell Netware 6 SP3


# ----------------- SCO ------------------
S3:64:1:60:M1460,N,W0,N,N,T: SCO:UnixWare:7.1:SCO
 UnixWare 7.1
S17:64:1:60:M1380,N,W0,N,N,T: SCO:UnixWare:7.1:SCO UnixWare 7.1.3 MP3
S23:64:1:44:M1380:  SCO:OpenServer:5.0:SCO OpenServer 5.0

# ------------------- DOS -------------------

2048:255:0:44:M536:  DOS:WATTCP:1.05:DOS Arachne via WATTCP/1.05
T2:255:0:44:M984:  DOS:WATTCP:1.05Arachne:Arachne via WATTCP/1.05 (eepro)

# ------------------ OS/2 -------------------

S56:64:0:44:M512:  OS/2:4::OS/2 4
28672:64:0:44:M1460:  OS/2:4::OS/2 Warp 4.0

# ----------------- TOPS-20 -----------------

# Another hardcore MSS, one of the ACK leakers hunted down.
# XXX QUIRK 0:64:0:44:M1460:A:TOPS-20:version 7
0:64:0:44:M1460:  TOPS-20:7::TOPS-20 version 7

# ----------------- FreeMiNT ----------------

S44:255:0:44:M536:  FreeMiNT:1:16A:FreeMiNT 1 patch 16A (Atari)

# ------------------ AMIGA ------------------

# XXX TCP option 12
# S32:64:1:56:M*,N,N,S,N,N,?12:.:AMIGA:3.9 BB2 with Miami stack

# ------------------ Plan9 ------------------

65535:255:0:48:M1460,W0,N: Plan9:4::Plan9 edition
 4

# ----------------- AMIGAOS -----------------
```

```
16384:64:1:48:M1560,N,N,S: AMIGAOS:3.9::AMIGAOS 3.9 BB2 MiamiDX

##########################################
# Appliance / embedded / other signatures #
##########################################

# ---------- Firewalls / routers ------------

S12:64:1:44:M1460:   @Checkpoint:::Checkpoint (unknown 1)
S12:64:1:48:N,N,S,M1460:  @Checkpoint:::Checkpoint (unknown 2)
4096:32:0:44:M1460:   ExtremeWare:4.x::ExtremeWare 4.x

# XXX TCP option 12
# S32:64:0:68:M512,N,W0,N,N,T,N,N,?12:.:Nokia:IPSO w/Checkpoint NG FP3
# S16:64:0:68:M1024,N,W0,N,N,T,N,N,?12:.:Nokia:IPSO 3.7 build 026

S4:64:1:60:W0,N,S,T,M1460:  FortiNet:FortiGate:50:FortiNet FortiGate 50

8192:64:1:44:M1460:   Eagle:::Eagle Secure Gateway

S52:128:1:48:M1260,N,N,N,N:  LinkSys:WRV54G::LinkSys WRV54G VPN router



# ------- Switches and other stuff ----------

4128:255:0:44:M*:   Cisco:::Cisco Catalyst 3500, 7500 etc
S8:255:0:44:M*:    Cisco:12008::Cisco 12008
60352:128:1:64:M1460,N,W2,N,N,T,N,N,S: Alteon:ACEswitch::Alteon
 ACEswitch
64512:128:1:44:M1370:   Nortel:Contivity Client::Nortel Conectivity Client


# ---------- Caches and whatnots ------------

S4:64:1:52:M1460,N,N,S,N,W0:  AOL:web cache::AOL web cache

32850:64:1:64:N,W1,N,N,T,N,N,S,M*: NetApp:5.x::NetApp Data OnTap 5.x
16384:64:1:64:M1460,N,N,S,N,W0,N: NetApp:5.3:1:NetApp 5.3.1
65535:64:0:64:M1460,N,N,S,N,W*,N,N,T: NetApp:5.3-5.5::NetApp 5.3-5.5
65535:64:0:60:M1460,N,W0,N,N,T:  NetApp:CacheFlow::NetApp CacheFlow
8192:64:1:64:M1460,N,N,S,N,W0,N,N,T: NetApp:5.2:1:NetApp NetCache 5.2.1
20480:64:1:64:M1460,N,N,S,N,W0,N,N,T: NetApp:4.1::NetApp NetCache4.1

65535:64:0:60:M1460,N,W0,N,N,T:  CacheFlow:4.1::CacheFlow CacheOS 4.1
8192:64:0:60:M1380,N,N,N,N,N,N,T: CacheFlow:1.1::CacheFlow CacheOS 1.1

S4:64:0:48:M1460,N,N,S:   Cisco:Content Engine::Cisco Content Engine
```

27085:128:0:40:.: Dell:PowerApp cache::Dell PowerApp (Linux-based)

65535:255:1:48:N,W1,M1460: Inktomi:crawler::Inktomi crawler
S1:255:1:60:M1460,S,T,N,W0: LookSmart:ZyBorg::LookSmart
ZyBorg

16384:255:0:40:.: Proxyblocker:::Proxyblocker (what's this?)

65535:255:0:48:M*,N,N,S: Redline:::Redline T|X 2200

32696:128:0:40:M1460: Spirent:Avalanche::Spirent Web Avalanche HTTP benchmarking engine

---------- Embedded systems ----------

S9:255:0:44:M536: PalmOS:Tungsten:C:PalmOS Tungsten C
S5:255:0:44:M536: PalmOS:3::PalmOS 3/4
S5:255:0:44:M536: PalmOS:4::PalmOS 3/4
S4:255:0:44:M536: PalmOS:3:5:PalmOS 3.5
2948:255:0:44:M536: PalmOS:3:5:PalmOS 3.5.3 (Handera)
S29:255:0:44:M536: PalmOS:5::PalmOS 5.0
16384:255:0:44:M1398: PalmOS:5.2:Clie:PalmOS 5.2 (Clie)
S14:255:0:44:M1350: PalmOS:5.2:Treo:PalmOS 5.2.1 (Treo)

S23:64:1:64:N,W1,N,N,T,N,N,S,M1460: SymbianOS:7::SymbianOS 7

8192:255:0:44:M1460: SymbianOS:6048::Symbian OS 6048 (Nokia 7650?)
8192:255:0:44:M536: SymbianOS:9210::Symbian OS (Nokia 9210?)
S22:64:1:56:M1460,T,S: SymbianOS:P800::Symbian OS ? (SE P800?)
S36:64:1:56:M1360,T,S: SymbianOS:6600::Symbian
OS 60xx (Nokia 6600?)

Perhaps S4?
5840:64:1:60:M1452,S,T,N,W1: Zaurus:3.10::Zaurus 3.10

32768:128:1:64:M1460,N,W0,N,N,T0,N,N,S: PocketPC:2002::PocketPC 2002

S1:255:0:44:M346: Contiki:1.1:rc0:Contiki 1.1-rc0

4096:128:0:44:M1460: Sega:Dreamcast:3.0:Sega Dreamcast Dreamkey 3.0
T5:64:0:44:M536: Sega:Dreamcast:HKT-3020:Sega Dreamcast HKT-3020 (browser disc 51027)
S22:64:1:44:M1460: Sony:PS2::Sony Playstation 2 (SOCOM?)

S12:64:0:44:M1452: AXIS:5600:v5.64:AXIS Printer Server 5600 v5.64

3100:32:1:44:M1460: Windows:CE:2.0:Windows CE 2.0

```
####################
# Fancy signatures #
####################

1024:64:0:40:.:    *NMAP:syn scan:1:NMAP syn scan (1)
2048:64:0:40:.:    *NMAP:syn scan:2:NMAP syn scan (2)
3072:64:0:40:.:    *NMAP:syn scan:3:NMAP syn scan (3)
4096:64:0:40:.:    *NMAP:syn scan:4:NMAP syn scan (4)

# Requires quirks support
# 1024:64:0:40:.:A:*NMAP:TCP sweep probe (1)
# 2048:64:0:40:.:A:*NMAP:TCP sweep probe (2)
# 3072:64:0:40:.:A:*NMAP:TCP sweep
 probe (3)
# 4096:64:0:40:.:A:*NMAP:TCP sweep probe (4)

1024:64:0:60:W10,N,M265,T:  *NMAP:OS:1:NMAP OS detection probe (1)
2048:64:0:60:W10,N,M265,T:  *NMAP:OS:2:NMAP OS detection probe (2)
3072:64:0:60:W10,N,M265,T:  *NMAP:OS:3:NMAP OS detection probe (3)
4096:64:0:60:W10,N,M265,T:  *NMAP:OS:4:NMAP OS detection probe (4)

32767:64:0:40:.:   *NAST:::NASTsyn scan

# Requires quirks support
# 12345:255:0:40:.:A:-p0f:sendsyn utility


#####################################
# Generic signatures - just in case #
#####################################

#*:64:1:60:M*,N,W*,N,N,T:  @FreeBSD:4.0-4.9::FreeBSD 4.x/5.x
#*:64:1:60:M*,N,W*,N,N,T:  @FreeBSD:5.0-5.1::FreeBSD 4.x/5.x

*:128:1:52:M*,N,W0,N,N,S:  @Windows:XP:RFC1323:Windows XP/2000 (RFC1323 no tstamp)
*:128:1:52:M*,N,W0,N,N,S:  @Windows:2000:RFC1323:Windows XP/2000 (RFC1323 no tstamp)
*:128:1:52:M*,N,W*,N,N,S:  @Windows:XP:RFC1323:Windows XP/2000 (RFC1323 no tstamp)
*:128:1:52:M*,N,W*,N,N,S:  @Windows:2000:RFC1323:Windows XP/2000 (RFC1323
 no tstamp)
*:128:1:64:M*,N,W0,N,N,T0,N,N,S: @Windows:XP:RFC1323:Windows XP/2000 (RFC1323)
*:128:1:64:M*,N,W0,N,N,T0,N,N,S: @Windows:2000:RFC1323:Windows XP/2000 (RFC1323)
*:128:1:64:M*,N,W*,N,N,T0,N,N,S: @Windows:XP:RFC1323:Windows XP (RFC1323, w+)
*:128:1:48:M536,N,N,S:   @Windows:98::Windows 98
*:128:1:48:M*,N,N,S:   @Windows:XP::Windows XP/2000
*:128:1:48:M*,N,N,S:   @Windows:2000::Windows XP/2000

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xz/usr/share/man/man3/ipq-read-3-gz/ipq_read.3
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From strings/apr_fnmatch.c, include/apr_fnmatch.h,
misc/unix/getopt.c,
file_io/unix/mktemp.c, strings/apr_strings.c:

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From dso/aix/dso.c:

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From strings/apr_strnatcmp.c, include/apr_strings.h:

 strnatcmp.c -- Perform 'natural order' comparisons of strings in C.
 Copyright (C) 2000 by Martin Pool <mbp@humbug.org.au>

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From test/CuTest.c, test/CuTest.h:

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The following was recevied Fenbruary 23,2000 From: "Linn, John" February 19,
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1.248 opencv 4.6.0

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John R. Hauser
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1.249 kmod 30

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1.251 nss-pam-ldapd 0.9.11

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1.252 pm-utils 1.4.1

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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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LuaFileSystem - File System Library for Lua
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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.
LuaFileSystem is free software and uses the same license as Lua 5.1

LuaRocks Installation

---

luarocks install luafilesystem

Documentation

Please check the documentation at 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]

Found in path(s):
* /opt/cola/permits/1547565634_1675069559.2011814/0/lunarmodules-luafilesystem-v1-5-0-0-g8ff2013-tar-gz/lunarmodules-luafilesystem-8ff2013/README

1.255 luaposix 5.1.28

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1.256 luuid 1.0

1.256.1 Available under license :

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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.
*
* Implemented by Ross Berteig <Ross@cheshireeng.com>
* Released 2007-09-24.
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*/
```

Found in path(s):
* /opt/cola/permits/1547567072_1675150749.62692/0/tp-luuid-1-051b6bb2c564-zip/wuuid.c
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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/lua/#luuid"
license = "Public domain"
maintainer = "Peter Kapec"

dependencies = {
 "lua ~> 5.1",
 Linux = {
  "uuid-dev >- 2.16"
 }
}
```

Found in path(s):
* /opt/cola/permits/1547567072_1675150749.62692/0/tp-luuid-1-051b6bb2c564-zip/dist.info
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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
possibily 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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Please send comments, suggestions, and bug reports to lhf@tecgraf.puc-rio.br .

---

uuid library:
isvalid(s) new([s]) time(s) version

Found
 in path(s):
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/*
* 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):
* /opt/cola/permits/1547567072_1675150749.62692/0/tp-luuid-1-051b6bb2c564-zip/luuid.c
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/*
* 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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*/

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Found in path(s):
* /opt/cola/permits/1547567072_1675150749.62692/0/tp-luuid-1-051b6bb2c564-zip/CMakeLists.txt
* /opt/cola/permits/1547567072_1675150749.62692/0/tp-luuid-1-051b6bb2c564-zip/cmake/lua.cmake
* /opt/cola/permits/1547567072_1675150749.62692/0/tp-luuid-1-051b6bb2c564-zip/cmake/dist.cmake

1.257 host-meson 0.55.1

1.257.1 Available under license :

```
project('bar', 'c', license: 'Apache')

executable('bar', 'bar.c')

license = meson.project_license()[0]
if license != 'Apache'
  error('The license should be Apache, but it is: ' + license)
endif
```

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1.258 host-ninja 1.10.0

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1.259 syslinux 4.07

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1.262 gvfs 1.28.2

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This option is useful when you wish to copy part of

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Version 3, 29 June 2007

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* /opt/cola/permits/1584157893_1677999786.1262538/0/snakeyaml-2-0-sources-jar/org/yaml/snakeyaml/composer/ComposerException.java
* /opt/cola/permits/1584157893_1677999786.1262538/0/snakeyaml-2-0-sources-jar/org/yaml/snakeyaml/nodes/MappingNode.java
* /opt/cola/permits/1584157893_1677999786.1262538/0/snakeyaml-2-0-sources-jar/org/yaml/snakeyaml/emitter/Emitable.java
* /opt/cola/permits/1584157893_1677999786.1262538/0/snakeyaml-2-0-sources-jar/org/yaml/snakeyaml/tokens/FlowMappingEndToken.java
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* /opt/cola/permits/1584157893_1677999786.1262538/0/snakeyaml-2-0-sources-jar/org/yaml/snakeyaml/tokens/FlowSequenceEndToken.java
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* /opt/cola/permits/1584157893_1677999786.1262538/0/snakeyaml-2-0-sources-jar/org/yaml/snakeyaml/representer/Represent.java
* /opt/cola/permits/1584157893_1677999786.1262538/0/snakeyaml-2-0-sources-jar/org/yaml/snakeyaml/nodes/Node.java
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* /opt/cola/permits/1584157893_1677999786.1262538/0/snakeyaml-2-0-sources-jar/org/yaml/snakeyaml/constructor/SafeConstructor.java
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* /opt/cola/permits/1584157893_1677999786.1262538/0/snakeyaml-2-0-sources-jar/org/yaml/snakeyaml/introspector/PropertyUtils.java
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* /opt/cola/permits/1584157893_1677999786.1262538/0/snakeyaml-2-0-sources-jar/org/yaml/snakeyaml/scanner/ScannerImpl.java
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/opt/cola/permits/1584157893_1677999786.1262538/0/snakeyaml-2-0-sources-jar/org/yaml/snakeyaml/constructor/DuplicateKeyException.java
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* /opt/cola/permits/1584157893_1677999786.1262538/0/snakeyaml-2-0-sources-jar/org/yaml/snakeyaml/introspector/GenericProperty.java
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* A Base64 encoder/decoder.
*
* <p>
* This class is used to encode and decode data in Base64 format as described in RFC 1521.
*
* <p>
* Project home page: www.
* source-code.biz/base64coder/java
* Author: Christian d'Heureuse, Inventec Informatik AG, Zurich, Switzerland
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*/

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* /opt/cola/permits/1584157893_1677999786.1262538/0/snakeyaml-2-0-sources-
jar/org/yaml/snakeyaml/external/biz/base64Coder/Base64Coder.java

1.266 apscheduler 3.10.1

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1.267 swagger-annotations 2.1.9

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* /opt/cola/permits/1610574891_1681843212.196202/0/swagger-annotations-2-1-9-sources-1-jar/io/swagger/v3/oas/annotations/responses/ApiResponses.java
* /opt/cola/permits/1610574891_1681843212.196202/0/swagger-annotations-2-1-9-sources-1-jar/io/swagger/v3/oas/annotations/security/OAuthScope.java
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/opt/cola/permits/1610574891_1681843212.196202/0/swagger-annotations-2-1-9-sources-1-jar/io/swagger/v3/oas/annotations/headers/Header.java
* /opt/cola/permits/1610574891_1681843212.196202/0/swagger-annotations-2-1-9-sources-1-jar/io/swagger/v3/oas/annotations/media/Content.java
* /opt/cola/permits/1610574891_1681843212.196202/0/swagger-annotations-2-1-9-sources-1-jar/io/swagger/v3/oas/annotations/security/SecurityRequirements.java
* /opt/cola/permits/1610574891_1681843212.196202/0/swagger-annotations-2-1-9-sources-1-jar/io/swagger/v3/oas/annotations/security/OAuthFlows.java
* /opt/cola/permits/1610574891_1681843212.196202/0/swagger-annotations-2-1-9-sources-1-jar/io/swagger/v3/oas/annotations/media/Schema.java
* /opt/cola/permits/1610574891_1681843212.196202/0/swagger-annotations-2-1-9-sources-1-jar/io/swagger/v3/oas/annotations/servers/Servers.java
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* /opt/cola/permits/1610574891_1681843212.196202/0/swagger-annotations-2-1-9-sources-1-jar/io/swagger/v3/oas/annotations/tags/Tag.java
* /opt/cola/permits/1610574891_1681843212.196202/0/swagger-annotations-2-1-9-sources-1-jar/io/swagger/v3/oas/annotations/callbacks/Callback.java
* /opt/cola/permits/1610574891_1681843212.196202/0/swagger-annotations-2-1-9-sources-1-jar/io/swagger/v3/oas/annotations/links/Link.java
* /opt/cola/permits/1610574891_1681843212.196202/0/swagger-annotations-2-1-9-sources-1-jar/io/swagger/v3/oas/annotations/security/SecurityRequirement.java
* /opt/cola/permits/1610574891_1681843212.196202/0/swagger-annotations-2-1-9-sources-1-jar/io/swagger/v3/oas/annotations/Parameters.java
* /opt/cola/permits/1610574891_1681843212.196202/0/swagger-annotations-2-1-9-sources-1-jar/io/swagger/v3/oas/annotations/extensions/Extensions.java
*
/opt/cola/permits/1610574891_1681843212.196202/0/swagger-annotations-2-1-9-sources-1-jar/io/swagger/v3/oas/annotations/security/OAuthFlow.java
* /opt/cola/permits/1610574891_1681843212.196202/0/swagger-annotations-2-1-9-sources-1-jar/io/swagger/v3/oas/annotations/security/SecurityScheme.java
* /opt/cola/permits/1610574891_1681843212.196202/0/swagger-annotations-2-1-9-sources-1-jar/io/swagger/v3/oas/annotations/media/ExampleObject.java
* /opt/cola/permits/1610574891_1681843212.196202/0/swagger-annotations-2-1-9-sources-1-jar/io/swagger/v3/oas/annotations/media/Encoding.java
* /opt/cola/permits/1610574891_1681843212.196202/0/swagger-annotations-2-1-9-sources-1-jar/io/swagger/v3/oas/annotations/Parameter.java
* /opt/cola/permits/1610574891_1681843212.196202/0/swagger-annotations-2-1-9-sources-1-jar/io/swagger/v3/oas/annotations/ExternalDocumentation.java

* /opt/cola/permits/1610574891_1681843212.196202/0/swagger-annotations-2-1-9-sources-1-jar/io/swagger/v3/oas/annotations/parameters/RequestBody.java
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/opt/cola/permits/1610574891_1681843212.196202/0/swagger-annotations-2-1-9-sources-1-jar/io/swagger/v3/oas/annotations/Operation.java
* /opt/cola/permits/1610574891_1681843212.196202/0/swagger-annotations-2-1-9-sources-1-jar/io/swagger/v3/oas/annotations/info/License.java
* /opt/cola/permits/1610574891_1681843212.196202/0/swagger-annotations-2-1-9-sources-1-jar/io/swagger/v3/oas/annotations/servers/ServerVariable.java
* /opt/cola/permits/1610574891_1681843212.196202/0/swagger-annotations-2-1-9-sources-1-jar/io/swagger/v3/oas/annotations/security/SecuritySchemes.java
* /opt/cola/permits/1610574891_1681843212.196202/0/swagger-annotations-2-1-9-sources-1-jar/io/swagger/v3/oas/annotations/links/LinkParameter.java
* /opt/cola/permits/1610574891_1681843212.196202/0/swagger-annotations-2-1-9-sources-1-jar/io/swagger/v3/oas/annotations/responses/ApiResponse.java
* /opt/cola/permits/1610574891_1681843212.196202/0/swagger-annotations-2-1-9-sources-1-jar/io/swagger/v3/oas/annotations/info/Contact.java
*
/opt/cola/permits/1610574891_1681843212.196202/0/swagger-annotations-2-1-9-sources-1-jar/io/swagger/v3/oas/annotations/OpenAPIDefinition.java
* /opt/cola/permits/1610574891_1681843212.196202/0/swagger-annotations-2-1-9-sources-1-jar/io/swagger/v3/oas/annotations/media/DiscriminatorMapping.java
* /opt/cola/permits/1610574891_1681843212.196202/0/swagger-annotations-2-1-9-sources-1-jar/io/swagger/v3/oas/annotations/tags/Tags.java
* /opt/cola/permits/1610574891_1681843212.196202/0/swagger-annotations-2-1-9-sources-1-jar/io/swagger/v3/oas/annotations/Hidden.java
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1.268 protobuf 3.6.1.3-2ubuntu5.2

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 Leandro Lucarella <llucax@gmail.com>
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   * Fix compiler to not make output executable.
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   * 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.
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 Monty Taylor <monty.taylor@gmail.com>

  * Solaris 10 + Sun Studio fixes.
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  * 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.
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  * 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.
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  * Emacs mode for Protocol Buffers (editors/protobuf-mode.el).
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  * 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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1.269 spring-expression 5.2.24.RELEASE

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* /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/standard/SpelCompiler.java
*
 /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/ast/MethodReference.java
* /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/support/ReflectivePropertyAccessor.java
* /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/ast/AstUtils.java
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* /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/TypeLocator.java
* /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/MethodFilter.java
*
 /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/EvaluationException.java
* /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/standard/TokenKind.java
* /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/ConstructorResolver.java
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* /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/ExpressionInvocationTargetException.java
*
 /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/MethodResolver.java
* /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/MethodExecutor.java
* /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/ConstructorExecutor.java

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* /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/common/ExpressionUtils.java
*
 /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/SpelParseException.java
* /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-

jar/org/springframework/expression/ParseException.java
* /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/OperatorOverloader.java
* /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/Expression.java
* /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/standard/Token.java
* /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/support/ReflectiveConstructorExecutor.java
* /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/TypeConverter.java
*
/opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/AccessException.java
* /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/ParserContext.java
* /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/SpelParserConfiguration.java
* /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/support/StandardTypeLocator.java
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* /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/BeanResolver.java
*
/opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-jar/org/springframework/expression/spel/ast/BeanReference.java
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* /opt/cola/permits/1651261883_1682398716.5588427/0/spring-expression-5-2-24-release-sources-

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* /opt/cola/permits/1651261834_1682321546.5973234/0/spring-beans-5-2-24-release-sources-jar/org/springframework/beans/BeanMetadataElement.java
* /opt/cola/permits/1651261834_1682321546.5973234/0/spring-beans-5-2-24-release-sources-jar/org/springframework/beans/PropertyDescriptorUtils.java
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* /opt/cola/permits/1651261834_1682321546.5973234/0/spring-beans-5-2-24-release-sources-jar/org/springframework/beans/factory/xml/AbstractSingleBeanDefinitionParser.java
* /opt/cola/permits/1651261834_1682321546.5973234/0/spring-beans-5-2-24-release-sources-jar/org/springframework/beans/PropertyAccessorUtils.java
* /opt/cola/permits/1651261834_1682321546.5973234/0/spring-beans-5-2-24-release-sources-jar/org/springframework/beans/factory/config/MapFactoryBean.java
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* /opt/cola/permits/1651261834_1682321546.5973234/0/spring-beans-5-2-24-release-sources-jar/org/springframework/beans/propertyeditors/ByteArrayPropertyEditor.java
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* /opt/cola/permits/1651261834_1682321546.5973234/0/spring-beans-5-2-24-release-sources-jar/org/springframework/beans/factory/xml/AbstractSimpleBeanDefinitionParser.java

* /opt/cola/permits/1651261834_1682321546.5973234/0/spring-beans-5-2-24-release-sources-jar/org/springframework/beans/factory/annotation/AnnotatedBeanDefinition.java
*
 /opt/cola/permits/1651261834_1682321546.5973234/0/spring-beans-5-2-24-release-sources-jar/org/springframework/beans/factory/SmartInitializingSingleton.java
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* /opt/cola/permits/1651261834_1682321546.5973234/0/spring-beans-5-2-24-release-sources-jar/org/springframework/beans/factory/annotation/Autowire.java

1.271 berkeley-db 4.4.20

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* $Id: LICENSE,v 12.1 2005/06/16 20:20:10 bostic Exp $
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1.272 libgpg-error 1.37-1

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1.280 libnss-nis 3.2

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1.281 apr 1.7.4

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file_io/unix/mktemp.c, strings/apr_strings.c:

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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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From
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1.282 cairo 1.17.6

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fontconfig/fc-case/CaseFolding.txt

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---

fontconfig/src/fcatomic.h

/*
* Mutex operations. Originally copied from HarfBuzz.
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*/

---

fontconfig/src/fcfoundry.h

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*/

---

fontconfig/src/fcmd5.h

/*
* 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.
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*
* 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.
*/

---

fontconfig/src/fcmutex.h

/*
* Atomic int and pointer operations. Originally copied from HarfBuzz.
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*/

---

fontconfig/src/ftglue.[ch]

```
/* ftglue.c: Glue code for compiling the OpenType code from
*           FreeType 1 using only the public API of FreeType 2
*
* By David Turner, The FreeType Project (www.freetype.org)
*
* This code is explicitely put in the public domain
*
* ========================================================================
*
* the OpenType
 parser codes was originally written as an extension to
* FreeType 1.x. As such, its source code was embedded within the library,
* and used many internal FreeType functions to deal with memory and
* stream i/o.
*
* When it was 'salvaged' for Pango and Qt, the code was "ported" to FreeType 2,
* which basically means that some macro tricks were performed in order to
* directly access FT2 _internal_ functions.
*
* these functions were never part of FT2 public API, and _did_ change between
* various releases. This created chaos for many users: when they upgraded the
* FreeType library on their system, they couldn't run Gnome anymore since
* Pango refused to link.
*
* Very fortunately, it's possible to completely avoid this problem because
* the FT_StreamRec and FT_MemoryRec structure types, which describe how
* memory and stream implementations interface with the rest of the font
* library, have always been part of the public API, and never changed.
*
* What we do
 thus is re-implement, within the OpenType parser, the few
* functions that depend on them. This only adds one or two kilobytes of
* code, and ensures that the parser can work with _any_ version
* of FreeType installed on your system. How sweet... !
*
* Note that we assume that Pango doesn't use any other internal functions
* from FreeType. It used to in old versions, but this should no longer
* be the case. (crossing my fingers).
*
*  - David Turner
*  - The FreeType Project  (www.freetype.org)
*
* PS: This "glue" code is explicitely put in the public domain
*/
```

1.285 acl 2.2.52

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Tue, 26 Feb 2002 13:25:26 +1100

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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.

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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.

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 combine 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.

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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) Use a suitable shared library
mechanism for linking with the
Library. A suitable mechanism is one that (1) uses at run time a copy of the library already present on the user's computer system, rather than copying library functions into the executable, and (2) will operate properly with a modified version of the library, if the user installs one, as long as the modified version is interface-compatible with the version that the work was made with.

c) 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.

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

For an executable, the required form of the "work that uses the
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reproducing the executable from it. However, as a special exception,
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1.286 libmspack 0.10.1

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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.

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4. You may copy and distribute the Library (or a portion or
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If distribution of object code is made by offering access to copy
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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
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This code is derived from section 17.1 of Applied Cryptography,
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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
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This code implements the MD5 message-digest algorithm.
The algorithm is due to Ron Rivest. This code was
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Equivalent code is available from RSA Data Security, Inc.
This code has been tested against that, and is equivalent,
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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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1.290 libpcap 1.8.0

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@Ci{$Id: manual.of $}
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@sect1{@title{Introduction}

Lua is a powerful, efficient, lightweight, embeddable scripting language.
It supports procedural programming,
object-oriented programming, functional programming,
data-driven programming, and data description.

Lua combines simple procedural syntax with powerful data description
constructs based on associative arrays and extensible semantics.
Lua is dynamically typed,
runs by interpreting bytecode with a register-based
virtual machine,
and has automatic memory management with
a generational garbage collection,
making it ideal for configuration, scripting,
and rapid prototyping.

Lua is implemented as a library, written in @emphx{clean C},
the common subset of @N{standard C} and C++.
The Lua distribution includes a host program called @id{lua},
which uses the Lua library to offer
a complete,
standalone Lua interpreter,
for interactive or batch use.
Lua is intended to be used both as a powerful, lightweight,
embeddable scripting language for any program that needs one,
and as a powerful but lightweight and efficient stand-alone language.

As an extension language, Lua has no notion of a @Q{main} program:
it works @emph{embedded} in a host client,
called the @emph{embedding program} or simply the @emphx{host}.
(Frequently, this host is the stand-alone @id{lua} program.)
The host program can invoke functions to execute a piece of Lua code,
can write and read Lua variables,
and can register @N{C functions} to be called by Lua code.
Through the use of @N{C functions}, Lua can be augmented to cope with
a wide range of different domains,
thus creating customized programming languages sharing a syntactical framework.

Lua is free software,
and is provided as usual with no guarantees,
as stated in its license.
The implementation described in this manual is available
at
Lua's official web site, @id{www.lua.org}.

Like any other reference manual,
this document is dry in places.
For a discussion of the decisions behind the design of Lua,

see the technical papers available at Lua's web site.
For a detailed introduction to programming in Lua,
see Roberto's book, @emphx{Programming in Lua}.

}

@C{--}
@sect1{basic| @title{Basic Concepts}

@simplesect{

This section describes the basic concepts of the language.

}

@sect2{TypesSec| @title{Values and Types}

Lua is a dynamically typed language.
This means that
variables do not have types; only values do.
There are no type definitions in the language.
All values carry their own type.

All values in Lua are first-class values.
This means that all values can be stored in variables,
passed as arguments to other functions, and returned as results.

There are eight @x{basic types} in Lua:
@def{nil}, @def{boolean}, @def{number},
@def{string},
 @def{function}, @def{userdata},
@def{thread}, and @def{table}.
The type @emph{nil} has one single value, @nil,
whose main property is to be different from any other value;
it often represents the absence of a useful value.
The type @emph{boolean} has two values, @false and @true.
Both @nil and @false make a condition false;
they are collectively called @def{false values}.
Any other value makes a condition true.
Despite its name,
@false is frequently used as an alternative to @nil,
with the key difference that @false behaves
like a regular value in a table,
while a @nil in a table represents an absent key.

The type @emph{number} represents both
integer numbers and real (floating-point) numbers,

using two @x{subtypes}: @def{integer} and @def{float}.
Standard Lua uses 64-bit integers and double-precision (64-bit) floats,
but you can also compile Lua so that it
uses 32-bit integers and/or single-precision (32-bit) floats.
The option with 32 bits for both integers and floats
is particularly
attractive
for small machines and embedded systems.
(See macro @id{LUA_32BITS} in file @id{luaconf.h}.)

Unless stated otherwise,
any overflow when manipulating integer values @def{wrap around},
according to the usual rules of two-complement arithmetic.
(In other words,
the actual result is the unique representable integer
that is equal modulo @M{2@sp{n}} to the mathematical result,
where @M{n} is the number of bits of the integer type.)

Lua has explicit rules about when each subtype is used,
but it also converts between them automatically as needed @see{coercion}.
Therefore,
the programmer may choose to mostly ignore the difference
between integers and floats
or to assume complete control over the representation of each number.

The type @emph{string} represents immutable sequences of bytes.
@index{eight-bit clean}
Lua is 8-bit clean:
strings can contain any 8-bit value,
including @x{embedded zeros} (@Char{\0}).
Lua is also encoding-agnostic;
it makes no assumptions about the contents
of a string.
The length of any string in Lua must fit in a Lua integer.

Lua can call (and manipulate) functions written in Lua and
functions written in C @see{functioncall}.
Both are represented by the type @emph{function}.

The type @emph{userdata} is provided to allow arbitrary @N{C data} to
be stored in Lua variables.
A userdata value represents a block of raw memory.
There are two kinds of userdata:
@emphx{full userdata},
which is an object with a block of memory managed by Lua,
and @emphx{light userdata},
which is simply a @N{C pointer} value.
Userdata has no predefined operations in Lua,

except assignment and identity test.
By using @emph{metatables},
the programmer can define operations for full userdata values
@see{metatable}.
Userdata values cannot be created or modified in Lua,
only through the @N{C API}.
This guarantees the integrity of data owned by
the host program and @N{C libraries}.

The type @def{thread} represents independent threads of execution
and it is used to
implement coroutines @see{coroutine}.
Lua threads are not related to operating-system threads.
Lua supports coroutines on all systems,
even those that do not support threads natively.

The type @emph{table} implements @x{associative arrays},
that is, @x{arrays} that can have as indices not only numbers,
but any Lua value except @nil and @x{NaN}.
(@emphx{Not a Number} is a special floating-point value
used by the @x{IEEE 754} standard to represent
undefined numerical results, such as @T{0/0}.)
Tables can be @emph{heterogeneous};
that is, they can contain values of all types (except @nil).
Any key associated to the value @nil is not considered part of the table.
Conversely, any key that is not part of a table has
an associated value @nil.

Tables are the sole data-structuring mechanism in Lua;
they can be used to represent ordinary arrays, lists,
symbol tables, sets, records, graphs, trees, etc.
To represent @x{records}, Lua uses the field name as an index.
The language supports this representation
by
providing @id{a.name} as syntactic sugar for @T{a["name"]}.
There are several convenient ways to create tables in Lua
@see{tableconstructor}.

Like indices,
the values of table fields can be of any type.
In particular,
because functions are first-class values,
table fields can contain functions.
Thus tables can also carry @emph{methods} @see{func-def}.

The indexing of tables follows
the definition of raw equality in the language.
The expressions @T{a[i]} and @T{a[j]}

denote the same table element
if and only if @id{i} and @id{j} are raw equal
(that is, equal without metamethods).
In particular, floats with integral values
are equal to their respective integers
(e.g., @T{1.0 == 1}).
To avoid ambiguities,
any float used as a key that is equal to an integer
is converted to that integer.
For instance, if you write @T{a[2.0] = true},
the actual key inserted into the table will be the integer @T{2}.

Tables, functions, threads, and (full) userdata values are @emph{objects}:
variables
do not actually @emph{contain} these values,
only @emph{references} to them.
Assignment, parameter passing, and function returns
always manipulate references to such values;
these operations do not imply any kind of copy.

The library function @Lid{type} returns a string describing the type
of a given value @seeF{type}.

}

@sect2{globalenv| @title{Environments and the Global Environment}

As we will discuss further in @refsec{variables} and @refsec{assignment},
any reference to a free name
(that is, a name not bound to any declaration) @id{var}
is syntactically translated to @T{_ENV.var}.
Moreover, every chunk is compiled in the scope of
an external local variable named @id{_ENV} @see{chunks},
so @id{_ENV} itself is never a free name in a chunk.

Despite the existence of this external @id{_ENV} variable and
the translation of free names,
@id{_ENV} is a completely regular name.
In particular,
you can define new variables and parameters with that name.
Each reference to a free
name uses the @id{_ENV} that is
visible at that point in the program,
following the usual visibility rules of Lua @see{visibility}.

Any table used as the value of @id{_ENV} is called an @def{environment}.

Lua keeps a distinguished environment called the @def{global environment}.
This value is kept at a special index in the C registry @see{registry}.
In Lua, the global variable @Lid{_G} is initialized with this same value.
(@Lid{_G} is never used internally,
so changing its value will affect only your own code.)

When Lua loads a chunk,
the default value for its @id{_ENV} variable
is the global environment @seeF{load}.
Therefore, by default,
free names in Lua code refer to entries in the global environment
and, therefore, they are also called @def{global variables}.
Moreover, all standard libraries are loaded in the global environment
and some functions there operate on that environment.
You can use @Lid{load} (or @Lid{loadfile})
to load a chunk with a different environment.
(In C,
you have to load the chunk and then change the value
of its first upvalue; see @See{lua_setupvalue}.)

}

@sect2{error| @title{Error Handling}

Several operations in Lua can @emph{raise} an error.
An error interrupts the normal flow of the program,
which can continue by @emph{catching} the error.

Lua code can explicitly raise an error by calling the
@Lid{error} function.
(This function never returns.)

To catch errors in Lua,
you can do a @def{protected call},
using @Lid{pcall} (or @Lid{xpcall}).
The function @Lid{pcall} calls a given function in @def{protected mode}.
Any error while running the function stops its execution,
and control returns immediately to @id{pcall},
which returns a status code.

Because Lua is an embedded extension language,
Lua code starts running by a call
from @N{C code} in the host program.
(When you use Lua standalone,
the @id{lua} application is the host program.)
Usually, this call is protected;
so, when an otherwise unprotected error occurs during
the compilation

or execution of a Lua chunk,
control returns to the host,
which can take appropriate measures,
such as printing an error message.

Whenever there is an error,
an @def{error object}
is propagated with information about the error.
Lua itself only generates errors whose error object is a string,
but programs may generate errors with
any value as the error object.
It is up to the Lua program or its host to handle such error objects.
For historical reasons,
an error object is often called an @def{error message},
even though it does not have to be a string.

When you use @Lid{xpcall} (or @Lid{lua_pcall}, in C)
you may give a @def{message handler}
to be called in case of errors.
This function is called with the original error object
and returns a new error object.
It is called before the error unwinds the stack,
so that it can gather more information about the error,
for instance by inspecting the stack and creating a stack traceback.
This message handler is still protected by the
protected call;
so, an error inside the message handler
will call the message handler again.
If this loop goes on for too long,
Lua breaks it and returns an appropriate message.
The message handler is called only for regular runtime errors.
It is not called for memory-allocation errors
nor for errors while running finalizers or other message handlers.

Lua also offers a system of @emph{warnings} @seeF{warn}.
Unlike errors, warnings do not interfere
in any way with program execution.
They typically only generate a message to the user,
although this behavior can be adapted from C @seeC{lua_setwarnf}.

}

@sect2{metatable| @title{Metatables and Metamethods}

Every value in Lua can have a @emph{metatable}.
This @def{metatable} is an ordinary Lua table
that defines the behavior of the original value

under certain events.
You can change several aspects of the behavior
of a value by setting specific fields in its metatable.
For instance, when a non-numeric value is the operand of an addition,
Lua
checks for a function in the field @idx{__add} of the value's metatable.
If it finds one,
Lua calls this function to perform the addition.

The key for each event in a metatable is a string
with the event name prefixed by two underscores;
the corresponding value is called a @def{metavalue}.
For most events, the metavalue must be a function,
which is then called a @def{metamethod}.
In the previous example, the key is the string @St{__add}
and the metamethod is the function that performs the addition.
Unless stated otherwise,
a metamethod may in fact be any @x{callable value},
which is either a function or a value with a @idx{__call} metamethod.

You can query the metatable of any value
using the @Lid{getmetatable} function.
Lua queries metamethods in metatables using a raw access @seeF{rawget}.

You can replace the metatable of tables
using the @Lid{setmetatable} function.
You cannot change the metatable of other types from Lua code,
except by using the @link{debuglib|debug library}.

Tables
and full userdata have individual metatables,
although multiple tables and userdata can share their metatables.
Values of all other types share one single metatable per type;
that is, there is one single metatable for all numbers,
one for all strings, etc.
By default, a value has no metatable,
but the string library sets a metatable for the string type @see{strlib}.

A detailed list of operations controlled by metatables is given next.
Each event is identified by its corresponding key.
By convention, all metatable keys used by Lua are composed by
two underscores followed by lowercase Latin letters.

@description{

@item{@idx{__add}|
the addition (@T{+}) operation.
If any operand for an addition is not a number,

Lua will try to call a metamethod.
It starts by checking the first operand (even if it is a number);
if that operand does not define a metamethod for @idx{__add},
then Lua will check the second operand.
If Lua can find a metamethod,
it calls the metamethod with the two
operands as arguments,
and the result of the call
(adjusted to one value)
is the result of the operation.
Otherwise, if no metamethod is found,
Lua raises an error.
}

@item{@idx{__sub}|
the subtraction (@T{-}) operation.
Behavior similar to the addition operation.
}

@item{@idx{__mul}|
the multiplication (@T{*}) operation.
Behavior similar to the addition operation.
}

@item{@idx{__div}|
the division (@T{/}) operation.
Behavior similar to the addition operation.
}

@item{@idx{__mod}|
the modulo (@T{%}) operation.
Behavior similar to the addition operation.
}

@item{@idx{__pow}|
the exponentiation (@T{^}) operation.
Behavior similar to the addition operation.
}

@item{@idx{__unm}|
the negation (unary @T{-}) operation.
Behavior similar to the addition operation.
}

@item{@idx{__idiv}|
the floor division (@T{//}) operation.
Behavior similar to the addition operation.
}

@item{@idx{__band}|
the bitwise AND (@T{&}) operation.
Behavior similar to the addition operation,
except that Lua will
try a metamethod
if any operand is neither an integer
nor a float coercible to an integer @see{coercion}.
}

@item{@idx{__bor}|
the bitwise OR (@T{|}) operation.
Behavior similar to the bitwise AND operation.
}

@item{@idx{__bxor}|
the bitwise exclusive OR (binary @T{~}) operation.
Behavior similar to the bitwise AND operation.
}

@item{@idx{__bnot}|
the bitwise NOT (unary @T{~}) operation.
Behavior similar to the bitwise AND operation.
}

@item{@idx{__shl}|
the bitwise left shift (@T{<<}) operation.
Behavior similar to the bitwise AND operation.
}

@item{@idx{__shr}|
the bitwise right shift (@T{>>}) operation.
Behavior similar to the bitwise AND operation.
}

@item{@idx{__concat}|
the concatenation (@T{..}) operation.
Behavior similar to the addition operation,
except that Lua will try a metamethod
if any operand is neither a string nor a number
(which is always coercible to a string).
}

@item{@idx{__len}|
the length (@T{#}) operation.
If the object is not a string,
Lua will try its

metamethod.
If there is a metamethod,
Lua calls it with the object as argument,
and the result of the call
(always adjusted to one value)
is the result of the operation.
If there is no metamethod but the object is a table,
then Lua uses the table length operation @see{len-op}.
Otherwise, Lua raises an error.
}

@item{@idx{__eq}|
the equal (@T{==}) operation.
Behavior similar to the addition operation,
except that Lua will try a metamethod only when the values
being compared are either both tables or both full userdata
and they are not primitively equal.
The result of the call is always converted to a boolean.
}

@item{@idx{__lt}|
the less than (@T{<}) operation.
Behavior similar to the addition operation,
except that Lua will try a metamethod only when the values
being compared are neither both numbers nor both strings.
Moreover, the result of the call is always converted to a boolean.
}

@item{@idx{__le}|
the less equal (@T{<=}) operation.
Behavior similar to the less than operation.
}

@item{@idx{__index}|
The
indexing access operation @T{table[key]}.
This event happens when @id{table} is not a table or
when @id{key} is not present in @id{table}.
The metavalue is looked up in the metatable of @id{table}.

The metavalue for this event can be either a function, a table,
or any value with an @idx{__index} metavalue.
If it is a function,
it is called with @id{table} and @id{key} as arguments,
and the result of the call
(adjusted to one value)
is the result of the operation.
Otherwise,

the final result is the result of indexing this metavalue with @id{key}.
This indexing is regular, not raw,
and therefore can trigger another @idx{__index} metavalue.
}

@item{@idx{__newindex}|
The indexing assignment @T{table[key] = value}.
Like the index event,
this event happens when @id{table} is not a table or
when @id{key} is not present in @id{table}.
The metavalue is looked up in the metatable of @id{table}.

Like with indexing,
the metavalue for this event can be either a function,
a table,
or any value with an @idx{__newindex} metavalue.
If it is a function,
it is called with @id{table}, @id{key}, and @id{value} as arguments.
Otherwise,
Lua repeats the indexing assignment over this metavalue
with the same key and value.
This assignment is regular, not raw,
and therefore can trigger another @idx{__newindex} metavalue.

Whenever a @idx{__newindex} metavalue is invoked,
Lua does not perform the primitive assignment.
If needed,
the metamethod itself can call @Lid{rawset}
to do the assignment.
}

@item{@idx{__call}|
The call operation @T{func(args)}.
This event happens when Lua tries to call a non-function value
(that is, @id{func} is not a function).
The metamethod is looked up in @id{func}.
If present,
the metamethod is called with @id{func} as its first argument,
followed by the arguments of the original call (@id{args}).
All results of the call
are the results of the operation.
This is the only metamethod that allows multiple results.
}

}

In addition to

the previous list,
the interpreter also respects the following keys in metatables:
@idx{__gc} @see{finalizers},
@idx{__close} @see{to-be-closed},
@idx{__mode} @see{weak-table},
and @idx{__name}.
(The entry @idx{__name},
when it contains a string,
may be used by @Lid{tostring} and in error messages.)

For the unary operators (negation, length, and bitwise NOT),
the metamethod is computed and called with a dummy second operand,
equal to the first one.
This extra operand is only to simplify Lua's internals
(by making these operators behave like a binary operation)
and may be removed in future versions.
For most uses this extra operand is irrelevant.

Because metatables are regular tables,
they can contain arbitrary fields,
not only the event names defined above.
Some functions in the standard library
(e.g., @Lid{tostring})
use other fields in metatables for their own purposes.

It is a good practice to add all needed metamethods to a table
before setting it as a metatable of some object.
In
particular, the @idx{__gc} metamethod works only when this order
is followed @see{finalizers}.
It is also a good practice to set the metatable of an object
right after its creation.

}

@sect2{GC| @title{Garbage Collection}

@simplesect{

Lua performs automatic memory management.
This means that
you do not have to worry about allocating memory for new objects
or freeing it when the objects are no longer needed.
Lua manages memory automatically by running
a @def{garbage collector} to collect all @emph{dead} objects.
All memory used by Lua is subject to automatic management:
strings, tables, userdata, functions, threads, internal structures, etc.

An object is considered @def{dead}
as soon as the collector can be sure the object
will not be accessed again in the normal execution of the program.
(@Q{Normal execution} here excludes finalizers,
which can resurrect dead objects @see{finalizers},
and excludes also operations using the debug library.)
Note that the time when the collector can
be sure that an object
is dead may not coincide with the programmer's expectations.
The only guarantees are that Lua will not collect an object
that may still be accessed in the normal execution of the program,
and it will eventually collect an object
that is inaccessible from Lua.
(Here,
@emph{inaccessible from Lua} means that neither a variable nor
another live object refer to the object.)
Because Lua has no knowledge about @N{C code},
it never collects objects accessible through the registry @see{registry},
which includes the global environment @see{globalenv}.

The garbage collector (GC) in Lua can work in two modes:
incremental and generational.

The default GC mode with the default parameters
are adequate for most uses.
However, programs that waste a large proportion of their time
allocating and freeing memory can benefit from other settings.
Keep in mind that the GC behavior is non-portable
both across platforms and across different Lua releases;
therefore, optimal settings
are also non-portable.

You can change the GC mode and parameters by calling
@Lid{lua_gc} @N{in C}
or @Lid{collectgarbage} in Lua.
You can also use these functions to control
the collector directly (e.g., to stop and restart it).

}

@sect3{incmode| @title{Incremental Garbage Collection}

In incremental mode,
each GC cycle performs a mark-and-sweep collection in small steps
interleaved with the program's execution.
In this mode,
the collector uses three numbers to control its garbage-collection cycles:

the @def{garbage-collector pause},
the @def{garbage-collector step multiplier},
and the @def{garbage-collector step size}.

The garbage-collector pause
controls how long the collector waits before starting a new cycle.
The collector starts a new cycle when the use of memory
hits @M{n%} of the use after the previous collection.
Larger values make the collector less aggressive.
Values equal to or less than 100 mean the collector will not wait to
start a new cycle.
A value of 200 means that
the collector waits for the total memory in use
to double before starting a new cycle.
The default value is 200; the maximum value is 1000.

The garbage-collector step multiplier
controls the speed of the collector relative to
memory allocation,
that is,
how many elements it marks or sweeps for each
kilobyte of memory allocated.
Larger values make the collector more aggressive but also increase
the size of each incremental step.
You should not use values less than 100,
because they make the collector too slow and
can result in the collector never finishing a cycle.
The default value is 100; the maximum value is 1000.

The garbage-collector step size controls the
size of each incremental step,
specifically how many bytes the interpreter allocates
before performing a step.
This parameter is logarithmic:
A value of @M{n} means the interpreter will allocate @M{2@sp{n}}
bytes between steps and perform equivalent work during the step.
A large value (e.g., 60) makes the collector a stop-the-world
(non-incremental)
collector.
The default value is 13,
which means steps of approximately @N{8 Kbytes}.

}

@sect3{genmode| @title{Generational Garbage Collection}

In generational mode,
the collector does frequent @emph{minor} collections,

which traverses only objects recently created.
If after a minor collection the use of memory is still above a limit,
the collector does a stop-the-world @emph{major} collection,
which traverses all objects.
The generational mode uses two parameters:
the @def{minor multiplier} and the @def{the major multiplier}.

The minor multiplier controls the frequency of minor collections.
For a minor multiplier @M{x},
a new minor collection will be done when memory
grows @M{x%} larger than the memory in use after the previous major
collection.
For instance, for a multiplier of 20,
the collector will do a minor collection when the use of memory
gets 20% larger than the use after the previous major collection.
The default value is 20; the maximum value is 200.

The
major multiplier controls the frequency of major collections.
For a major multiplier @M{x},
a new major collection will be done when memory
grows @M{x%} larger than the memory in use after the previous major
collection.
For instance, for a multiplier of 100,
the collector will do a major collection when the use of memory
gets larger than twice the use after the previous collection.
The default value is 100; the maximum value is 1000.

}

@sect3{finalizers| @title{Garbage-Collection Metamethods}

You can set garbage-collector metamethods for tables
and, using the @N{C API},
for full userdata @see{metatable}.
These metamethods, called @def{finalizers},
are called when the garbage collector detects that the
corresponding table or userdata is dead.
Finalizers allow you to coordinate Lua's garbage collection
with external resource management such as closing files,
network or database connections,
or freeing your own memory.

For an object (table or userdata) to be finalized when collected,
you
must @emph{mark} it for finalization.
@index{mark (for finalization)}
You mark an object for finalization when you set its metatable

and the metatable has a @idx{__gc} metamethod.
Note that if you set a metatable without a @idx{__gc} field
and later create that field in the metatable,
the object will not be marked for finalization.

When a marked object becomes dead,
it is not collected immediately by the garbage collector.
Instead, Lua puts it in a list.
After the collection,
Lua goes through that list.
For each object in the list,
it checks the object's @idx{__gc} metamethod:
If it is present,
Lua calls it with the object as its single argument.

At the end of each garbage-collection cycle,
the finalizers are called in
the reverse order that the objects were marked for finalization,
among those collected in that cycle;
that is, the first finalizer to be called is the one associated
with the object marked last in the program.
The execution of each finalizer may occur at any
point during
the execution of the regular code.

Because the object being collected must still be used by the finalizer,
that object (and other objects accessible only through it)
must be @emph{resurrected} by Lua.@index{resurrection}
Usually, this resurrection is transient,
and the object memory is freed in the next garbage-collection cycle.
However, if the finalizer stores the object in some global place
(e.g., a global variable),
then the resurrection is permanent.
Moreover, if the finalizer marks a finalizing object for finalization again,
its finalizer will be called again in the next cycle where the
object is dead.
In any case,
the object memory is freed only in a GC cycle where
the object is dead and not marked for finalization.

When you close a state @seeF{lua_close},
Lua calls the finalizers of all objects marked for finalization,
following the reverse order that they were marked.
If any finalizer marks objects for collection during that phase,
these marks have no effect.

Finalizers

cannot yield nor run the garbage collector.
Because they can run in unpredictable times,
it is good practice to restrict each finalizer
to the minimum necessary to properly release
its associated resource.

Any error while running a finalizer generates a warning;
the error is not propagated.

}

@sect3{weak-table| @title{Weak Tables}

A @def{weak table} is a table whose elements are
@def{weak references}.
A weak reference is ignored by the garbage collector.
In other words,
if the only references to an object are weak references,
then the garbage collector will collect that object.

A weak table can have weak keys, weak values, or both.
A table with weak values allows the collection of its values,
but prevents the collection of its keys.
A table with both weak keys and weak values allows the collection of
both keys and values.
In any case, if either the key or the value is collected,
the whole pair is removed from the table.
The weakness of a table is controlled by the
@idx{__mode}
field of its metatable.
This metavalue, if present, must be one of the following strings:
@St{k}, for a table with weak keys;
@St{v}, for a table with weak values;
or @St{kv}, for a table with both weak keys and values.

A table with weak keys and strong values
is also called an @def{ephemeron table}.
In an ephemeron table,
a value is considered reachable only if its key is reachable.
In particular,
if the only reference to a key comes through its value,
the pair is removed.

Any change in the weakness of a table may take effect only
at the next collect cycle.
In particular, if you change the weakness to a stronger mode,
Lua may still collect some items from that table
before the change takes effect.

Only objects that have an explicit construction
are removed from weak tables.
Values, such as numbers and @x{light @N{C functions}},
are not subject to garbage collection,
and therefore are not removed from weak tables
(unless their associated values are collected).
Although strings
are subject to garbage collection,
they do not have an explicit construction and
their equality is by value;
they behave more like values than like objects.
Therefore, they are not removed from weak tables.

Resurrected objects
(that is, objects being finalized
and objects accessible only through objects being finalized)
have a special behavior in weak tables.
They are removed from weak values before running their finalizers,
but are removed from weak keys only in the next collection
after running their finalizers, when such objects are actually freed.
This behavior allows the finalizer to access properties
associated with the object through weak tables.

If a weak table is among the resurrected objects in a collection cycle,
it may not be properly cleared until the next cycle.

}

}

@sect2{coroutine| @title{Coroutines}

Lua supports coroutines,
also called @emphx{collaborative multithreading}.
A coroutine in Lua represents an independent thread of execution.
Unlike threads in multithread
systems, however,
a coroutine only suspends its execution by explicitly calling
a yield function.

You create a coroutine by calling @Lid{coroutine.create}.
Its sole argument is a function
that is the main function of the coroutine.
The @id{create} function only creates a new coroutine and
returns a handle to it (an object of type @emph{thread});
it does not start the coroutine.

You execute a coroutine by calling @Lid{coroutine.resume}.
When you first call @Lid{coroutine.resume},
passing as its first argument
a thread returned by @Lid{coroutine.create},
the coroutine starts its execution by
calling its main function.
Extra arguments passed to @Lid{coroutine.resume} are passed
as arguments to that function.
After the coroutine starts running,
it runs until it terminates or @emph{yields}.

A coroutine can terminate its execution in two ways:
normally, when its main function returns
(explicitly or implicitly, after the last instruction);
and abnormally, if there is an unprotected
error.
In case of normal termination,
@Lid{coroutine.resume} returns @true,
plus any values returned by the coroutine main function.
In case of errors, @Lid{coroutine.resume} returns @false
plus the error object.
In this case, the coroutine does not unwind its stack,
so that it is possible to inspect it after the error
with the debug API.

A coroutine yields by calling @Lid{coroutine.yield}.
When a coroutine yields,
the corresponding @Lid{coroutine.resume} returns immediately,
even if the yield happens inside nested function calls
(that is, not in the main function,
but in a function directly or indirectly called by the main function).
In the case of a yield, @Lid{coroutine.resume} also returns @true,
plus any values passed to @Lid{coroutine.yield}.
The next time you resume the same coroutine,
it continues its execution from the point where it yielded,
with the call to @Lid{coroutine.yield} returning any extra
arguments passed to @Lid{coroutine.resume}.

Like @Lid{coroutine.create},
the
@Lid{coroutine.wrap} function also creates a coroutine,
but instead of returning the coroutine itself,
it returns a function that, when called, resumes the coroutine.
Any arguments passed to this function
go as extra arguments to @Lid{coroutine.resume}.
@Lid{coroutine.wrap} returns all the values returned by @Lid{coroutine.resume},
except the first one (the boolean error code).
Unlike @Lid{coroutine.resume},

the function created by @Lid{coroutine.wrap}
propagates any error to the caller.
In this case,
the function also closes the coroutine @seeF{coroutine.close}.

As an example of how coroutines work,
consider the following code:
@verbatim{
```
function foo (a)
 print("foo", a)
 return coroutine.yield(2*a)
end

co = coroutine.create(function (a,b)
    print("co-body", a, b)
    local r = foo(a+1)
    print("co-body", r)
    local r, s = coroutine.yield(a+b, a-b)
    print("co-body", r, s)
    return b, "end"
end)

print("main", coroutine.resume(co, 1, 10))
print("main", coroutine.resume(co,
 "r"))
print("main", coroutine.resume(co, "x", "y"))
print("main", coroutine.resume(co, "x", "y"))
```
}
When you run it, it produces the following output:
@verbatim{
```
co-body 1       10
foo     2
main    true    4
co-body r
main    true    11      -9
co-body x       y
main    true    10      end
main    false   cannot resume dead coroutine
```
}

You can also create and manipulate coroutines through the C API:
see functions @Lid{lua_newthread}, @Lid{lua_resume},
and @Lid{lua_yield}.

}

}

@C{--}
@sect1{language| @title{The Language}

@simplesect{

This section describes the lexis, the syntax, and the semantics of Lua.
In other words,
this section describes
which tokens are valid,
how they can be combined,
and what their combinations mean.

Language constructs will be explained using the usual extended BNF notation,
in which
@N{@bnfrep{@rep{a}} means 0} or more @rep{a}'s, and
@N{@bnfopt{@rep{a}} means} an
optional @rep{a}.
Non-terminals are shown like @bnfNter{non-terminal},
keywords are shown like @rw{kword},
and other terminal symbols are shown like @bnfter{=}.
The complete syntax of Lua can be found in @refsec{BNF}
at the end of this manual.

}

@sect2{lexical| @title{Lexical Conventions}

Lua is a @x{free-form} language.
It ignores spaces and comments between lexical elements (@x{tokens}),
except as delimiters between two tokens.
In source code,
Lua recognizes as spaces the standard ASCII whitespace
characters space, form feed, newline,
carriage return, horizontal tab, and vertical tab.

@def{Names}
(also called @def{identifiers})
in Lua can be any string of Latin letters,
Arabic-Indic digits, and underscores,
not beginning with a digit and
not being a reserved word.
Identifiers are used to name variables, table fields, and labels.

The following @def{keywords} are reserved
and cannot be used as names:
@index{reserved words}
@verbatim{

and break do else elseif
end
false for function goto if in
local nil not or repeat return
then true until while
}

Lua is a case-sensitive language:
@id{and} is a reserved word, but @id{And} and @id{AND}
are two different, valid names.
As a convention,
programs should avoid creating
names that start with an underscore followed by
one or more uppercase letters (such as @Lid{_VERSION}).

The following strings denote other @x{tokens}:
@verbatim{
+ - * / % ^ #
& ~ | << >> //
== ~= <= >= < > =
( ) { } [ ] ::
; : , ...
}

A @def{short literal string}
can be delimited by matching single or double quotes,
and can contain the following C-like escape sequences:
@Char{\a} (bell),
@Char{\b} (backspace),
@Char{\f} (form feed),
@Char{\n} (newline),
@Char{\r} (carriage return),
@Char{\t} (horizontal tab),
@Char{\v} (vertical tab),
@Char{\\} (backslash),
@Char{\"}
(quotation mark [double quote]),
and @Char{\'} (apostrophe [single quote]).
A backslash followed by a line break
results in a newline in the string.
The escape sequence @Char{\z} skips the following span
of whitespace characters,
including line breaks;
it is particularly useful to break and indent a long literal string
into multiple lines without adding the newlines and spaces
into the string contents.
A short literal string cannot contain unescaped line breaks
nor escapes not forming a valid escape sequence.

We can specify any byte in a short literal string,
including @x{embedded zeros},
by its numeric value.
This can be done
with the escape sequence @T{\x@rep{XX}},
where @rep{XX} is a sequence of exactly two hexadecimal digits,
or with the escape sequence @T{\@rep{ddd}},
where @rep{ddd} is a sequence of up to three decimal digits.
(Note that if a decimal escape sequence is to be followed by a digit,
it must be expressed using exactly three digits.)

The @x{UTF-8} encoding
of a @x{Unicode} character
can be inserted in a literal string with
the escape sequence @T{\u{@rep{XXX}}}
(with mandatory enclosing braces),
where @rep{XXX} is a sequence of one or more hexadecimal digits
representing the character code point.
This code point can be any value less than @M{2@sp{31}}.
(Lua uses the original UTF-8 specification here,
which is not restricted to valid Unicode code points.)

Literal strings can also be defined using a long format
enclosed by @def{long brackets}.
We define an @def{opening long bracket of level @rep{n}} as an opening
square bracket followed by @rep{n} equal signs followed by another
opening square bracket.
So, an opening long bracket of @N{level 0} is written as @T{[[}, @C{]]}
an opening long bracket of @N{level 1} is written as @T{[=[}, @C{]]}
and so on.
A @emph{closing long bracket} is defined similarly;
for instance,
a closing long bracket of @N{level 4} is written as @C{]] @T{]====]}.
A @def{long literal} starts with an opening long bracket
of any level and
ends at the first closing long bracket of the same level.
It can contain any text except a closing bracket of the same level.
Literals in this bracketed form can run for several lines,
do not interpret any escape sequences,
and ignore long brackets of any other level.
Any kind of end-of-line sequence
(carriage return, newline, carriage return followed by newline,
or newline followed by carriage return)
is converted to a simple newline.
When the opening long bracket is immediately followed by a newline,
the newline is not included in the string.

As an example, in a system using ASCII
(in which @Char{a} is coded @N{as 97},
newline is coded @N{as 10}, and @Char{1} is coded @N{as 49}),
the five literal strings below denote the same string:
@verbatim{
a = 'alo\n123"'
a = "alo\n123\""
a = '\97lo\10\04923"'
a = [[alo
123"]]
a = [==[
alo
123"]==]
}

Any byte in a literal string not
explicitly affected by the previous rules represents itself.
However, Lua opens files for
parsing in text mode,
and the system's file functions may have problems with
some control characters.
So, it is safer to represent
binary data as a quoted literal with
explicit escape sequences for the non-text characters.

A @def{numeric constant} (or @def{numeral})
can be written with an optional fractional part
and an optional decimal exponent,
marked by a letter @Char{e} or @Char{E}.
Lua also accepts @x{hexadecimal constants},
which start with @T{0x} or @T{0X}.
Hexadecimal constants also accept an optional fractional part
plus an optional binary exponent,
marked by a letter @Char{p} or @Char{P} and written in decimal.
(For instance, @T{0x1.fp10} denotes 1984,
which is @M{0x1f / 16} multiplied by @M{2@sp{10}}.)

A numeric constant with a radix point or an exponent
denotes a float;
otherwise,
if its value fits in an integer or it is a hexadecimal constant,
it denotes an integer;
otherwise (that is, a decimal integer numeral that overflows),
it denotes a float.
Hexadecimal numerals
with neither a radix point nor an exponent
always denote an integer value;
if the value overflows, it @emph{wraps around}

to fit into a valid integer.

Examples of valid integer constants are
@verbatim{
3   345   0xff   0xBEBADA
}
Examples of valid float constants are
@verbatim{
3.0   3.1416   314.16e-2   0.31416E1   34e1
0x0.1E 0xA23p-4   0X1.921FB54442D18P+1
}

A @def{comment} starts with a double hyphen (@T{--})
anywhere outside a string.
If the text immediately after @T{--} is not an opening long bracket,
the comment is a @def{short comment},
which runs until the end of the line.
Otherwise, it is a @def{long comment},
which runs until the corresponding closing long bracket.

}

@sect2{variables| @title{Variables}

Variables are places that store values.
There are three kinds of variables in Lua:
global variables, local variables, and table fields.

A single name can denote a global variable or a local variable
(or a function's formal parameter,
which is a particular kind of
 local variable):
@Produc{
@producname{var}@producbody{@bnfNter{Name}}
}
@bnfNter{Name} denotes identifiers @see{lexical}.

Any variable name is assumed to be global unless explicitly declared
as a local @see{localvar}.
@x{Local variables} are @emph{lexically scoped}:
local variables can be freely accessed by functions
defined inside their scope @see{visibility}.

Before the first assignment to a variable, its value is @nil.

Square brackets are used to index a table:
@Produc{
@producname{var}@producbody{prefixexp @bnfter{[} exp @bnfter{]}}

}
The meaning of accesses to table fields can be changed via metatables
@see{metatable}.

The syntax @id{var.Name} is just syntactic sugar for
@T{var["Name"]}:
@Produc{
@producname{var}@producbody{prefixexp @bnfter{.} @bnfNter{Name}}
}

An access to a global variable @id{x}
is equivalent to @id{_ENV.x}.
Due to the way that chunks are compiled,
the variable @id{_ENV} itself is never global @see{globalenv}.

}

@sect2{stats| @title{Statements}

@simplesect{

Lua
 supports an almost conventional set of @x{statements},
similar to those in other conventional languages.
This set includes
blocks, assignments, control structures, function calls,
and variable declarations.

}

@sect3{@title{Blocks}

A @x{block} is a list of statements,
which are executed sequentially:
@Produc{
@producname{block}@producbody{@bnfrep{stat}}
}
Lua has @def{empty statements}
that allow you to separate statements with semicolons,
start a block with a semicolon
or write two semicolons in sequence:
@Produc{
@producname{stat}@producbody{@bnfter{;}}
}

Both function calls and assignments
can start with an open parenthesis.
This possibility leads to an ambiguity in Lua's grammar.

Consider the following fragment:
@verbatim{
a = b + c
(print or io.write)('done')
}
The grammar could see this fragment in two ways:
@verbatim{
a = b + c(print or io.write)('done')

a = b + c; (print or io.write)('done')
}
The current parser always sees such constructions
in the first way,
interpreting
the open parenthesis
as the start of the arguments to a call.
To avoid this ambiguity,
it is a good practice to always precede with a semicolon
statements that start with a parenthesis:
@verbatim{
;(print or io.write)('done')
}

A block can be explicitly delimited to produce a single statement:
@Produc{
@producname{stat}@producbody{@Rw{do} block @Rw{end}}
}
Explicit blocks are useful
to control the scope of variable declarations.
Explicit blocks are also sometimes used to
add a @Rw{return} statement in the middle
of another block @see{control}.

}

@sect3{chunks| @title{Chunks}

The unit of compilation of Lua is called a @def{chunk}.
Syntactically,
a chunk is simply a block:
@Produc{
@producname{chunk}@producbody{block}
}

Lua handles a chunk as the body of an anonymous function
with a variable number of arguments
@see{func-def}.
As such, chunks can define local variables,

receive arguments, and return values.
Moreover, such anonymous function is compiled as in the
scope of
an external local variable called @id{_ENV} @see{globalenv}.
The resulting function always has @id{_ENV} as its only external variable,
even if it does not use that variable.

A chunk can be stored in a file or in a string inside the host program.
To execute a chunk,
Lua first @emph{loads} it,
precompiling the chunk's code into instructions for a virtual machine,
and then Lua executes the compiled code
with an interpreter for the virtual machine.

Chunks can also be precompiled into binary form;
see the program @idx{luac} and the function @Lid{string.dump} for details.
Programs in source and compiled forms are interchangeable;
Lua automatically detects the file type and acts accordingly @seeF{load}.

}

@sect3{assignment| @title{Assignment}

Lua allows @x{multiple assignments}.
Therefore, the syntax for assignment
defines a list of variables on the left side
and a list of expressions on the right side.
The elements in both lists are separated by commas:
@Produc{
@producname{stat}@producbody{varlist
@bnfter{=} explist}
@producname{varlist}@producbody{var @bnfrep{@bnfter{,} var}}
@producname{explist}@producbody{exp @bnfrep{@bnfter{,} exp}}
}
Expressions are discussed in @See{expressions}.

Before the assignment,
the list of values is @emph{adjusted} to the length of
the list of variables @see{multires}.

If a variable is both assigned and read
inside a multiple assignment,
Lua ensures that all reads get the value of the variable
before the assignment.
Thus the code
@verbatim{
i = 3
i, a[i] = i+1, 20

}
sets @T{a[3]} to 20, without affecting @T{a[4]}
because the @id{i} in @T{a[i]} is evaluated (to 3)
before it is @N{assigned 4}.
Similarly, the line
@verbatim{
x, y = y, x
}
exchanges the values of @id{x} and @id{y},
and
@verbatim{
x, y, z = y, z, x
}
cyclically permutes the values of @id{x}, @id{y}, and @id{z}.

Note that this guarantee covers only accesses
syntactically inside the assignment statement.
If a function or a metamethod called during the assignment
changes
the value of a variable,
Lua gives no guarantees about the order of that access.

An assignment to a global name @T{x = val}
is equivalent to the assignment
@T{_ENV.x = val} @see{globalenv}.

The meaning of assignments to table fields and
global variables (which are actually table fields, too)
can be changed via metatables @see{metatable}.

}

@sect3{control| @title{Control Structures}
The control structures
@Rw{if}, @Rw{while}, and @Rw{repeat} have the usual meaning and
familiar syntax:
@index{while-do statement}
@index{repeat-until statement}
@index{if-then-else statement}
@Produc{
@producname{stat}@producbody{@Rw{while} exp @Rw{do} block @Rw{end}}
@producname{stat}@producbody{@Rw{repeat} block @Rw{until} exp}
@producname{stat}@producbody{@Rw{if} exp @Rw{then} block
 @bnfrep{@Rw{elseif} exp @Rw{then} block}
  @bnfopt{@Rw{else} block} @Rw{end}}
}
Lua also has a @Rw{for} statement, in two flavors @see{for}.

The @x{condition expression} of a
control structure can return any value.
Both
@false and @nil test false.
All values different from @nil and @false test true.
In particular, the number 0 and the empty string also test true.

In the @Rw{repeat}@En@Rw{until} loop,
the inner block does not end at the @Rw{until} keyword,
but only after the condition.
So, the condition can refer to local variables
declared inside the loop block.

The @Rw{goto} statement transfers the program control to a label.
For syntactical reasons,
labels in Lua are considered statements too:
@index{goto statement}
@index{label}
@Produc{
@producname{stat}@producbody{@Rw{goto} Name}
@producname{stat}@producbody{label}
@producname{label}@producbody{@bnfter{::} Name @bnfter{::}}
}

A label is visible in the entire block where it is defined,
except inside nested functions.
A goto may jump to any visible label as long as it does not
enter into the scope of a local variable.
A label should not be declared
where a label with the same name is visible,
even if this other label has been declared in an
enclosing block.

The @Rw{break} statement terminates the execution of a
@Rw{while}, @Rw{repeat}, or @Rw{for} loop,
skipping to the next statement after the loop:
@index{break statement}
@Produc{
@producname{stat}@producbody{@Rw{break}}
}
A @Rw{break} ends the innermost enclosing loop.

The @Rw{return} statement is used to return values
from a function or a chunk
(which is handled as an anonymous function).
@index{return statement}
Functions can return more than one value,
so the syntax for the @Rw{return} statement is

@Produc{
@producname{stat}@producbody{@Rw{return} @bnfopt{explist} @bnfopt{@bnfter{;}}}
}

The @Rw{return} statement can only be written
as the last statement of a block.
If it is necessary to @Rw{return} in the middle of a block,
then an explicit inner block can be used,
as in the idiom @T{do return end},
because now @Rw{return} is the last statement in its (inner) block.

}

@sect3{for| @title{For Statement}

@index{for statement}
The @Rw{for} statement has two forms:
one
numerical and one generic.

@sect4{@title{The numerical @Rw{for} loop}

The numerical @Rw{for} loop repeats a block of code while a
control variable goes through an arithmetic progression.
It has the following syntax:
@Produc{
@producname{stat}@producbody{@Rw{for} @bnfNter{Name} @bnfter{=}
exp @bnfter{,} exp @bnfopt{@bnfter{,} exp} @Rw{do} block @Rw{end}}
}
The given identifier (@bnfNter{Name}) defines the control variable,
which is a new variable local to the loop body (@emph{block}).

The loop starts by evaluating once the three control expressions.
Their values are called respectively
the @emph{initial value}, the @emph{limit}, and the @emph{step}.
If the step is absent, it defaults @N{to 1}.

If both the initial value and the step are integers,
the loop is done with integers;
note that the limit may not be an integer.
Otherwise, the three values are converted to
floats and the loop is done with floats.
Beware of floating-point accuracy in this case.

After that initialization,
the
loop body is repeated with the value of the control variable
going through an arithmetic progression,

starting at the initial value,
with a common difference given by the step.
A negative step makes a decreasing sequence;
a step equal to zero raises an error.
The loop continues while the value is less than
or equal to the limit
(greater than or equal to for a negative step).
If the initial value is already greater than the limit
(or less than, if the step is negative),
the body is not executed.

For integer loops,
the control variable never wraps around;
instead, the loop ends in case of an overflow.

You should not change the value of the control variable
during the loop.
If you need its value after the loop,
assign it to another variable before exiting the loop.

}

@sect4{@title{The generic @Rw{for} loop}

The generic @Rw{for} statement works over functions,
called @def{iterators}.
On each iteration, the iterator function is called to produce a new value,
stopping when this new
value is @nil.
The generic @Rw{for} loop has the following syntax:
@Produc{
@producname{stat}@producbody{@Rw{for} namelist @Rw{in} explist
@Rw{do} block @Rw{end}}
@producname{namelist}@producbody{@bnfNter{Name} @bnfrep{@bnfter{,} @bnfNter{Name}}}
}
A @Rw{for} statement like
@verbatim{
for @rep{var_1}, @Cdots, @rep{var_n} in @rep{explist} do @rep{body} end
}
works as follows.

The names @rep{var_i} declare loop variables local to the loop body.
The first of these variables is the @emph{control variable}.

The loop starts by evaluating @rep{explist}
to produce four values:
an @emph{iterator function},

a @emph{state},
an initial value for the control variable,
and a @emph{closing value}.

Then, at each iteration,
Lua calls the iterator function with two arguments:
the state and the control variable.
The results from this call are then assigned to the loop variables,
following the rules of multiple assignments @see{assignment}.
If the control variable becomes @nil,
the
loop terminates.
Otherwise, the body is executed and the loop goes
to the next iteration.

The closing value behaves like a
to-be-closed variable @see{to-be-closed},
which can be used to release resources when the loop ends.
Otherwise, it does not interfere with the loop.

You should not change the value of the control variable
during the loop.

}

}

@sect3{funcstat| @title{Function Calls as Statements}
To allow possible side-effects,
function calls can be executed as statements:
@Produc{
@producname{stat}@producbody{functioncall}
}
In this case, all returned values are thrown away.
Function calls are explained in @See{functioncall}.

}

@sect3{localvar| @title{Local Declarations}
@x{Local variables} can be declared anywhere inside a block.
The declaration can include an initialization:
@Produc{
@producname{stat}@producbody{@Rw{local} attnamelist @bnfopt{@bnfter{=} explist}}
@producname{attnamelist}@producbody{
@bnfNter{Name} attrib @bnfrep{@bnfter{,} @bnfNter{Name} attrib}}
}
If

present, an initial assignment has the same semantics
of a multiple assignment @see{assignment}.
Otherwise, all variables are initialized with @nil.

Each variable name may be postfixed by an attribute
(a name between angle brackets):
@Produc{
@producname{attrib}@producbody{@bnfopt{@bnfter{<} @bnfNter{Name} @bnfter{>}}}
}
There are two possible attributes:
@id{const}, which declares a @x{constant variable},
that is, a variable that cannot be assigned to
after its initialization;
and @id{close}, which declares a to-be-closed variable @see{to-be-closed}.
A list of variables can contain at most one to-be-closed variable.

A chunk is also a block @see{chunks},
and so local variables can be declared in a chunk outside any explicit block.

The visibility rules for local variables are explained in @See{visibility}.

}

@sect3{to-be-closed| @title{To-be-closed Variables}

A to-be-closed variable behaves like a constant local variable,
except that its value is @emph{closed} whenever the variable
goes
out of scope, including normal block termination,
exiting its block by @Rw{break}/@Rw{goto}/@Rw{return},
or exiting by an error.

Here, to @emph{close} a value means
to call its @idx{__close} metamethod.
When calling the metamethod,
the value itself is passed as the first argument
and the error object that caused the exit (if any)
is passed as a second argument;
if there was no error, the second argument is @nil.

The value assigned to a to-be-closed variable
must have a @idx{__close} metamethod
or be a false value.
(@nil and @false are ignored as to-be-closed values.)

If several to-be-closed variables go out of scope at the same event,
they are closed in the reverse order that they were declared.

If there is any error while running a closing method,
that error is handled like an error in the regular code
where the variable was defined.
After an error,
the other pending closing methods will still be called.

If a coroutine yields and is never resumed again,
some variables may
never go out of scope,
and therefore they will never be closed.
(These variables are the ones created inside the coroutine
and in scope at the point where the coroutine yielded.)
Similarly, if a coroutine ends with an error,
it does not unwind its stack,
so it does not close any variable.
In both cases,
you can either use finalizers
or call @Lid{coroutine.close} to close the variables.
However, if the coroutine was created
through @Lid{coroutine.wrap},
then its corresponding function will close the coroutine
in case of errors.

}

}

@sect2{expressions| @title{Expressions}

@simplesect{

The basic expressions in Lua are the following:
@Produc{
@producname{exp}@producbody{prefixexp}
@producname{exp}@producbody{@Rw{nil} @Or @Rw{false} @Or @Rw{true}}
@producname{exp}@producbody{@bnfNter{Numeral}}
@producname{exp}@producbody{@bnfNter{LiteralString}}
@producname{exp}@producbody{functiondef}
@producname{exp}@producbody{tableconstructor}
@producname{exp}@producbody{@bnfter{...}}
@producname{exp}@producbody{exp
binop exp}
@producname{exp}@producbody{unop exp}
@producname{prefixexp}@producbody{var @Or functioncall @Or
@bnfter{(} exp @bnfter{)}}
}

Numerals and literal strings are explained in @See{lexical};

variables are explained in @See{variables};
function definitions are explained in @See{func-def};
function calls are explained in @See{functioncall};
table constructors are explained in @See{tableconstructor}.
Vararg expressions,
denoted by three dots (@Char{...}), can only be used when
directly inside a variadic function;
they are explained in @See{func-def}.

Binary operators comprise arithmetic operators @see{arith},
bitwise operators @see{bitwise},
relational operators @see{rel-ops}, logical operators @see{logic},
and the concatenation operator @see{concat}.
Unary operators comprise the unary minus @see{arith},
the unary bitwise NOT @see{bitwise},
the unary logical @Rw{not} @see{logic},
and the unary @def{length operator} @see{len-op}.

}

@sect3{arith|
 @title{Arithmetic Operators}
Lua supports the following @x{arithmetic operators}:
@description{
@item{@T{+}|addition}
@item{@T{-}|subtraction}
@item{@T{*}|multiplication}
@item{@T{/}|float division}
@item{@T{//}|floor division}
@item{@T{%}|modulo}
@item{@T{^}|exponentiation}
@item{@T{-}|unary minus}
}

With the exception of exponentiation and float division,
the arithmetic operators work as follows:
If both operands are integers,
the operation is performed over integers and the result is an integer.
Otherwise, if both operands are numbers,
then they are converted to floats,
the operation is performed following the machine's rules
for floating-point arithmetic
(usually the @x{IEEE 754} standard),
and the result is a float.
(The string library coerces strings to numbers in

arithmetic operations; see @See{coercion} for details.)

Exponentiation and float division (@T{/})
always convert their operands to floats
and the result is always a float.
Exponentiation uses the
@ANSI{pow},
so that it works for non-integer exponents too.

Floor division (@T{//}) is a division
that rounds the quotient towards minus infinity,
resulting in the floor of the division of its operands.

Modulo is defined as the remainder of a division
that rounds the quotient towards minus infinity (floor division).

In case of overflows in integer arithmetic,
all operations @emphx{wrap around}.
}

@sect3{bitwise| @title{Bitwise Operators}
Lua supports the following @x{bitwise operators}:
@description{
@item{@T{&}|bitwise AND}
@item{@T{@VerBar}|bitwise OR}
@item{@T{~}|bitwise exclusive OR}
@item{@T{>>}|right shift}
@item{@T{<<}|left shift}
@item{@T{~}|unary bitwise NOT}
}

All bitwise operations convert its operands to integers
@see{coercion},
operate on all bits of those integers,
and result in an integer.

Both right and left shifts fill the vacant bits with zeros.
Negative displacements shift to the other direction;
displacements with absolute values equal to or higher than
the
number of bits in an integer
result in zero (as all bits are shifted out).

}

@sect3{coercion| @title{Coercions and Conversions}
Lua provides some automatic conversions between some
types and representations at run time.

Bitwise operators always convert float operands to integers.
Exponentiation and float division
always convert integer operands to floats.
All other arithmetic operations applied to mixed numbers
(integers and floats) convert the integer operand to a float.
The C API also converts both integers to floats and
floats to integers, as needed.
Moreover, string concatenation accepts numbers as arguments,
besides strings.

In a conversion from integer to float,
if the integer value has an exact representation as a float,
that is the result.
Otherwise,
the conversion gets the nearest higher or
the nearest lower representable value.
This kind of conversion never fails.

The conversion from float to integer
checks whether the float has an exact representation as an integer
(that
is, the float has an integral value and
it is in the range of integer representation).
If it does, that representation is the result.
Otherwise, the conversion fails.

Several places in Lua coerce strings to numbers when necessary.
In particular,
the string library sets metamethods that try to coerce
strings to numbers in all arithmetic operations.
If the conversion fails,
the library calls the metamethod of the other operand
(if present) or it raises an error.
Note that bitwise operators do not do this coercion.

It is always a good practice not to rely on the
implicit coercions from strings to numbers,
as they are not always applied;
in particular, @T{"1"==1} is false and @T{"1"<1} raises an error
@see{rel-ops}.
These coercions exist mainly for compatibility and may be removed
in future versions of the language.

A string is converted to an integer or a float
following its syntax and the rules of the Lua lexer.
The string may have also leading and trailing whitespaces and a sign.
All

conversions from strings to numbers
accept both a dot and the current locale mark
as the radix character.
(The Lua lexer, however, accepts only a dot.)
If the string is not a valid numeral,
the conversion fails.
If necessary, the result of this first step is then converted
to a specific number subtype following the previous rules
for conversions between floats and integers.

The conversion from numbers to strings uses a
non-specified human-readable format.
To convert numbers to strings in any specific way,
use the function @Lid{string.format}.

}

@sect3{rel-ops| @title{Relational Operators}
Lua supports the following @x{relational operators}:
@description{
@item{@T{==}|equality}
@item{@T{~=}|inequality}
@item{@T{<}|less than}
@item{@T{>}|greater than}
@item{@T{<=}|less or equal}
@item{@T{>=}|greater or equal}
}
These operators always result in @false or @true.

Equality (@T{==}) first compares the type of its operands.
If the types are different, then the result is @false.
Otherwise,
the values of the operands are compared.
Strings are equal if they have the same byte content.
Numbers are equal if they denote the same mathematical value.

Tables, userdata, and threads
are compared by reference:
two objects are considered equal only if they are the same object.
Every time you create a new object
(a table, a userdata, or a thread),
this new object is different from any previously existing object.
A function is always equal to itself.
Functions with any detectable difference
(different behavior, different definition) are always different.
Functions created at different times but with no detectable differences
may be classified as equal or not
(depending on internal caching details).

You can change the way that Lua compares tables and userdata
by using the @idx{__eq} metamethod @see{metatable}.

Equality comparisons do not convert strings to numbers
or vice versa.
Thus, @T{"0"==0} evaluates to @false,
and @T{t[0]} and @T{t["0"]} denote different
entries in a table.

The
operator @T{~=} is exactly the negation of equality (@T{==}).

The order operators work as follows.
If both arguments are numbers,
then they are compared according to their mathematical values,
regardless of their subtypes.
Otherwise, if both arguments are strings,
then their values are compared according to the current locale.
Otherwise, Lua tries to call the @idx{__lt} or the @idx{__le}
metamethod @see{metatable}.
A comparison @T{a > b} is translated to @T{b < a}
and @T{a >= b} is translated to @T{b <= a}.

Following the @x{IEEE 754} standard,
the special value @x{NaN} is considered neither less than,
nor equal to, nor greater than any value, including itself.

}

@sect3{logic| @title{Logical Operators}
The @x{logical operators} in Lua are
@Rw{and}, @Rw{or}, and @Rw{not}.
Like the control structures @see{control},
all logical operators consider both @false and @nil as false
and anything else as true.

The negation operator @Rw{not} always returns @false or @true.
The conjunction
operator @Rw{and} returns its first argument
if this value is @false or @nil;
otherwise, @Rw{and} returns its second argument.
The disjunction operator @Rw{or} returns its first argument
if this value is different from @nil and @false;
otherwise, @Rw{or} returns its second argument.
Both @Rw{and} and @Rw{or} use @x{short-circuit evaluation};
that is,
the second operand is evaluated only if necessary.

Here are some examples:
@verbatim{
10 or 20 --> 10
10 or error() --> 10
nil or "a" --> "a"
nil and 10 --> nil
false and error() --> false
false and nil --> false
false or nil --> nil
10 and 20 --> 20
}

}

@sect3{concat| @title{Concatenation}
The string @x{concatenation} operator in Lua is
denoted by two dots (@Char{..}).
If both operands are strings or numbers,
then the numbers are converted to strings
in a non-specified format @see{coercion}.
Otherwise, the @idx{__concat} metamethod is called @see{metatable}.

}

@sect3{len-op|
@title{The Length Operator}

The length operator is denoted by the unary prefix operator @T{#}.

The length of a string is its number of bytes.
(That is the usual meaning of string length when each
character is one byte.)

The length operator applied on a table
returns a @x{border} in that table.
A @def{border} in a table @id{t} is any non-negative integer
that satisfies the following condition:
@verbatim{
(border == 0 or t[border] ~= nil) and
(t[border + 1] == nil or border == math.maxinteger)
}
In words,
a border is any positive integer index present in the table
that is followed by an absent index,
plus two limit cases:
zero, when index 1 is absent;
and the maximum value for an integer, when that index is present.
Note that keys that are not positive integers

do not interfere with borders.

A table with exactly one border is called a @def{sequence}.
For instance, the table @T{{10, 20, 30, 40, 50}} is a sequence,
as it has only one border (5).
The table @T{{10, 20, 30, nil, 50}} has
two borders (3 and 5),
and therefore it is not a sequence.
(The @nil at index 4 is called a @emphx{hole}.)
The table @T{{nil, 20, 30, nil, nil, 60, nil}}
has three borders (0, 3, and 6),
so it is not a sequence, too.
The table @T{{}} is a sequence with border 0.

When @id{t} is a sequence,
@T{#t} returns its only border,
which corresponds to the intuitive notion of the length of the sequence.
When @id{t} is not a sequence,
@T{#t} can return any of its borders.
(The exact one depends on details of
the internal representation of the table,
which in turn can depend on how the table was populated and
the memory addresses of its non-numeric keys.)

The computation of the length of a table
has a guaranteed worst time of @M{O(log n)},
where @M{n} is the largest integer key in the table.

A program can modify the behavior of the length operator for
any value but strings through the @idx{__len} metamethod @see{metatable}.

}

@sect3{prec| @title{Precedence}
@x{Operator precedence} in Lua follows
the table below,
from lower to higher priority:
@verbatim{
or
and
< > <= >= ~= ==
|
~
&
<< >>
..
+ -
* / // %

unary operators (not # - ~)
^
}
As usual,
you can use parentheses to change the precedences of an expression.
The concatenation (@Char{..}) and exponentiation (@Char{^})
operators are right associative.
All other binary operators are left associative.

}

@sect3{tableconstructor| @title{Table Constructors}
Table @x{constructors} are expressions that create tables.
Every time a constructor is evaluated, a new table is created.
A constructor can be used to create an empty table
or to create a table and initialize some of its fields.
The general syntax for constructors is
@Produc{
@producname{tableconstructor}@producbody{@bnfter{@Open} @bnfopt{fieldlist} @bnfter{@Close}}
@producname{fieldlist}@producbody{field @bnfrep{fieldsep field} @bnfopt{fieldsep}}
@producname{field}@producbody{@bnfter{[} exp @bnfter{]} @bnfter{=} exp @Or

@bnfNter{Name} @bnfter{=} exp @Or exp}
@producname{fieldsep}@producbody{@bnfter{,} @Or @bnfter{;}}
}

Each field of the form @T{[exp1] = exp2} adds to the new table an entry
with key @id{exp1} and value @id{exp2}.
A field of the form @T{name = exp} is equivalent to
@T{["name"] = exp}.
Fields of the form @id{exp} are equivalent to
@T{[i] = exp}, where @id{i} are consecutive integers
starting with 1;
fields in the other formats do not affect this counting.
For example,
@verbatim{
a = { [f(1)] = g; "x", "y"; x = 1, f(x), [30] = 23; 45 }
}
is equivalent to
@verbatim{
do
 local t = {}
 t[f(1)] = g
 t[1] = "x" -- 1st exp
 t[2] = "y" -- 2nd exp
 t.x = 1 -- t["x"] = 1
 t[3] = f(x) -- 3rd exp
 t[30] = 23

t[4] = 45 -- 4th exp
a = t
end
}

The order of the assignments in a constructor is undefined.
(This order would be relevant only when there are repeated keys.)

If the last field in the list has the form @id{exp}
and the expression
is a multires expression,
then all values returned by this expression enter the list consecutively
@see{multires}.

The field list can have an optional trailing separator,
as a convenience for machine-generated code.

}

@sect3{functioncall| @title{Function Calls}
A @x{function call} in Lua has the following syntax:
@Produc{
@producname{functioncall}@producbody{prefixexp args}
}
In a function call,
first @bnfNter{prefixexp} and @bnfNter{args} are evaluated.
If the value of @bnfNter{prefixexp} has type @emph{function},
then this function is called
with the given arguments.
Otherwise, if present,
the @bnfNter{prefixexp} @idx{__call} metamethod is called:
its first argument is the value of @bnfNter{prefixexp},
followed by the original call arguments
@see{metatable}.

The form
@Produc{
@producname{functioncall}@producbody{prefixexp @bnfter{:} @bnfNter{Name} args}
}
can be used to emulate methods.
A call @T{v:name(@rep{args})}
is syntactic sugar for @T{v.name(v,@rep{args})},
except that @id{v}
is evaluated only once.

Arguments have the following syntax:
@Produc{
@producname{args}@producbody{@bnfter{(} @bnfopt{explist} @bnfter{)}}

@producname{args}@producbody{tableconstructor}
@producname{args}@producbody{@bnfNter{LiteralString}}
}
All argument expressions are evaluated before the call.
A call of the form @T{f{@rep{fields}}} is
syntactic sugar for @T{f({@rep{fields}})};
that is, the argument list is a single new table.
A call of the form @T{f'@rep{string}'}
(or @T{f"@rep{string}"} or @T{f[[@rep{string}]]})
is syntactic sugar for @T{f('@rep{string}')};
that is, the argument list is a single literal string.

A call of the form @T{return @rep{functioncall}} not in the
scope of a to-be-closed variable is called a @def{tail call}.
Lua implements @def{proper tail calls}
(or @def{proper tail recursion}):
In a tail call,
the called function reuses the stack entry of the calling function.
Therefore, there is no limit on the number of nested tail calls that
a program can execute.
However,
a tail call erases any debug information about the
calling function.
Note that a tail call only happens with a particular syntax,
where the @Rw{return} has one single function call as argument,
and it is outside the scope of any to-be-closed variable.
This syntax makes the calling function return exactly
the returns of the called function,
without any intervening action.
So, none of the following examples are tail calls:
@verbatim{
return (f(x))   -- results adjusted to 1
return 2 * f(x)   -- result multiplied by 2
return x, f(x)   -- additional results
f(x); return   -- results discarded
return x or f(x)   -- results adjusted to 1
}

}

@sect3{func-def| @title{Function Definitions}

The syntax for function definition is
@Produc{
@producname{functiondef}@producbody{@Rw{function} funcbody}
@producname{funcbody}@producbody{@bnfter{(} @bnfopt{parlist} @bnfter{)} block @Rw{end}}
}

The following syntactic sugar simplifies function definitions:
@Produc{
@producname{stat}@producbody{@Rw{function}
funcname funcbody}
@producname{stat}@producbody{@Rw{local} @Rw{function} @bnfNter{Name} funcbody}
@producname{funcname}@producbody{@bnfNter{Name} @bnfrep{@bnfter{.} @bnfNter{Name}}
@bnfopt{@bnfter{:} @bnfNter{Name}}}
}
The statement
@verbatim{
function f () @rep{body} end
}
translates to
@verbatim{
f = function () @rep{body} end
}
The statement
@verbatim{
function t.a.b.c.f () @rep{body} end
}
translates to
@verbatim{
t.a.b.c.f = function () @rep{body} end
}
The statement
@verbatim{
local function f () @rep{body} end
}
translates to
@verbatim{
local f; f = function () @rep{body} end
}
not to
@verbatim{
local f = function () @rep{body} end
}
(This only makes a difference when the body of the function
contains references to @id{f}.)

A function definition is an executable expression,
whose value has type @emph{function}.
When Lua precompiles a chunk,
all its function bodies are precompiled too,
but they are not created yet.
Then, whenever Lua executes the
function definition,
the function is @emph{instantiated} (or @emph{closed}).
This function instance, or @emphx{closure},

is the final value of the expression.

Parameters act as local variables that are
initialized with the argument values:
@Produc{
@producname{parlist}@producbody{namelist @bnfopt{@bnfter{,} @bnfter{...}} @Or
 @bnfter{...}}
}
When a Lua function is called,
it adjusts its list of @x{arguments} to
the length of its list of parameters @see{multires},
unless the function is a @def{variadic function},
which is indicated by three dots (@Char{...})
at the end of its parameter list.
A variadic function does not adjust its argument list;
instead, it collects all extra arguments and supplies them
to the function through a @def{vararg expression},
which is also written as three dots.
The value of this expression is a list of all actual extra arguments,
similar to a function with multiple results @see{multires}.

As an example, consider the following definitions:
@verbatim{
function
 f(a, b) end
function g(a, b, ...) end
function r() return 1,2,3 end
}
Then, we have the following mapping from arguments to parameters and
to the vararg expression:
@verbatim{
CALL   PARAMETERS

f(3)   a=3, b=nil
f(3, 4)   a=3, b=4
f(3, 4, 5)   a=3, b=4
f(r(), 10)   a=1, b=10
f(r())   a=1, b=2

g(3)   a=3, b=nil, ... --> (nothing)
g(3, 4)   a=3, b=4,   ... --> (nothing)
g(3, 4, 5, 8)   a=3, b=4,   ... --> 5 8
g(5, r())   a=5, b=1,   ... --> 2 3
}

Results are returned using the @Rw{return} statement @see{control}.
If control reaches the end of a function

without encountering a @Rw{return} statement,
then the function returns with no results.

@index{multiple return}
There is a system-dependent limit on the number of values
that a function may return.
This limit is guaranteed to be greater than 1000.

The @emphx{colon} syntax
is used to emulate @def{methods},
adding an implicit extra parameter @idx{self} to
the function.
Thus, the statement
@verbatim{
function t.a.b.c:f (@rep{params}) @rep{body} end
}
is syntactic sugar for
@verbatim{
t.a.b.c.f = function (self, @rep{params}) @rep{body} end
}

}

@sect3{multires| @title{Lists of expressions, multiple results,
and adjustment}

Both function calls and vararg expressions can result in multiple values.
These expressions are called @def{multires expressions}.

When a multires expression is used as the last element
of a list of expressions,
all results from the expression are added to the
list of values produced by the list of expressions.
Note that a single expression
in a place that expects a list of expressions
is the last expression in that (singleton) list.

These are the places where Lua expects a list of expressions:
@description{

@item{A @rw{return} statement,
for instance @T{return e1, e2, e3} @see{control}.}

@item{A table constructor,
for instance @T{{e1, e2, e3}} @see{tableconstructor}.}

@item{The arguments of a function call,
for

instance @T{foo(e1, e2, e3)} @see{functioncall}.}

@item{A multiple assignment,
for instance @T{a , b, c = e1, e2, e3} @see{assignment}.}

@item{A local declaration,
for instance @T{local a , b, c = e1, e2, e3} @see{localvar}.}

@item{The initial values in a generic @rw{for} loop,
for instance @T{for k in e1, e2, e3 do ... end} @see{for}.}

}
In the last four cases,
the list of values from the list of expressions
must be @emph{adjusted} to a specific length:
the number of parameters in a call to a non-variadic function
@see{func-def},
the number of variables in a multiple assignment or
a local declaration,
and exactly four values for a generic @rw{for} loop.
The @def{adjustment} follows these rules:
If there are more values than needed,
the extra values are thrown away;
if there are fewer values than needed,
the list is extended with @nil's.
When the list of expressions ends with a multires expression,
all results from that expression enter the list of values
before the adjustment.

When
a multires expression is used
in a list of expressions without being the last element,
or in a place where the syntax expects a single expression,
Lua adjusts the result list of that expression to one element.
As a particular case,
the syntax expects a single expression inside a parenthesized expression;
therefore, adding parentheses around a multires expression
forces it to produce exactly one result.

We seldom need to use a vararg expression in a place
where the syntax expects a single expression.
(Usually it is simpler to add a regular parameter before
the variadic part and use that parameter.)
When there is such a need,
we recommend assigning the vararg expression
to a single variable and using that variable
in its place.

Here are some examples of uses of mutlres expressions.
In all cases, when the construction needs
@Q{the n-th result} and there is no such result,
it uses a @nil.
@verbatim{
print(x, f())   -- prints x and all results from f().
print(x, (f()))   -- prints
 x and the first result from f().
print(f(), x)   -- prints the first result from f() and x.
print(1 + f())   -- prints 1 added to the first result from f().
local x = ...   -- x gets the first vararg argument.
x,y = ...   -- x gets the first vararg argument,
                   -- y gets the second vararg argument.
x,y,z = w, f()   -- x gets w, y gets the first result from f(),
                   -- z gets the second result from f().
x,y,z = f()   -- x gets the first result from f(),
                   -- y gets the second result from f(),
                   -- z gets the third result from f().
x,y,z = f(), g()   -- x gets the first result from f(),
                   -- y gets the first result from g(),
                   -- z gets the second result from g().
x,y,z = (f())   -- x gets the first result from f(), y and z get nil.
return f()   -- returns all results from f().
return x, ...   -- returns x and all received vararg arguments.
return x,y,f()
    -- returns x, y, and all results from f().
{f()}   -- creates a list with all results from f().
{...}   -- creates a list with all vararg arguments.
{f(), 5}   -- creates a list with the first result from f() and 5.
}

}

}

@sect2{visibility| @title{Visibility Rules}

@index{visibility}
Lua is a lexically scoped language.
The scope of a local variable begins at the first statement after
its declaration and lasts until the last non-void statement
of the innermost block that includes the declaration.
(@emph{Void statements} are labels and empty statements.)
Consider the following example:
@verbatim{
x = 10   -- global variable
do   -- new block
 local x = x   -- new 'x', with value 10

```
 print(x)          --> 10
 x = x+1
 do                -- another block
   local x = x+1     -- another 'x'
   print(x)        --> 12
 end
 print(x)          --> 11
end
print(x)           --> 10  (the global one)
}
```

Notice
that, in a declaration like @T{local x = x},
the new @id{x} being declared is not in scope yet,
and so the second @id{x} refers to the outside variable.

Because of the @x{lexical scoping} rules,
local variables can be freely accessed by functions
defined inside their scope.
A local variable used by an inner function is called an @def{upvalue}
(or @emphx{external local variable}, or simply @emphx{external variable})
inside the inner function.

Notice that each execution of a @Rw{local} statement
defines new local variables.
Consider the following example:

```
@verbatim{
a = {}
local x = 20
for i = 1, 10 do
 local y = 0
 a[i] = function () y = y + 1; return x + y end
end
}
```

The loop creates ten closures
(that is, ten instances of the anonymous function).
Each of these closures uses a different @id{y} variable,
while all of them share the same @id{x}.

}

}

@C{--}
@sect1{API| @title{The Application Program Interface}

@simplesect{

@index{C
API}
This section describes the @N{C API} for Lua, that is,
the set of @N{C functions} available to the host program to communicate
with Lua.
All API functions and related types and constants
are declared in the header file @defid{lua.h}.

Even when we use the term @Q{function},
any facility in the API may be provided as a macro instead.
Except where stated otherwise,
all such macros use each of their arguments exactly once
(except for the first argument, which is always a Lua state),
and so do not generate any hidden side-effects.

As in most @N{C libraries},
the Lua API functions do not check their arguments
for validity or consistency.
However, you can change this behavior by compiling Lua
with the macro @defid{LUA_USE_APICHECK} defined.

The Lua library is fully reentrant:
it has no global variables.
It keeps all information it needs in a dynamic structure,
called the @def{Lua state}.

Each Lua state has one or more threads,
which correspond to independent,
cooperative lines of execution.
The type @Lid{lua_State} (despite its name) refers to a thread.
(Indirectly, through the thread, it also refers to the
Lua state associated to the thread.)

A pointer to a thread must be passed as the first argument to
every function in the library, except to @Lid{lua_newstate},
which creates a Lua state from scratch and returns a pointer
to the @emph{main thread} in the new state.

}

@sect2{@title{The Stack}

@simplesect{

Lua uses a @emph{virtual stack} to pass values to and from C.
Each element in this stack represents a Lua value

(@nil, number, string, etc.).
Functions in the API can access this stack through the
Lua state parameter that they receive.

Whenever Lua calls C, the called function gets a new stack,
which is independent of previous stacks and of stacks of
@N{C functions} that are still active.
This stack initially contains any arguments to the @N{C function}
and it is where the @N{C function} can store temporary
Lua values and must push
its results
to be returned to the caller @seeC{lua_CFunction}.

For convenience,
most query operations in the API do not follow a strict stack discipline.
Instead, they can refer to any element in the stack
by using an @emph{index}:@index{index (API stack)}
A positive index represents an absolute stack position,
starting @N{at 1} as the bottom of the stack;
a negative index represents an offset relative to the top of the stack.
More specifically, if the stack has @rep{n} elements,
then @N{index 1} represents the first element
(that is, the element that was pushed onto the stack first)
and
@N{index @rep{n}} represents the last element;
@N{index @num{-1}} also represents the last element
(that is, the element at @N{the top})
and index @M{-n} represents the first element.

}

@sect3{stacksize| @title{Stack Size}

When you interact with the Lua API,
you are responsible for ensuring consistency.
In particular,
@emph{you are responsible for controlling stack overflow}.
When you call any
API function,
you must ensure the stack has enough room to accommodate the results.

There is one exception to the above rule:
When you call a Lua function
without a fixed number of results @seeF{lua_call},
Lua ensures that the stack has enough space for all results.
However, it does not ensure any extra space.
So, before pushing anything on the stack after such a call
you should use @Lid{lua_checkstack}.

Whenever Lua calls C,
it ensures that the stack has space for
at least @defid{LUA_MINSTACK} extra elements;
that is, you can safely push up to @id{LUA_MINSTACK} values into it.
@id{LUA_MINSTACK} is defined as 20,
so that usually you do not have to worry about stack space
unless your code has loops pushing elements onto the stack.
Whenever necessary,
you can use the function @Lid{lua_checkstack}
to ensure that the stack has enough space for pushing new elements.

}

@sect3{@title{Valid and Acceptable Indices}

Any function in the API that receives stack indices
works only with @emphx{valid
 indices} or @emphx{acceptable indices}.

A @def{valid index} is an index that refers to a
position that stores a modifiable Lua value.
It comprises stack indices @N{between 1} and the stack top
(@T{1 @leq abs(index) @leq top})
@index{stack index}
plus @def{pseudo-indices},
which represent some positions that are accessible to @N{C code}
but that are not in the stack.
Pseudo-indices are used to access the registry @see{registry}
and the upvalues of a @N{C function} @see{c-closure}.

Functions that do not need a specific mutable position,
but only a value (e.g., query functions),
can be called with acceptable indices.
An @def{acceptable index} can be any valid index,
but it also can be any positive index after the stack top
within the space allocated for the stack,
that is, indices up to the stack size.
(Note that 0 is never an acceptable index.)
Indices to upvalues @see{c-closure} greater than the real number
of upvalues in the current @N{C function} are also acceptable (but invalid).
Except
 when noted otherwise,
functions in the API work with acceptable indices.

Acceptable indices serve to avoid extra tests
against the stack top when querying the stack.
For instance, a @N{C function} can query its third argument

without the need to check whether there is a third argument,
that is, without the need to check whether 3 is a valid index.

For functions that can be called with acceptable indices,
any non-valid index is treated as if it
contains a value of a virtual type @defid{LUA_TNONE},
which behaves like a nil value.

}

@sect3{constchar|@title{Pointers to strings}

Several functions in the API return pointers (@T{const char*})
to Lua strings in the stack.
(See @Lid{lua_pushfstring}, @Lid{lua_pushlstring},
@Lid{lua_pushstring}, and @Lid{lua_tolstring}.
See also @Lid{luaL_checklstring}, @Lid{luaL_checkstring},
and @Lid{luaL_tolstring} in the auxiliary library.)

In general,
Lua's garbage collection can free or move internal memory
and then invalidate pointers to
internal strings.
To allow a safe use of these pointers,
the API guarantees that any pointer to a string in a stack index
is valid while the string value at that index is not removed from the stack.
(It can be moved to another index, though.)
When the index is a pseudo-index (referring to an upvalue),
the pointer is valid while the corresponding call is active and
the corresponding upvalue is not modified.

Some functions in the debug interface
also return pointers to strings,
namely @Lid{lua_getlocal}, @Lid{lua_getupvalue},
@Lid{lua_setlocal}, and @Lid{lua_setupvalue}.
For these functions, the pointer is guaranteed to
be valid while the caller function is active and
the given closure (if one was given) is in the stack.

Except for these guarantees,
the garbage collector is free to invalidate
any pointer to internal strings.

}

}

@sect2{c-closure| @title{C Closures}

When a @N{C function} is created,
it is possible to associate some values with it,
thus creating a @def{@N{C closure}}
@seeC{lua_pushcclosure};
these
values are called @def{upvalues} and are
accessible to the function whenever it is called.

Whenever a @N{C function} is called,
its upvalues are located at specific pseudo-indices.
These pseudo-indices are produced by the macro
@Lid{lua_upvalueindex}.
The first upvalue associated with a function is at index
@T{lua_upvalueindex(1)}, and so on.
Any access to @T{lua_upvalueindex(@rep{n})},
where @rep{n} is greater than the number of upvalues of the
current function
(but not greater than 256,
which is one plus the maximum number of upvalues in a closure),
produces an acceptable but invalid index.

A @N{C closure} can also change the values
of its corresponding upvalues.

}

@sect2{registry| @title{Registry}

Lua provides a @def{registry},
a predefined table that can be used by any @N{C code} to
store whatever Lua values it needs to store.
The registry table is always accessible at pseudo-index
@defid{LUA_REGISTRYINDEX}.
Any @N{C library} can store data into
this table,
but it must take care to choose keys
that are different from those used
by other libraries, to avoid collisions.
Typically, you should use as key a string containing your library name,
or a light userdata with the address of a @N{C object} in your code,
or any Lua object created by your code.
As with variable names,
string keys starting with an underscore followed by
uppercase letters are reserved for Lua.

The integer keys in the registry are used
by the reference mechanism @seeC{luaL_ref}

and by some predefined values.
Therefore, integer keys in the registry
must not be used for other purposes.

When you create a new Lua state,
its registry comes with some predefined values.
These predefined values are indexed with integer keys
defined as constants in @id{lua.h}.
The following constants are defined:
@description{
@item{@defid{LUA_RIDX_MAINTHREAD}| At this index the registry has
the main thread of the state.
(The main thread is the one created together with the state.)
}

@item{@defid{LUA_RIDX_GLOBALS}|
 At this index the registry has
the @x{global environment}.
}
}

}

@sect2{C-error|@title{Error Handling in C}

@simplesect{

Internally, Lua uses the C @id{longjmp} facility to handle errors.
(Lua will use exceptions if you compile it as C++;
search for @id{LUAI_THROW} in the source code for details.)
When Lua faces any error,
such as a @x{memory allocation error} or a type error,
it @emph{raises} an error;
that is, it does a long jump.
A @emphx{protected environment} uses @id{setjmp}
to set a recovery point;
any error jumps to the most recent active recovery point.

Inside a @N{C function} you can raise an error explicitly
by calling @Lid{lua_error}.

Most functions in the API can raise an error,
for instance due to a @x{memory allocation error}.
The documentation for each function indicates whether
it can raise errors.

If an error happens outside any protected environment,
Lua calls a @def{panic function} (see @Lid{lua_atpanic})

and then calls @T{abort},
thus
exiting the host application.
Your panic function can avoid this exit by
never returning
(e.g., doing a long jump to your own recovery point outside Lua).

The panic function,
as its name implies,
is a mechanism of last resort.
Programs should avoid it.
As a general rule,
when a @N{C function} is called by Lua with a Lua state,
it can do whatever it wants on that Lua state,
as it should be already protected.
However,
when C code operates on other Lua states
(e.g., a Lua-state argument to the function,
a Lua state stored in the registry, or
the result of @Lid{lua_newthread}),
it should use them only in API calls that cannot raise errors.

The panic function runs as if it were a @x{message handler} @see{error};
in particular, the error object is on the top of the stack.
However, there is no guarantee about stack space.
To push anything on the stack,
the panic function must first check the available space @see{stacksize}.

}

@sect3{statuscodes|@title{Status Codes}

Several functions
that report errors in the API use the following
status codes to indicate different kinds of errors or other conditions:
@description{

@item{@defid{LUA_OK} (0)| no errors.}

@item{@defid{LUA_ERRRUN}| a runtime error.}

@item{@defid{LUA_ERRMEM}|
@x{memory allocation error}.
For such errors, Lua does not call the @x{message handler}.
}

@item{@defid{LUA_ERRERR}| error while running the @x{message handler}.}

@item{@defid{LUA_ERRSYNTAX}| syntax error during precompilation.}

@item{@defid{LUA_YIELD}| the thread (coroutine) yields.}

@item{@defid{LUA_ERRFILE}| a file-related error;
e.g., it cannot open or read the file.}

}
These constants are defined in the header file @id{lua.h}.

}

}

@sect2{continuations|@title{Handling Yields in C}

Internally, Lua uses the C @id{longjmp} facility to yield a coroutine.
Therefore, if a @N{C function} @id{foo} calls an API function
and this API function yields
(directly or indirectly by calling another function that yields),
Lua cannot return to
@id{foo} any more,
because the @id{longjmp} removes its frame from the @N{C stack}.

To avoid this kind of problem,
Lua raises an error whenever it tries to yield across an API call,
except for three functions:
@Lid{lua_yieldk}, @Lid{lua_callk}, and @Lid{lua_pcallk}.
All those functions receive a @def{continuation function}
(as a parameter named @id{k}) to continue execution after a yield.

We need to set some terminology to explain continuations.
We have a @N{C function} called from Lua which we will call
the @emph{original function}.
This original function then calls one of those three functions in the C API,
which we will call the @emph{callee function},
that then yields the current thread.
This can happen when the callee function is @Lid{lua_yieldk},
or when the callee function is either @Lid{lua_callk} or @Lid{lua_pcallk}
and the function called by them yields.

Suppose the running thread yields while executing the callee function.
After the thread resumes,
it eventually will finish
running the callee function.
However,
the callee function cannot return to the original function,

because its frame in the @N{C stack} was destroyed by the yield.
Instead, Lua calls a @def{continuation function},
which was given as an argument to the callee function.
As the name implies,
the continuation function should continue the task
of the original function.

As an illustration, consider the following function:
@verbatim{
int original_function (lua_State *L) {
 ... /* code 1 */
 status = lua_pcall(L, n, m, h); /* calls Lua */
 ... /* code 2 */
}
}
Now we want to allow
the Lua code being run by @Lid{lua_pcall} to yield.
First, we can rewrite our function like here:
@verbatim{
int k (lua_State *L, int status, lua_KContext ctx) {
 ... /* code 2 */
}

int original_function (lua_State *L) {
 ... /* code 1 */
 return k(L, lua_pcall(L, n, m, h), ctx);
}
}
In the above code,
the new function @id{k} is a
@emph{continuation function} (with type @Lid{lua_KFunction}),
which
 should do all the work that the original function
was doing after calling @Lid{lua_pcall}.
Now, we must inform Lua that it must call @id{k} if the Lua code
being executed by @Lid{lua_pcall} gets interrupted in some way
(errors or yielding),
so we rewrite the code as here,
replacing @Lid{lua_pcall} by @Lid{lua_pcallk}:
@verbatim{
int original_function (lua_State *L) {
 ... /* code 1 */
 return k(L, lua_pcallk(L, n, m, h, ctx2, k), ctx1);
}
}
Note the external, explicit call to the continuation:
Lua will call the continuation only if needed, that is,
in case of errors or resuming after a yield.

If the called function returns normally without ever yielding,
@Lid{lua_pcallk} (and @Lid{lua_callk}) will also return normally.
(Of course, instead of calling the continuation in that case,
you can do the equivalent work directly inside the original function.)

Besides the Lua state,
the continuation function has two other parameters:
the final status of the call and the context value
(@id{ctx}) that
was passed originally to @Lid{lua_pcallk}.
Lua does not use this context value;
it only passes this value from the original function to the
continuation function.
For @Lid{lua_pcallk},
the status is the same value that would be returned by @Lid{lua_pcallk},
except that it is @Lid{LUA_YIELD} when being executed after a yield
(instead of @Lid{LUA_OK}).
For @Lid{lua_yieldk} and @Lid{lua_callk},
the status is always @Lid{LUA_YIELD} when Lua calls the continuation.
(For these two functions,
Lua will not call the continuation in case of errors,
because they do not handle errors.)
Similarly, when using @Lid{lua_callk},
you should call the continuation function
with @Lid{LUA_OK} as the status.
(For @Lid{lua_yieldk}, there is not much point in calling
directly the continuation function,
because @Lid{lua_yieldk} usually does not return.)

Lua treats the continuation function as if it were the original function.
The continuation function receives the same Lua stack
from the original
function,
in the same state it would be if the callee function had returned.
(For instance,
after a @Lid{lua_callk} the function and its arguments are
removed from the stack and replaced by the results from the call.)
It also has the same upvalues.
Whatever it returns is handled by Lua as if it were the return
of the original function.

}

@sect2{@title{Functions and Types}

Here we list all functions and types from the @N{C API} in
alphabetical order.
Each function has an indicator like this:

@apii{o,p,x}

The first field, @T{o},
is how many elements the function pops from the stack.
The second field, @T{p},
is how many elements the function pushes onto the stack.
(Any function always pushes its results after popping its arguments.)
A field in the form @T{x|y} means the function can push (or pop)
@T{x} or @T{y} elements,
depending on the situation;
an interrogation mark @Char{?} means that
we cannot know how many elements the function pops/pushes
by looking only at its arguments.
(For
 instance, they may depend on what is in the stack.)
The third field, @T{x},
tells whether the function may raise errors:
@Char{-} means the function never raises any error;
@Char{m} means the function may raise only out-of-memory errors;
@Char{v} means the function may raise the errors explained in the text;
@Char{e} means the function can run arbitrary Lua code,
either directly or through metamethods,
and therefore may raise any errors.

@APIEntry{int lua_absindex (lua_State *L, int idx);|
@apii{0,0,-}

Converts the @x{acceptable index} @id{idx}
into an equivalent @x{absolute index}
(that is, one that does not depend on the stack size).

}

@APIEntry{
typedef void * (*lua_Alloc) (void *ud,
                             void *ptr,
                             size_t osize,
                             size_t nsize);|

The type of the @x{memory-allocation function} used by Lua states.
The allocator function must provide a
functionality similar to @id{realloc},
but not exactly the
 same.
Its arguments are
@id{ud}, an opaque pointer passed to @Lid{lua_newstate};

@id{ptr}, a pointer to the block being allocated/reallocated/freed;
@id{osize}, the original size of the block or some code about what
is being allocated;
and @id{nsize}, the new size of the block.

When @id{ptr} is not @id{NULL},
@id{osize} is the size of the block pointed by @id{ptr},
that is, the size given when it was allocated or reallocated.

When @id{ptr} is @id{NULL},
@id{osize} encodes the kind of object that Lua is allocating.
@id{osize} is any of
@Lid{LUA_TSTRING}, @Lid{LUA_TTABLE}, @Lid{LUA_TFUNCTION},
@Lid{LUA_TUSERDATA}, or @Lid{LUA_TTHREAD} when (and only when)
Lua is creating a new object of that type.
When @id{osize} is some other value,
Lua is allocating memory for something else.

Lua assumes the following behavior from the allocator function:

When @id{nsize} is zero,
the allocator must behave like @id{free}
and then return @id{NULL}.

When @id{nsize} is not zero,
the allocator must behave
like @id{realloc}.
In particular, the allocator returns @id{NULL}
if and only if it cannot fulfill the request.

Here is a simple implementation for the @x{allocator function}.
It is used in the auxiliary library by @Lid{luaL_newstate}.
@verbatim{
```
static void *l_alloc (void *ud, void *ptr, size_t osize,
                                  size_t nsize) {
 (void)ud;  (void)osize;  /* not used */
 if (nsize == 0) {
   free(ptr);
   return NULL;
 }
 else
   return realloc(ptr, nsize);
}
```
}
Note that @N{ISO C} ensures
that @T{free(NULL)} has no effect and that
@T{realloc(NULL,size)} is equivalent to @T{malloc(size)}.

}

@APIEntry{void lua_arith (lua_State *L, int op);|
@apii{2|1,1,e}

Performs an arithmetic or bitwise operation over the two values
(or one, in the case of negations)
at the top of the stack,
with the value on the top being the second operand,
pops these values, and pushes the result of the operation.
The function follows the semantics of the corresponding Lua
operator
(that is, it may call metamethods).

The value of @id{op} must be one of the following constants:
@description{

@item{@defid{LUA_OPADD}| performs addition (@T{+})}
@item{@defid{LUA_OPSUB}| performs subtraction (@T{-})}
@item{@defid{LUA_OPMUL}| performs multiplication (@T{*})}
@item{@defid{LUA_OPDIV}| performs float division (@T{/})}
@item{@defid{LUA_OPIDIV}| performs floor division (@T{//})}
@item{@defid{LUA_OPMOD}| performs modulo (@T{%})}
@item{@defid{LUA_OPPOW}| performs exponentiation (@T{^})}
@item{@defid{LUA_OPUNM}| performs mathematical negation (unary @T{-})}
@item{@defid{LUA_OPBNOT}| performs bitwise NOT (@T{~})}
@item{@defid{LUA_OPBAND}| performs bitwise AND (@T{&})}
@item{@defid{LUA_OPBOR}| performs bitwise OR (@T{|})}
@item{@defid{LUA_OPBXOR}| performs bitwise exclusive OR (@T{~})}
@item{@defid{LUA_OPSHL}| performs left shift (@T{<<})}
@item{@defid{LUA_OPSHR}| performs right shift (@T{>>})}

}

}

@APIEntry{lua_CFunction lua_atpanic (lua_State *L, lua_CFunction
panicf);|
@apii{0,0,-}

Sets a new panic function and returns the old one @see{C-error}.

}

@APIEntry{void lua_call (lua_State *L, int nargs, int nresults);|
@apii{nargs+1,nresults,e}

Calls a function.

Like regular Lua calls,
@id{lua_call} respects the @idx{__call} metamethod.
So, here the word @Q{function}
means any callable value.

To do a call you must use the following protocol:
first, the function to be called is pushed onto the stack;
then, the arguments to the call are pushed
in direct order;
that is, the first argument is pushed first.
Finally you call @Lid{lua_call};
@id{nargs} is the number of arguments that you pushed onto the stack.
When the function returns,
all arguments and the function value are popped
and the call results are pushed onto the stack.
The number of results is adjusted to @id{nresults},
unless @id{nresults} is @defid{LUA_MULTRET}.
In this case, all results from the function are pushed;
Lua takes care that the returned values fit into the stack space,
but
it does not ensure any extra space in the stack.
The function results are pushed onto the stack in direct order
(the first result is pushed first),
so that after the call the last result is on the top of the stack.

Any error while calling and running the function is propagated upwards
(with a @id{longjmp}).

The following example shows how the host program can do the
equivalent to this Lua code:
@verbatim{
a = f("how", t.x, 14)
}
Here it is @N{in C}:
@verbatim{
lua_getglobal(L, "f"); /* function to be called */
lua_pushliteral(L, "how"); /* 1st argument */
lua_getglobal(L, "t"); /* table to be indexed */
lua_getfield(L, -1, "x"); /* push result of t.x (2nd arg) */
lua_remove(L, -2); /* remove 't' from the stack */
lua_pushinteger(L, 14); /* 3rd argument */
lua_call(L, 3, 1); /* call 'f' with 3 arguments and 1 result */
lua_setglobal(L, "a"); /* set global
 'a' */
}
Note that the code above is @emph{balanced}:
at its end, the stack is back to its original configuration.
This is considered good programming practice.

}

@APIEntry{
void lua_callk (lua_State *L,
int nargs,
int nresults,
lua_KContext ctx,
lua_KFunction k);|
@apii{nargs + 1,nresults,e}

This function behaves exactly like @Lid{lua_call},
but allows the called function to yield @see{continuations}.

}

@APIEntry{typedef int (*lua_CFunction) (lua_State *L);|

Type for @N{C functions}.

In order to communicate properly with Lua,
a @N{C function} must use the following protocol,
which defines the way parameters and results are passed:
a @N{C function} receives its arguments from Lua in its stack
in direct order (the first argument is pushed first).
So, when the function starts,
@T{lua_gettop(L)} returns the number of arguments received by the function.
The first argument (if any) is at index 1
and its last argument
is at index @T{lua_gettop(L)}.
To return values to Lua, a @N{C function} just pushes them onto the stack,
in direct order (the first result is pushed first),
and returns in C the number of results.
Any other value in the stack below the results will be properly
discarded by Lua.
Like a Lua function, a @N{C function} called by Lua can also return
many results.

As an example, the following function receives a variable number
of numeric arguments and returns their average and their sum:
@verbatim{
static int foo (lua_State *L) {
int n = lua_gettop(L); /* number of arguments */
lua_Number sum = 0.0;
int i;
for (i = 1; i <= n; i++) {
if (!lua_isnumber(L, i)) {
lua_pushliteral(L, "incorrect argument");

```
    lua_error(L);
  }
  sum += lua_tonumber(L, i);
 }
 lua_pushnumber(L, sum/n);        /* first result */
 lua_pushnumber(L, sum);         /* second result */
 return 2;                   /* number of results */
}
}
```

```
}
```

@APIEntry{int lua_checkstack (lua_State
*L, int n);|
@apii{0,0,-}

Ensures that the stack has space for at least @id{n} extra elements,
that is, that you can safely push up to @id{n} values into it.
It returns false if it cannot fulfill the request,
either because it would cause the stack
to be greater than a fixed maximum size
(typically at least several thousand elements) or
because it cannot allocate memory for the extra space.
This function never shrinks the stack;
if the stack already has space for the extra elements,
it is left unchanged.

}

@APIEntry{void lua_close (lua_State *L);|
@apii{0,0,-}

Close all active to-be-closed variables in the main thread,
release all objects in the given Lua state
(calling the corresponding garbage-collection metamethods, if any),
and frees all dynamic memory used by this state.

On several platforms, you may not need to call this function,
because all resources are naturally released when the host program ends.
On the other hand, long-running programs that create multiple states,
such
as daemons or web servers,
will probably need to close states as soon as they are not needed.

}

@APIEntry{void lua_closeslot (lua_State *L, int index);|
@apii{0,0,e}

Close the to-be-closed slot at the given index and set its value to @nil.
The index must be the last index previously marked to be closed
@see{lua_toclose} that is still active (that is, not closed yet).

A @idx{__close} metamethod cannot yield
when called through this function.

(This function was introduced in @N{release 5.4.3}.)

}

@APIEntry{int lua_closethread (lua_State *L, lua_State *from);|
@apii{0,?,-}

Resets a thread, cleaning its call stack and closing all pending
to-be-closed variables.
Returns a status code:
@Lid{LUA_OK} for no errors in the thread
(either the original error that stopped the thread or
errors in closing methods),
or an error status otherwise.
In case of error,
leaves the error object on the top of the stack.

The parameter @id{from} represents the coroutine that is resetting @id{L}.
If
 there is no such coroutine,
this parameter can be @id{NULL}.

(This function was introduced in @N{release 5.4.6}.)

}

@APIEntry{int lua_compare (lua_State *L, int index1, int index2, int op);|
@apii{0,0,e}

Compares two Lua values.
Returns 1 if the value at index @id{index1} satisfies @id{op}
when compared with the value at index @id{index2},
following the semantics of the corresponding Lua operator
(that is, it may call metamethods).
Otherwise @N{returns 0}.
Also @N{returns 0} if any of the indices is not valid.

The value of @id{op} must be one of the following constants:
@description{

@item{@defid{LUA_OPEQ}| compares for equality (@T{==})}
@item{@defid{LUA_OPLT}| compares for less than (@T{<})}
@item{@defid{LUA_OPLE}| compares for less or equal (@T{<=})}

}

}

@APIEntry{void lua_concat (lua_State *L, int n);|
@apii{n,1,e}

Concatenates the @id{n} values at the top of the stack,
pops them, and leaves the result on the top.
If @N{@T{n} is 1}, the result is the single value on the
stack
(that is, the function does nothing);
if @id{n} is 0, the result is the empty string.
Concatenation is performed following the usual semantics of Lua
@see{concat}.

}

@APIEntry{void lua_copy (lua_State *L, int fromidx, int toidx);|
@apii{0,0,-}

Copies the element at index @id{fromidx}
into the valid index @id{toidx},
replacing the value at that position.
Values at other positions are not affected.

}

@APIEntry{void lua_createtable (lua_State *L, int narr, int nrec);|
@apii{0,1,m}

Creates a new empty table and pushes it onto the stack.
Parameter @id{narr} is a hint for how many elements the table
will have as a sequence;
parameter @id{nrec} is a hint for how many other elements
the table will have.
Lua may use these hints to preallocate memory for the new table.
This preallocation may help performance when you know in advance
how many elements the table will have.
Otherwise you can use the function @Lid{lua_newtable}.

}

@APIEntry{int lua_dump (lua_State *L,

lua_Writer writer,
void *data,
int strip);|
@apii{0,0,-}

Dumps a function as a binary chunk.
Receives a Lua function on the top of the stack
and produces a binary chunk that,
if loaded again,
results in a function equivalent to the one dumped.
As it produces parts of the chunk,
@Lid{lua_dump} calls function @id{writer} @seeC{lua_Writer}
with the given @id{data}
to write them.

If @id{strip} is true,
the binary representation may not include all debug information
about the function,
to save space.

The value returned is the error code returned by the last
call to the writer;
@N{0 means} no errors.

This function does not pop the Lua function from the stack.

}

@APIEntry{int lua_error (lua_State *L);|
@apii{1,0,v}

Raises a Lua error,
using the value on the top of the stack as the error object.
This function does a long jump,
and therefore never returns
@seeC{luaL_error}.

}

@APIEntry{int lua_gc (lua_State *L, int what, ...);|
@apii{0,0,-}

Controls

the garbage collector.

This function performs several tasks,
according to the value of the parameter @id{what}.
For options that need extra arguments,
they are listed after the option.
@description{

@item{@id{LUA_GCCOLLECT}|
Performs a full garbage-collection cycle.
}

@item{@id{LUA_GCSTOP}|
Stops the garbage collector.
}

@item{@id{LUA_GCRESTART}|
Restarts the garbage collector.
}

@item{@id{LUA_GCCOUNT}|
Returns the current amount of memory (in Kbytes) in use by Lua.
}

@item{@id{LUA_GCCOUNTB}|
Returns the remainder of dividing the current amount of bytes of
memory in use by Lua by 1024.
}

@item{@id{LUA_GCSTEP} @T{(int stepsize)}|
Performs an incremental step of garbage collection,
corresponding to the allocation of @id{stepsize} Kbytes.
}

@item{@id{LUA_GCISRUNNING}|
Returns a boolean that tells whether the collector is running
(i.e., not stopped).
}

@item{@id{LUA_GCINC} (int pause, int stepmul, stepsize)|
Changes the collector to incremental mode
with the
given parameters @see{incmode}.
Returns the previous mode (@id{LUA_GCGEN} or @id{LUA_GCINC}).
}

@item{@id{LUA_GCGEN} (int minormul, int majormul)|
Changes the collector to generational mode

with the given parameters @see{genmode}.
Returns the previous mode (@id{LUA_GCGEN} or @id{LUA_GCINC}).
}

}
For more details about these options,
see @Lid{collectgarbage}.

This function should not be called by a finalizer.

}

@APIEntry{lua_Alloc lua_getallocf (lua_State *L, void **ud);|
@apii{0,0,-}

Returns the @x{memory-allocation function} of a given state.
If @id{ud} is not @id{NULL}, Lua stores in @T{*ud} the
opaque pointer given when the memory-allocator function was set.

}

@APIEntry{int lua_getfield (lua_State *L, int index, const char *k);|
@apii{0,1,e}

Pushes onto the stack the value @T{t[k]},
where @id{t} is the value at the given index.
As in Lua, this function may trigger a metamethod
for the @Q{index} event @see{metatable}.

Returns the type of the pushed value.

}

@APIEntry{void
 *lua_getextraspace (lua_State *L);|
@apii{0,0,-}

Returns a pointer to a raw memory area associated with the
given Lua state.
The application can use this area for any purpose;
Lua does not use it for anything.

Each new thread has this area initialized with a copy
of the area of the @x{main thread}.

By default, this area has the size of a pointer to void,
but you can recompile Lua with a different size for this area.
(See @id{LUA_EXTRASPACE} in @id{luaconf.h}.)

}

@APIEntry{int lua_getglobal (lua_State *L, const char *name);|
@apii{0,1,e}

Pushes onto the stack the value of the global @id{name}.
Returns the type of that value.

}

@APIEntry{int lua_geti (lua_State *L, int index, lua_Integer i);|
@apii{0,1,e}

Pushes onto the stack the value @T{t[i]},
where @id{t} is the value at the given index.
As in Lua, this function may trigger a metamethod
for the @Q{index} event @see{metatable}.

Returns the type of the pushed value.

}

@APIEntry{int lua_getmetatable (lua_State *L, int index);|
@apii{0,0|1,-}

If
the value at the given index has a metatable,
the function pushes that metatable onto the stack and @N{returns 1}.
Otherwise,
the function @N{returns 0} and pushes nothing on the stack.

}

@APIEntry{int lua_gettable (lua_State *L, int index);|
@apii{1,1,e}

Pushes onto the stack the value @T{t[k]},
where @id{t} is the value at the given index
and @id{k} is the value on the top of the stack.

This function pops the key from the stack,
pushing the resulting value in its place.
As in Lua, this function may trigger a metamethod
for the @Q{index} event @see{metatable}.

Returns the type of the pushed value.

}

@APIEntry{int lua_gettop (lua_State *L);|
@apii{0,0,-}

Returns the index of the top element in the stack.
Because indices start @N{at 1},
this result is equal to the number of elements in the stack;
in particular, @N{0 means} an empty stack.

}

@APIEntry{int lua_getiuservalue (lua_State *L, int index, int n);|
@apii{0,1,-}

Pushes onto the stack the @id{n}-th
user value associated with the
full userdata at the given index and
returns the type of the pushed value.

If the userdata does not have that value,
pushes @nil and returns @Lid{LUA_TNONE}.

}

@APIEntry{void lua_insert (lua_State *L, int index);|
@apii{1,1,-}

Moves the top element into the given valid index,
shifting up the elements above this index to open space.
This function cannot be called with a pseudo-index,
because a pseudo-index is not an actual stack position.

}

@APIEntry{typedef @ldots lua_Integer;|

The type of integers in Lua.

By default this type is @id{long long},
(usually a 64-bit two-complement integer),
but that can be changed to @id{long} or @id{int}
(usually a 32-bit two-complement integer).
(See @id{LUA_INT_TYPE} in @id{luaconf.h}.)

Lua also defines the constants
@defid{LUA_MININTEGER} and @defid{LUA_MAXINTEGER},
with the minimum and the maximum values that fit in this type.

}

@APIEntry{int lua_isboolean (lua_State *L, int index);|
@apii{0,0,-}

Returns 1
 if the value at the given index is a boolean,
and @N{0 otherwise}.

}

@APIEntry{int lua_iscfunction (lua_State *L, int index);|
@apii{0,0,-}

Returns 1 if the value at the given index is a @N{C function},
and @N{0 otherwise}.

}

@APIEntry{int lua_isfunction (lua_State *L, int index);|
@apii{0,0,-}

Returns 1 if the value at the given index is a function
(either C or Lua), and @N{0 otherwise}.

}

@APIEntry{int lua_isinteger (lua_State *L, int index);|
@apii{0,0,-}

Returns 1 if the value at the given index is an integer
(that is, the value is a number and is represented as an integer),
and @N{0 otherwise}.

}

@APIEntry{int lua_islightuserdata (lua_State *L, int index);|
@apii{0,0,-}

Returns 1 if the value at the given index is a light userdata,
and @N{0 otherwise}.

}

@APIEntry{int lua_isnil (lua_State *L, int index);|
@apii{0,0,-}

Returns 1 if the value at the given index is @nil,
and @N{0 otherwise}.

}

@APIEntry{int lua_isnone (lua_State *L, int index);|
@apii{0,0,-}

Returns
 1 if the given index is not valid,
and @N{0 otherwise}.

}

@APIEntry{int lua_isnoneornil (lua_State *L, int index);|
@apii{0,0,-}

Returns 1 if the given index is not valid
or if the value at this index is @nil,
and @N{0 otherwise}.

}

@APIEntry{int lua_isnumber (lua_State *L, int index);|
@apii{0,0,-}

Returns 1 if the value at the given index is a number
or a string convertible to a number,
and @N{0 otherwise}.

}

@APIEntry{int lua_isstring (lua_State *L, int index);|
@apii{0,0,-}

Returns 1 if the value at the given index is a string
or a number (which is always convertible to a string),
and @N{0 otherwise}.

}

@APIEntry{int lua_istable (lua_State *L, int index);|
@apii{0,0,-}

Returns 1 if the value at the given index is a table,
and @N{0 otherwise}.

}

@APIEntry{int lua_isthread (lua_State *L, int index);|
@apii{0,0,-}

Returns 1 if the value at the given index is a thread,
and @N{0 otherwise}.

}

@APIEntry{int lua_isuserdata (lua_State *L, int index);|
@apii{0,0,-}

Returns
1 if the value at the given index is a userdata
(either full or light), and @N{0 otherwise}.

}

@APIEntry{int lua_isyieldable (lua_State *L);|
@apii{0,0,-}

Returns 1 if the given coroutine can yield,
and @N{0 otherwise}.

}

@APIEntry{typedef @ldots lua_KContext;|

The type for continuation-function contexts.
It must be a numeric type.
This type is defined as @id{intptr_t}
when @id{intptr_t} is available,
so that it can store pointers too.
Otherwise, it is defined as @id{ptrdiff_t}.

}

@APIEntry{
typedef int (*lua_KFunction) (lua_State *L, int status, lua_KContext ctx);|

Type for continuation functions @see{continuations}.

}

@APIEntry{void lua_len (lua_State *L, int index);|
@apii{0,1,e}

Returns the length of the value at the given index.

It is equivalent to the @Char{#} operator in Lua @see{len-op} and
may trigger a metamethod for the @Q{length} event @see{metatable}.
The result is pushed on the stack.

}

@APIEntry{
int lua_load (lua_State *L,
lua_Reader reader,
void *data,
const char *chunkname,
const char *mode);|
@apii{0,1,-}

Loads a Lua chunk without running it.
If there are no errors,
@id{lua_load} pushes the compiled chunk as a Lua
function on top of the stack.
Otherwise, it pushes an error message.

The @id{lua_load} function uses a user-supplied @id{reader} function
to read the chunk @seeC{lua_Reader}.
The @id{data} argument is an opaque value passed to the reader function.

The @id{chunkname} argument gives a name to the chunk,
which is used for error messages and in debug information @see{debugI}.

@id{lua_load} automatically detects whether the chunk is text or binary
and loads it accordingly (see program @idx{luac}).
The string @id{mode} works as in function @Lid{load},
with the addition that
a @id{NULL} value is equivalent to the string @St{bt}.

@id{lua_load} uses the stack internally,
so the reader function must always leave the stack
unmodified when returning.

@id{lua_load} can return
@Lid{LUA_OK},
@Lid{LUA_ERRSYNTAX}, or @Lid{LUA_ERRMEM}.
The function may also return other values corresponding to
errors raised by the read function @see{statuscodes}.

If the resulting function has upvalues,
its first upvalue is set to the value of the @x{global environment}
stored at index @id{LUA_RIDX_GLOBALS} in the registry @see{registry}.
When loading main chunks,
this upvalue will be the @id{_ENV} variable @see{globalenv}.

Other upvalues are initialized with @nil.

}

@APIEntry{lua_State *lua_newstate (lua_Alloc f, void *ud);|
@apii{0,0,-}

Creates a new independent state and returns its main thread.
Returns @id{NULL} if it cannot create the state
(due to lack of memory).
The argument @id{f} is the @x{allocator function};
Lua will do all memory allocation for this state
through this function @seeF{lua_Alloc}.
The second argument, @id{ud}, is an opaque pointer that Lua
passes to the allocator in every call.

}

@APIEntry{void lua_newtable (lua_State *L);|
@apii{0,1,m}

Creates
 a new empty table and pushes it onto the stack.
It is equivalent to @T{lua_createtable(L, 0, 0)}.

}

@APIEntry{lua_State *lua_newthread (lua_State *L);|
@apii{0,1,m}

Creates a new thread, pushes it on the stack,
and returns a pointer to a @Lid{lua_State} that represents this new thread.
The new thread returned by this function shares with the original thread
its global environment,
but has an independent execution stack.

Threads are subject to garbage collection,
like any Lua object.

}

@APIEntry{void *lua_newuserdatauv (lua_State *L, size_t size, int nuvalue);|
@apii{0,1,m}

This function creates and pushes on the stack a new full userdata,
with @id{nuvalue} associated Lua values, called @id{user values},
plus an associated block of raw memory with @id{size} bytes.
(The user values can be set and read with the functions

@Lid{lua_setiuservalue} and @Lid{lua_getiuservalue}.)

The function returns the address of the block of memory.
Lua ensures that this address is valid as long as
the
corresponding userdata is alive @see{GC}.
Moreover, if the userdata is marked for finalization @see{finalizers},
its address is valid at least until the call to its finalizer.

}

@APIEntry{int lua_next (lua_State *L, int index);|
@apii{1,2|0,v}

Pops a key from the stack,
and pushes a key@En{}value pair from the table at the given index,
the @Q{next} pair after the given key.
If there are no more elements in the table,
then @Lid{lua_next} @N{returns 0} and pushes nothing.

A typical table traversal looks like this:
@verbatim{
/* table is in the stack at index 't' */
lua_pushnil(L); /* first key */
while (lua_next(L, t) != 0) {
 /* uses 'key' (at index -2) and 'value' (at index -1) */
 printf("%s - %s\n",
        lua_typename(L, lua_type(L, -2)),
        lua_typename(L, lua_type(L, -1)));
 /* removes 'value'; keeps 'key' for next iteration */
 lua_pop(L, 1);
}
}

While traversing a table,
avoid calling @Lid{lua_tolstring} directly on a key,
unless you know that the key is
actually a string.
Recall that @Lid{lua_tolstring} may change
the value at the given index;
this confuses the next call to @Lid{lua_next}.

This function may raise an error if the given key
is neither @nil nor present in the table.
See function @Lid{next} for the caveats of modifying
the table during its traversal.

}

@APIEntry{typedef @ldots lua_Number;|

The type of floats in Lua.

By default this type is double,
but that can be changed to a single float or a long double.
(See @id{LUA_FLOAT_TYPE} in @id{luaconf.h}.)

}

@APIEntry{int lua_numbertointeger (lua_Number n, lua_Integer *p);|

Tries to convert a Lua float to a Lua integer;
the float @id{n} must have an integral value.
If that value is within the range of Lua integers,
it is converted to an integer and assigned to @T{*p}.
The macro results in a boolean indicating whether the
conversion was successful.
(Note that this range test can be tricky to do
correctly without this macro, due to rounding.)

This macro may evaluate its
arguments more than once.

}

@APIEntry{int lua_pcall (lua_State *L, int nargs, int nresults, int msgh);|
@apii{nargs + 1,nresults|1,-}

Calls a function (or a callable object) in protected mode.

Both @id{nargs} and @id{nresults} have the same meaning as
in @Lid{lua_call}.
If there are no errors during the call,
@Lid{lua_pcall} behaves exactly like @Lid{lua_call}.
However, if there is any error,
@Lid{lua_pcall} catches it,
pushes a single value on the stack (the error object),
and returns an error code.
Like @Lid{lua_call},
@Lid{lua_pcall} always removes the function
and its arguments from the stack.

If @id{msgh} is 0,
then the error object returned on the stack
is exactly the original error object.
Otherwise, @id{msgh} is the stack index of a

@emph{message handler}.
(This index cannot be a pseudo-index.)
In case of runtime errors,
this handler will be called with the error object
and its return value will be the object
returned on the stack by @Lid{lua_pcall}.

Typically, the message
handler is used to add more debug
information to the error object, such as a stack traceback.
Such information cannot be gathered after the return of @Lid{lua_pcall},
since by then the stack has unwound.

The @Lid{lua_pcall} function returns one of the following status codes:
@Lid{LUA_OK}, @Lid{LUA_ERRRUN}, @Lid{LUA_ERRMEM}, or @Lid{LUA_ERRERR}.

}

@APIEntry{
int lua_pcallk (lua_State *L,
int nargs,
int nresults,
int msgh,
lua_KContext ctx,
lua_KFunction k);|
@apii{nargs + 1,nresults|1,-}

This function behaves exactly like @Lid{lua_pcall},
except that it allows the called function to yield @see{continuations}.

}

@APIEntry{void lua_pop (lua_State *L, int n);|
@apii{n,0,e}

Pops @id{n} elements from the stack.
It is implemented as a macro over @Lid{lua_settop}.

}

@APIEntry{void lua_pushboolean (lua_State *L, int b);|
@apii{0,1,-}

Pushes a boolean value with value @id{b} onto the stack.

}

@APIEntry{void

lua_pushcclosure (lua_State *L, lua_CFunction fn, int n);|
@apii{n,1,m}

Pushes a new @N{C closure} onto the stack.
This function receives a pointer to a @N{C function}
and pushes onto the stack a Lua value of type @id{function} that,
when called, invokes the corresponding @N{C function}.
The parameter @id{n} tells how many upvalues this function will have
@see{c-closure}.

Any function to be callable by Lua must
follow the correct protocol to receive its parameters
and return its results @seeC{lua_CFunction}.

When a @N{C function} is created,
it is possible to associate some values with it,
the so called upvalues;
these upvalues are then accessible to the function whenever it is called.
This association is called a @x{@N{C closure}} @see{c-closure}.
To create a @N{C closure},
first the initial values for its upvalues must be pushed onto the stack.
(When there are multiple upvalues, the first value is pushed first.)
Then @Lid{lua_pushcclosure}
is called to create and push the @N{C
function} onto the stack,
with the argument @id{n} telling how many values will be
associated with the function.
@Lid{lua_pushcclosure} also pops these values from the stack.

The maximum value for @id{n} is 255.

When @id{n} is zero,
this function creates a @def{light @N{C function}},
which is just a pointer to the @N{C function}.
In that case, it never raises a memory error.

}

@APIEntry{void lua_pushcfunction (lua_State *L, lua_CFunction f);|
@apii{0,1,-}

Pushes a @N{C function} onto the stack.
This function is equivalent to @Lid{lua_pushcclosure} with no upvalues.

}

@APIEntry{const char *lua_pushfstring (lua_State *L, const char *fmt, ...);|
@apii{0,1,v}

Pushes onto the stack a formatted string
and returns a pointer to this string @see{constchar}.
It is similar to the @ANSI{sprintf},
but has two important differences.
First,
you do not have to allocate space for the result;
the result is a Lua string and Lua takes care of memory allocation
(and deallocation, through garbage
 collection).
Second,
the conversion specifiers are quite restricted.
There are no flags, widths, or precisions.
The conversion specifiers can only be
@Char{%%} (inserts the character @Char{%}),
@Char{%s} (inserts a zero-terminated string, with no size restrictions),
@Char{%f} (inserts a @Lid{lua_Number}),
@Char{%I} (inserts a @Lid{lua_Integer}),
@Char{%p} (inserts a pointer),
@Char{%d} (inserts an @T{int}),
@Char{%c} (inserts an @T{int} as a one-byte character), and
@Char{%U} (inserts a @T{long int} as a @x{UTF-8} byte sequence).

This function may raise errors due to memory overflow
or an invalid conversion specifier.

}

@APIEntry{void lua_pushglobaltable (lua_State *L);|
@apii{0,1,-}

Pushes the @x{global environment} onto the stack.

}

@APIEntry{void lua_pushinteger (lua_State *L, lua_Integer n);|
@apii{0,1,-}

Pushes an integer with value @id{n} onto the stack.

}

@APIEntry{void lua_pushlightuserdata (lua_State *L, void *p);|
@apii{0,1,-}

Pushes a light userdata onto the stack.

Userdata

represent @N{C values} in Lua.
A @def{light userdata} represents a pointer, a @T{void*}.
It is a value (like a number):
you do not create it, it has no individual metatable,
and it is not collected (as it was never created).
A light userdata is equal to @Q{any}
light userdata with the same @N{C address}.

}

@APIEntry{const char *lua_pushliteral (lua_State *L, const char *s);|
@apii{0,1,m}

This macro is equivalent to @Lid{lua_pushstring},
but should be used only when @id{s} is a literal string.
(Lua may optimize this case.)

}

@APIEntry{const char *lua_pushlstring (lua_State *L, const char *s, size_t len);|
@apii{0,1,m}

Pushes the string pointed to by @id{s} with size @id{len}
onto the stack.
Lua will make or reuse an internal copy of the given string,
so the memory at @id{s} can be freed or reused immediately after
the function returns.
The string can contain any binary data,
including @x{embedded zeros}.

Returns a pointer to the internal copy of the string @see{constchar}.

}

@APIEntry{void
lua_pushnil (lua_State *L);|
@apii{0,1,-}

Pushes a nil value onto the stack.

}

@APIEntry{void lua_pushnumber (lua_State *L, lua_Number n);|
@apii{0,1,-}

Pushes a float with value @id{n} onto the stack.

}

@APIEntry{const char *lua_pushstring (lua_State *L, const char *s);|
@apii{0,1,m}

Pushes the zero-terminated string pointed to by @id{s}
onto the stack.
Lua will make or reuse an internal copy of the given string,
so the memory at @id{s} can be freed or reused immediately after
the function returns.

Returns a pointer to the internal copy of the string @see{constchar}.

If @id{s} is @id{NULL}, pushes @nil and returns @id{NULL}.

}

@APIEntry{int lua_pushthread (lua_State *L);|
@apii{0,1,-}

Pushes the thread represented by @id{L} onto the stack.
Returns 1 if this thread is the @x{main thread} of its state.

}

@APIEntry{void lua_pushvalue (lua_State *L, int index);|
@apii{0,1,-}

Pushes a copy of the element at the given index
onto the stack.

}

@APIEntry{
const
 char *lua_pushvfstring (lua_State *L,
                         const char *fmt,
                         va_list argp);|
@apii{0,1,v}

Equivalent to @Lid{lua_pushfstring}, except that it receives a @id{va_list}
instead of a variable number of arguments.

}

@APIEntry{int lua_rawequal (lua_State *L, int index1, int index2);|
@apii{0,0,-}

Returns 1 if the two values in indices @id{index1} and

@id{index2} are primitively equal
(that is, equal without calling the @idx{__eq} metamethod).
Otherwise @N{returns 0}.
Also @N{returns 0} if any of the indices are not valid.

}

@APIEntry{int lua_rawget (lua_State *L, int index);|
@apii{1,1,-}

Similar to @Lid{lua_gettable}, but does a raw access
(i.e., without metamethods).
The value at @id{index} must be a table.

}

@APIEntry{int lua_rawgeti (lua_State *L, int index, lua_Integer n);|
@apii{0,1,-}

Pushes onto the stack the value @T{t[n]},
where @id{t} is the table at the given index.
The access is raw,
that is, it does not use
the @idx{__index} metavalue.

Returns the type of the pushed value.

}

@APIEntry{int lua_rawgetp (lua_State *L, int index, const void *p);|
@apii{0,1,-}

Pushes onto the stack the value @T{t[k]},
where @id{t} is the table at the given index and
@id{k} is the pointer @id{p} represented as a light userdata.
The access is raw;
that is, it does not use the @idx{__index} metavalue.

Returns the type of the pushed value.

}

@APIEntry{lua_Unsigned lua_rawlen (lua_State *L, int index);|
@apii{0,0,-}

Returns the raw @Q{length} of the value at the given index:
for strings, this is the string length;
for tables, this is the result of the length operator (@Char{#})

with no metamethods;
for userdata, this is the size of the block of memory allocated
for the userdata.
For other values, this call @N{returns 0}.

}

@APIEntry{void lua_rawset (lua_State *L, int index);|
@apii{2,0,m}

Similar to @Lid{lua_settable}, but does a raw assignment
(i.e., without metamethods).
The value at @id{index} must
be a table.

}

@APIEntry{void lua_rawseti (lua_State *L, int index, lua_Integer i);|
@apii{1,0,m}

Does the equivalent of @T{t[i] = v},
where @id{t} is the table at the given index
and @id{v} is the value on the top of the stack.

This function pops the value from the stack.
The assignment is raw,
that is, it does not use the @idx{__newindex} metavalue.

}

@APIEntry{void lua_rawsetp (lua_State *L, int index, const void *p);|
@apii{1,0,m}

Does the equivalent of @T{t[p] = v},
where @id{t} is the table at the given index,
@id{p} is encoded as a light userdata,
and @id{v} is the value on the top of the stack.

This function pops the value from the stack.
The assignment is raw,
that is, it does not use the @idx{__newindex} metavalue.

}

@APIEntry{
typedef const char * (*lua_Reader) (lua_State *L,
                                    void *data,
                                    size_t *size);|

The reader function used by @Lid{lua_load}.
Every time @Lid{lua_load} needs another piece of
the chunk,
it calls the reader,
passing along its @id{data} parameter.
The reader must return a pointer to a block of memory
with a new piece of the chunk
and set @id{size} to the block size.
The block must exist until the reader function is called again.
To signal the end of the chunk,
the reader must return @id{NULL} or set @id{size} to zero.
The reader function may return pieces of any size greater than zero.

}

@APIEntry{void lua_register (lua_State *L, const char *name, lua_CFunction f);|
@apii{0,0,e}

Sets the @N{C function} @id{f} as the new value of global @id{name}.
It is defined as a macro:
@verbatim{
#define lua_register(L,n,f) \
    (lua_pushcfunction(L, f), lua_setglobal(L, n))
}

}

@APIEntry{void lua_remove (lua_State *L, int index);|
@apii{1,0,-}

Removes the element at the given valid index,
shifting down the elements above this index to fill the gap.
This function cannot be called with a pseudo-index,
because a pseudo-index is not an actual stack position.

}

@APIEntry{void
lua_replace (lua_State *L, int index);|
@apii{1,0,-}

Moves the top element into the given valid index
without shifting any element
(therefore replacing the value at that given index),
and then pops the top element.

}

@APIEntry{int lua_resetthread (lua_State *L);|
@apii{0,?,-}

This function is deprecated;
it is equivalent to @Lid{lua_closethread} with
@id{from} being @id{NULL}.

}

@APIEntry{int lua_resume (lua_State *L, lua_State *from, int nargs,
                          int *nresults);|
@apii{?,?,-}

Starts and resumes a coroutine in the given thread @id{L}.

To start a coroutine,
you push the main function plus any arguments
onto the empty stack of the thread.
then you call @Lid{lua_resume},
with @id{nargs} being the number of arguments.
This call returns when the coroutine suspends or finishes its execution.
When it returns,
@id{*nresults} is updated and
the top of the stack contains
the @id{*nresults} values passed to @Lid{lua_yield}
or returned by the body function.
@Lid{lua_resume}
 returns
@Lid{LUA_YIELD} if the coroutine yields,
@Lid{LUA_OK} if the coroutine finishes its execution
without errors,
or an error code in case of errors @see{statuscodes}.
In case of errors,
the error object is on the top of the stack.

To resume a coroutine,
you remove the @id{*nresults} yielded values from its stack,
push the values to be passed as results from @id{yield},
and then call @Lid{lua_resume}.

The parameter @id{from} represents the coroutine that is resuming @id{L}.
If there is no such coroutine,
this parameter can be @id{NULL}.

}

@APIEntry{void lua_rotate (lua_State *L, int idx, int n);|

@apii{0,0,-}

Rotates the stack elements between the valid index @id{idx}
and the top of the stack.
The elements are rotated @id{n} positions in the direction of the top,
for a positive @id{n},
or @T{-n} positions in the direction of the bottom,
for a negative @id{n}.
The absolute value of @id{n} must not be greater than the size
of the slice being rotated.
This function
 cannot be called with a pseudo-index,
because a pseudo-index is not an actual stack position.

}

@APIEntry{void lua_setallocf (lua_State *L, lua_Alloc f, void *ud);|
@apii{0,0,-}

Changes the @x{allocator function} of a given state to @id{f}
with user data @id{ud}.

}

@APIEntry{void lua_setfield (lua_State *L, int index, const char *k);|
@apii{1,0,e}

Does the equivalent to @T{t[k] = v},
where @id{t} is the value at the given index
and @id{v} is the value on the top of the stack.

This function pops the value from the stack.
As in Lua, this function may trigger a metamethod
for the @Q{newindex} event @see{metatable}.

}

@APIEntry{void lua_setglobal (lua_State *L, const char *name);|
@apii{1,0,e}

Pops a value from the stack and
sets it as the new value of global @id{name}.

}

@APIEntry{void lua_seti (lua_State *L, int index, lua_Integer n);|
@apii{1,0,e}

Does the equivalent to @T{t[n] = v},
where @id{t} is the value at the given index
and @id{v} is the value on the top of
the stack.

This function pops the value from the stack.
As in Lua, this function may trigger a metamethod
for the @Q{newindex} event @see{metatable}.

}

@APIEntry{int lua_setiuservalue (lua_State *L, int index, int n);|
@apii{1,0,-}

Pops a value from the stack and sets it as
the new @id{n}-th user value associated to the
full userdata at the given index.
Returns 0 if the userdata does not have that value.

}

@APIEntry{int lua_setmetatable (lua_State *L, int index);|
@apii{1,0,-}

Pops a table or @nil from the stack and
sets that value as the new metatable for the value at the given index.
(@nil means no metatable.)

(For historical reasons, this function returns an @id{int},
which now is always 1.)

}

@APIEntry{void lua_settable (lua_State *L, int index);|
@apii{2,0,e}

Does the equivalent to @T{t[k] = v},
where @id{t} is the value at the given index,
@id{v} is the value on the top of the stack,
and @id{k} is the value just below the top.

This function pops both the key and the value
from the stack.
As in Lua, this function may trigger a metamethod
for the @Q{newindex} event @see{metatable}.

}

@APIEntry{void lua_settop (lua_State *L, int index);|
@apii{?,?,e}

Accepts any index, @N{or 0},
and sets the stack top to this index.
If the new top is greater than the old one,
then the new elements are filled with @nil.
If @id{index} @N{is 0}, then all stack elements are removed.

This function can run arbitrary code when removing an index
marked as to-be-closed from the stack.

}

@APIEntry{void lua_setwarnf (lua_State *L, lua_WarnFunction f, void *ud);|
@apii{0,0,-}

Sets the @x{warning function} to be used by Lua to emit warnings
@see{lua_WarnFunction}.
The @id{ud} parameter sets the value @id{ud} passed to
the warning function.

}

@APIEntry{typedef struct lua_State lua_State;|

An opaque structure that points to a thread and indirectly
(through the thread) to the whole state of a Lua interpreter.
The Lua library is fully reentrant:
it has no global variables.
All
information about a state is accessible through this structure.

A pointer to this structure must be passed as the first argument to
every function in the library, except to @Lid{lua_newstate},
which creates a Lua state from scratch.

}

@APIEntry{int lua_status (lua_State *L);|
@apii{0,0,-}

Returns the status of the thread @id{L}.

The status can be @Lid{LUA_OK} for a normal thread,
an error code if the thread finished the execution
of a @Lid{lua_resume} with an error,
or @Lid{LUA_YIELD} if the thread is suspended.

You can call functions only in threads with status @Lid{LUA_OK}.
You can resume threads with status @Lid{LUA_OK}
(to start a new coroutine) or @Lid{LUA_YIELD}
(to resume a coroutine).

}

@APIEntry{size_t lua_stringtonumber (lua_State *L, const char *s);|
@apii{0,1,-}

Converts the zero-terminated string @id{s} to a number,
pushes that number into the stack,
and returns the total size of the string,
that is, its length plus one.
The conversion can result in an integer
 or a float,
according to the lexical conventions of Lua @see{lexical}.
The string may have leading and trailing whitespaces and a sign.
If the string is not a valid numeral,
returns 0 and pushes nothing.
(Note that the result can be used as a boolean,
true if the conversion succeeds.)

}

@APIEntry{int lua_toboolean (lua_State *L, int index);|
@apii{0,0,-}

Converts the Lua value at the given index to a @N{C boolean}
value (@N{0 or 1}).
Like all tests in Lua,
@Lid{lua_toboolean} returns true for any Lua value
different from @false and @nil;
otherwise it returns false.
(If you want to accept only actual boolean values,
use @Lid{lua_isboolean} to test the value's type.)

}

@APIEntry{lua_CFunction lua_tocfunction (lua_State *L, int index);|
@apii{0,0,-}

Converts a value at the given index to a @N{C function}.
That value must be a @N{C function};
otherwise, returns @id{NULL}.

}

@APIEntry{void lua_toclose (lua_State *L, int index);|
@apii{0,0,m}

Marks the given index in the stack as a
to-be-closed
slot @see{to-be-closed}.
Like a to-be-closed variable in Lua,
the value at that slot in the stack will be closed
when it goes out of scope.
Here, in the context of a C function,
to go out of scope means that the running function returns to Lua,
or there is an error,
or the slot is removed from the stack through
@Lid{lua_settop} or @Lid{lua_pop},
or there is a call to @Lid{lua_closeslot}.
A slot marked as to-be-closed should not be removed from the stack
by any other function in the API except @Lid{lua_settop} or @Lid{lua_pop},
unless previously deactivated by @Lid{lua_closeslot}.

This function should not be called for an index
that is equal to or below an active to-be-closed slot.

Note that, both in case of errors and of a regular return,
by the time the @idx{__close} metamethod runs,
the @N{C stack} was already unwound,
so that any automatic @N{C variable} declared in the calling function
(e.g., a buffer) will be out of scope.

}

@APIEntry{lua_Integer lua_tointeger (lua_State
*L, int index);|
@apii{0,0,-}

Equivalent to @Lid{lua_tointegerx} with @id{isnum} equal to @id{NULL}.

}

@APIEntry{lua_Integer lua_tointegerx (lua_State *L, int index, int *isnum);|
@apii{0,0,-}

Converts the Lua value at the given index
to the signed integral type @Lid{lua_Integer}.
The Lua value must be an integer,
or a number or string convertible to an integer @see{coercion};
otherwise, @id{lua_tointegerx} @N{returns 0}.

If @id{isnum} is not @id{NULL},
its referent is assigned a boolean value that
indicates whether the operation succeeded.

}

@APIEntry{const char *lua_tolstring (lua_State *L, int index, size_t *len);|
@apii{0,0,m}

Converts the Lua value at the given index to a @N{C string}.
If @id{len} is not @id{NULL},
it sets @T{*len} with the string length.
The Lua value must be a string or a number;
otherwise, the function returns @id{NULL}.
If the value is a number,
then @id{lua_tolstring} also
@emph{changes the actual value in the stack to a string}.
(This change
 confuses @Lid{lua_next}
when @id{lua_tolstring} is applied to keys during a table traversal.)

@id{lua_tolstring} returns a pointer
to a string inside the Lua state @see{constchar}.
This string always has a zero (@Char{\0})
after its last character (as @N{in C}),
but can contain other zeros in its body.

}

@APIEntry{lua_Number lua_tonumber (lua_State *L, int index);|
@apii{0,0,-}

Equivalent to @Lid{lua_tonumberx} with @id{isnum} equal to @id{NULL}.

}

@APIEntry{lua_Number lua_tonumberx (lua_State *L, int index, int *isnum);|
@apii{0,0,-}

Converts the Lua value at the given index
to the @N{C type} @Lid{lua_Number} @seeC{lua_Number}.
The Lua value must be a number or a string convertible to a number
@see{coercion};
otherwise, @Lid{lua_tonumberx} @N{returns 0}.

If @id{isnum} is not @id{NULL},
its referent is assigned a boolean value that
indicates whether the operation succeeded.

}

@APIEntry{const void *lua_topointer (lua_State *L, int index);|
@apii{0,0,-}

Converts the value at the
given index to a generic
@N{C pointer} (@T{void*}).
The value can be a userdata, a table, a thread, a string, or a function;
otherwise, @id{lua_topointer} returns @id{NULL}.
Different objects will give different pointers.
There is no way to convert the pointer back to its original value.

Typically this function is used only for hashing and debug information.

}

@APIEntry{const char *lua_tostring (lua_State *L, int index);|
@apii{0,0,m}

Equivalent to @Lid{lua_tolstring} with @id{len} equal to @id{NULL}.

}

@APIEntry{lua_State *lua_tothread (lua_State *L, int index);|
@apii{0,0,-}

Converts the value at the given index to a Lua thread
(represented as @T{lua_State*}).
This value must be a thread;
otherwise, the function returns @id{NULL}.

}

@APIEntry{void *lua_touserdata (lua_State *L, int index);|
@apii{0,0,-}

If the value at the given index is a full userdata,
returns its memory-block address.
If the value is a light userdata,
returns its value (a pointer).
Otherwise, returns
@id{NULL}.

}

@APIEntry{int lua_type (lua_State *L, int index);|

@apii{0,0,-}

Returns the type of the value in the given valid index,
or @id{LUA_TNONE} for a non-valid but acceptable index.
The types returned by @Lid{lua_type} are coded by the following constants
defined in @id{lua.h}:
@defid{LUA_TNIL},
@defid{LUA_TNUMBER},
@defid{LUA_TBOOLEAN},
@defid{LUA_TSTRING},
@defid{LUA_TTABLE},
@defid{LUA_TFUNCTION},
@defid{LUA_TUSERDATA},
@defid{LUA_TTHREAD},
and
@defid{LUA_TLIGHTUSERDATA}.

}

@APIEntry{const char *lua_typename (lua_State *L, int tp);|
@apii{0,0,-}

Returns the name of the type encoded by the value @id{tp},
which must be one the values returned by @Lid{lua_type}.

}

@APIEntry{typedef @ldots lua_Unsigned;|

The unsigned version of @Lid{lua_Integer}.

}

@APIEntry{int lua_upvalueindex (int i);|
@apii{0,0,-}

Returns the pseudo-index that represents the @id{i}-th upvalue of
the running function @see{c-closure}.
@id{i} must be in the range @M{[1,256]}.

}

@APIEntry{lua_Number
 lua_version (lua_State *L);|
@apii{0,0,-}

Returns the version number of this core.

}

@APIEntry{
typedef void (*lua_WarnFunction) (void *ud, const char *msg, int tocont);|

The type of @x{warning function}s, called by Lua to emit warnings.
The first parameter is an opaque pointer
set by @Lid{lua_setwarnf}.
The second parameter is the warning message.
The third parameter is a boolean that
indicates whether the message is
to be continued by the message in the next call.

See @Lid{warn} for more details about warnings.

}

@APIEntry{
void lua_warning (lua_State *L, const char *msg, int tocont);|
@apii{0,0,-}

Emits a warning with the given message.
A message in a call with @id{tocont} true should be
continued in another call to this function.

See @Lid{warn} for more details about warnings.

}

@APIEntry{
typedef int (*lua_Writer) (lua_State *L,
                           const void* p,
                           size_t sz,
                           void* ud);|

The type of the writer
 function used by @Lid{lua_dump}.
Every time @Lid{lua_dump} produces another piece of chunk,
it calls the writer,
passing along the buffer to be written (@id{p}),
its size (@id{sz}),
and the @id{ud} parameter supplied to @Lid{lua_dump}.

The writer returns an error code:
@N{0 means} no errors;
any other value means an error and stops @Lid{lua_dump} from
calling the writer again.

}

@APIEntry{void lua_xmove (lua_State *from, lua_State *to, int n);|
@apii{?,?,-}

Exchange values between different threads of the same state.

This function pops @id{n} values from the stack @id{from},
and pushes them onto the stack @id{to}.

}

@APIEntry{int lua_yield (lua_State *L, int nresults);|
@apii{?,?,v}

This function is equivalent to @Lid{lua_yieldk},
but it has no continuation @see{continuations}.
Therefore, when the thread resumes,
it continues the function that called
the function calling @id{lua_yield}.
To avoid surprises,
this function should be called only in a tail call.

}

@APIEntry{
int
 lua_yieldk (lua_State *L,
        int nresults,
        lua_KContext ctx,
        lua_KFunction k);|
@apii{?,?,v}

Yields a coroutine (thread).

When a @N{C function} calls @Lid{lua_yieldk},
the running coroutine suspends its execution,
and the call to @Lid{lua_resume} that started this coroutine returns.
The parameter @id{nresults} is the number of values from the stack
that will be passed as results to @Lid{lua_resume}.

When the coroutine is resumed again,
Lua calls the given @x{continuation function} @id{k} to continue
the execution of the @N{C function} that yielded @see{continuations}.
This continuation function receives the same stack
from the previous function,
with the @id{n} results removed and

replaced by the arguments passed to @Lid{lua_resume}.
Moreover,
the continuation function receives the value @id{ctx}
that was passed to @Lid{lua_yieldk}.

Usually, this function does not return;
when the coroutine eventually resumes,
it continues executing the
 continuation function.
However, there is one special case,
which is when this function is called
from inside a line or a count hook @see{debugI}.
In that case, @id{lua_yieldk} should be called with no continuation
(probably in the form of @Lid{lua_yield}) and no results,
and the hook should return immediately after the call.
Lua will yield and,
when the coroutine resumes again,
it will continue the normal execution
of the (Lua) function that triggered the hook.

This function can raise an error if it is called from a thread
with a pending C call with no continuation function
(what is called a @emphx{C-call boundary}),
or it is called from a thread that is not running inside a resume
(typically the main thread).

}

}

@sect2{debugI| @title{The Debug Interface}

Lua has no built-in debugging facilities.
Instead, it offers a special interface
by means of functions and @emph{hooks}.
This interface allows the construction of different
kinds of debuggers, profilers, and other tools
that need
 @Q{inside information} from the interpreter.

@APIEntry{
typedef struct lua_Debug {
 int event;
 const char *name;   /* (n) */
 const char *namewhat;   /* (n) */
 const char *what;   /* (S) */
 const char *source;   /* (S) */

```
 size_t srclen;            /* (S) */
 int currentline;          /* (l) */
 int linedefined;          /* (S) */
 int lastlinedefined;      /* (S) */
 unsigned char nups;       /* (u) number of upvalues */
 unsigned char nparams;    /* (u) number of parameters */
 char isvararg;            /* (u) */
 char istailcall;          /* (t) */
 unsigned short ftransfer;   /* (r) index of first value transferred */
 unsigned short ntransfer;   /* (r) number of transferred values */
 char short_src[LUA_IDSIZE]; /* (S) */
 /* private part */
 @rep{other fields}
} lua_Debug;
|
```

A structure used to carry different pieces of
information about a function or an activation record.
@Lid{lua_getstack} fills only the private
part
of this structure, for later use.
To fill the other fields of @Lid{lua_Debug} with useful information,
you must call @Lid{lua_getinfo} with an appropriate parameter.
(Specifically, to get a field,
you must add the letter between parentheses in the field's comment
to the parameter @id{what} of @Lid{lua_getinfo}.)

The fields of @Lid{lua_Debug} have the following meaning:
@description{

@item{@id{source}|
the source of the chunk that created the function.
If @T{source} starts with a @Char{@At},
it means that the function was defined in a file where
the file name follows the @Char{@At}.
If @T{source} starts with a @Char{=},
the remainder of its contents describes the source in a user-dependent manner.
Otherwise,
the function was defined in a string where
@T{source} is that string.
}

@item{@id{srclen}|
The length of the string @id{source}.
}

@item{@id{short_src}|
a @Q{printable} version of @T{source}, to be used in error messages.

}

@item{@id{linedefined}|
the line number where
the definition of the function starts.
}

@item{@id{lastlinedefined}|
the line number where the definition of the function ends.
}

@item{@id{what}|
the string @T{"Lua"} if the function is a Lua function,
@T{"C"} if it is a @N{C function},
@T{"main"} if it is the main part of a chunk.
}

@item{@id{currentline}|
the current line where the given function is executing.
When no line information is available,
@T{currentline} is set to @num{-1}.
}

@item{@id{name}|
a reasonable name for the given function.
Because functions in Lua are first-class values,
they do not have a fixed name:
some functions can be the value of multiple global variables,
while others can be stored only in a table field.
The @T{lua_getinfo} function checks how the function was
called to find a suitable name.
If it cannot find a name,
then @id{name} is set to @id{NULL}.
}

@item{@id{namewhat}|
explains the @T{name} field.
The value of @T{namewhat} can be
@T{"global"}, @T{"local"}, @T{"method"},
@T{"field"}, @T{"upvalue"},
or @T{""} (the empty string),
according to how the function was called.
(Lua uses the empty string when no other option seems to apply.)
}

@item{@id{istailcall}|
true if this function invocation was called by a tail call.
In this case, the caller of this level is not in the stack.

}

@item{@id{nups}|
the number of upvalues of the function.
}

@item{@id{nparams}|
the number of parameters of the function
(always @N{0 for} @N{C functions}).
}

@item{@id{isvararg}|
true if the function is a variadic function
(always true for @N{C functions}).
}

@item{@id{ftransfer}|
the index in the stack of the first value being @Q{transferred},
that is, parameters in a call or return values in a return.
(The other values are in consecutive indices.)
Using this index, you can access and modify these values
through @Lid{lua_getlocal} and @Lid{lua_setlocal}.
This field is only meaningful during a
call hook, denoting the first parameter,
or a return hook, denoting the first value being returned.
(For call
 hooks, this value is always 1.)
}

@item{@id{ntransfer}|
The number of values being transferred (see previous item).
(For calls of Lua functions,
this value is always equal to @id{nparams}.)
}

}

}

@APIEntry{lua_Hook lua_gethook (lua_State *L);|
@apii{0,0,-}

Returns the current hook function.

}

@APIEntry{int lua_gethookcount (lua_State *L);|
@apii{0,0,-}

Returns the current hook count.

}

@APIEntry{int lua_gethookmask (lua_State *L);|
@apii{0,0,-}

Returns the current hook mask.

}

@APIEntry{int lua_getinfo (lua_State *L, const char *what, lua_Debug *ar);|
@apii{0|1,0|1|2,m}

Gets information about a specific function or function invocation.

To get information about a function invocation,
the parameter @id{ar} must be a valid activation record that was
filled by a previous call to @Lid{lua_getstack} or
given as argument to a hook @seeC{lua_Hook}.

To get information about a function, you push it onto the stack
and start the @id{what} string with the character @Char{>}.
(In
 that case,
@id{lua_getinfo} pops the function from the top of the stack.)
For instance, to know in which line a function @id{f} was defined,
you can write the following code:
@verbatim{
lua_Debug ar;
lua_getglobal(L, "f"); /* get global 'f' */
lua_getinfo(L, ">S", &ar);
printf("%d\n", ar.linedefined);
}

Each character in the string @id{what}
selects some fields of the structure @id{ar} to be filled or
a value to be pushed on the stack.
(These characters are also documented in the declaration of
the structure @Lid{lua_Debug},
between parentheses in the comments following each field.)
@description{

@item{@Char{f}|
pushes onto the stack the function that is
running at the given level;
}

@item{@Char{l}| fills in the field @id{currentline};
}

@item{@Char{n}| fills in the fields @id{name} and @id{namewhat};
}

@item{@Char{r}| fills in the fields @id{ftransfer} and @id{ntransfer};
}

@item{@Char{S}|
fills in the fields @id{source}, @id{short_src},
@id{linedefined}, @id{lastlinedefined},
and @id{what};
}

@item{@Char{t}| fills in the field @id{istailcall};
}

@item{@Char{u}| fills in the fields
@id{nups}, @id{nparams}, and @id{isvararg};
}

@item{@Char{L}|
pushes onto the stack a table whose indices are
the lines on the function with some associated code,
that is, the lines where you can put a break point.
(Lines with no code include empty lines and comments.)
If this option is given together with option @Char{f},
its table is pushed after the function.
This is the only option that can raise a memory error.
}

}

This function returns 0 to signal an invalid option in @id{what};
even then the valid options are handled correctly.

}

@APIEntry{const char *lua_getlocal (lua_State *L, const lua_Debug *ar, int n);|
@apii{0,0|1,-}

Gets information about a local variable or a temporary value
of a given activation record or a given function.

In the first case,
the parameter @id{ar} must be a valid activation record that was

filled by a previous call to @Lid{lua_getstack} or
given
as argument to a hook @seeC{lua_Hook}.
The index @id{n} selects which local variable to inspect;
see @Lid{debug.getlocal} for details about variable indices
and names.

@Lid{lua_getlocal} pushes the variable's value onto the stack
and returns its name.

In the second case, @id{ar} must be @id{NULL} and the function
to be inspected must be on the top of the stack.
In this case, only parameters of Lua functions are visible
(as there is no information about what variables are active)
and no values are pushed onto the stack.

Returns @id{NULL} (and pushes nothing)
when the index is greater than
the number of active local variables.

}

@APIEntry{int lua_getstack (lua_State *L, int level, lua_Debug *ar);|
@apii{0,0,-}

Gets information about the interpreter runtime stack.

This function fills parts of a @Lid{lua_Debug} structure with
an identification of the @emph{activation record}
of the function executing at a given level.
@N{Level 0} is the current running function,
whereas level
@M{n+1} is the function that has called level @M{n}
(except for tail calls, which do not count in the stack).
When called with a level greater than the stack depth,
@Lid{lua_getstack} returns 0;
otherwise it returns 1.

}

@APIEntry{const char *lua_getupvalue (lua_State *L, int funcindex, int n);|
@apii{0,0|1,-}

Gets information about the @id{n}-th upvalue
of the closure at index @id{funcindex}.
It pushes the upvalue's value onto the stack
and returns its name.
Returns @id{NULL} (and pushes nothing)

when the index @id{n} is greater than the number of upvalues.

See @Lid{debug.getupvalue} for more information about upvalues.

}

@APIEntry{typedef void (*lua_Hook) (lua_State *L, lua_Debug *ar);|

Type for debugging hook functions.

Whenever a hook is called, its @id{ar} argument has its field
@id{event} set to the specific event that triggered the hook.
Lua identifies these events with the following constants:
@defid{LUA_HOOKCALL}, @defid{LUA_HOOKRET},
@defid{LUA_HOOKTAILCALL}, @defid{LUA_HOOKLINE},
and
@defid{LUA_HOOKCOUNT}.
Moreover, for line events, the field @id{currentline} is also set.
To get the value of any other field in @id{ar},
the hook must call @Lid{lua_getinfo}.

For call events, @id{event} can be @id{LUA_HOOKCALL},
the normal value, or @id{LUA_HOOKTAILCALL}, for a tail call;
in this case, there will be no corresponding return event.

While Lua is running a hook, it disables other calls to hooks.
Therefore, if a hook calls back Lua to execute a function or a chunk,
this execution occurs without any calls to hooks.

Hook functions cannot have continuations,
that is, they cannot call @Lid{lua_yieldk},
@Lid{lua_pcallk}, or @Lid{lua_callk} with a non-null @id{k}.

Hook functions can yield under the following conditions:
Only count and line events can yield;
to yield, a hook function must finish its execution
calling @Lid{lua_yield} with @id{nresults} equal to zero
(that is, with no values).

}

@APIEntry{void lua_sethook (lua_State *L, lua_Hook f, int mask,
int count);|
@apii{0,0,-}

Sets the debugging hook function.

Argument @id{f} is the hook function.

@id{mask} specifies on which events the hook will be called:
it is formed by a bitwise OR of the constants
@defid{LUA_MASKCALL},
@defid{LUA_MASKRET},
@defid{LUA_MASKLINE},
and @defid{LUA_MASKCOUNT}.
The @id{count} argument is only meaningful when the mask
includes @id{LUA_MASKCOUNT}.
For each event, the hook is called as explained below:
@description{

@item{The call hook| is called when the interpreter calls a function.
The hook is called just after Lua enters the new function.
}

@item{The return hook| is called when the interpreter returns from a function.
The hook is called just before Lua leaves the function.
}

@item{The line hook| is called when the interpreter is about to
start the execution of a new line of code,
or when it jumps back in the code (even to the same line).
This event only happens while Lua is executing a Lua function.
}

@item{The count hook| is called after the
interpreter executes every
@T{count} instructions.
This event only happens while Lua is executing a Lua function.
}

}

Hooks are disabled by setting @id{mask} to zero.

}

@APIEntry{const char *lua_setlocal (lua_State *L, const lua_Debug *ar, int n);|
@apii{0|1,0,-}

Sets the value of a local variable of a given activation record.
It assigns the value on the top of the stack
to the variable and returns its name.
It also pops the value from the stack.

Returns @id{NULL} (and pops nothing)
when the index is greater than
the number of active local variables.

Parameters @id{ar} and @id{n} are as in the function @Lid{lua_getlocal}.

}

@APIEntry{const char *lua_setupvalue (lua_State *L, int funcindex, int n);|
@apii{0|1,0,-}

Sets the value of a closure's upvalue.
It assigns the value on the top of the stack
to the upvalue and returns its name.
It also pops the value from the stack.

Returns @id{NULL} (and pops nothing)
when the index @id{n} is greater than the number of upvalues.

Parameters
@id{funcindex} and @id{n} are as in
the function @Lid{lua_getupvalue}.

}

@APIEntry{void *lua_upvalueid (lua_State *L, int funcindex, int n);|
@apii{0,0,-}

Returns a unique identifier for the upvalue numbered @id{n}
from the closure at index @id{funcindex}.

These unique identifiers allow a program to check whether different
closures share upvalues.
Lua closures that share an upvalue
(that is, that access a same external local variable)
will return identical ids for those upvalue indices.

Parameters @id{funcindex} and @id{n} are as in
the function @Lid{lua_getupvalue},
but @id{n} cannot be greater than the number of upvalues.

}

@APIEntry{
void lua_upvaluejoin (lua_State *L, int funcindex1, int n1,
                      int funcindex2, int n2);|
@apii{0,0,-}

Make the @id{n1}-th upvalue of the Lua closure at index @id{funcindex1}
refer to the @id{n2}-th upvalue of the Lua closure at index @id{funcindex2}.

}

}

}

@C{---}
@sect1{auxlib|@title{The
Auxiliary Library}

@simplesect{

@index{lauxlib.h}
The @def{auxiliary library} provides several convenient functions
to interface C with Lua.
While the basic API provides the primitive functions for all
interactions between C and Lua,
the auxiliary library provides higher-level functions for some
common tasks.

All functions and types from the auxiliary library
are defined in header file @id{lauxlib.h} and
have a prefix @id{luaL_}.

All functions in the auxiliary library are built on
top of the basic API,
and so they provide nothing that cannot be done with that API.
Nevertheless, the use of the auxiliary library ensures
more consistency to your code.

Several functions in the auxiliary library use internally some
extra stack slots.
When a function in the auxiliary library uses less than five slots,
it does not check the stack size;
it simply assumes that there are enough slots.

Several functions in the auxiliary library are used
to
check @N{C function} arguments.
Because the error message is formatted for arguments
(e.g., @St{bad argument #1}),
you should not use these functions for other stack values.

Functions called @id{luaL_check*}
always raise an error if the check is not satisfied.

}

@sect2{@title{Functions and Types}

Here we list all functions and types from the auxiliary library
in alphabetical order.

@APIEntry{void luaL_addchar (luaL_Buffer *B, char c);|
@apii{?,?,m}

Adds the byte @id{c} to the buffer @id{B}
@seeC{luaL_Buffer}.

}

@APIEntry{
const void luaL_addgsub (luaL_Buffer *B, const char *s,
                         const char *p, const char *r);|
@apii{?,?,m}

Adds a copy of the string @id{s} to the buffer @id{B} @seeC{luaL_Buffer},
replacing any occurrence of the string @id{p}
with the string @id{r}.

}

@APIEntry{void luaL_addlstring (luaL_Buffer *B, const char *s, size_t l);|
@apii{?,?,m}

Adds the string pointed to by @id{s} with length @id{l} to
the buffer @id{B}
@seeC{luaL_Buffer}.
The
 string can contain @x{embedded zeros}.

}

@APIEntry{void luaL_addsize (luaL_Buffer *B, size_t n);|
@apii{?,?,-}

Adds to the buffer @id{B}
a string of length @id{n} previously copied to the
buffer area @seeC{luaL_prepbuffer}.

}

@APIEntry{void luaL_addstring (luaL_Buffer *B, const char *s);|
@apii{?,?,m}

Adds the zero-terminated string pointed to by @id{s}
to the buffer @id{B}
@seeC{luaL_Buffer}.

}

@APIEntry{void luaL_addvalue (luaL_Buffer *B);|
@apii{?,?,m}

Adds the value on the top of the stack
to the buffer @id{B}
@seeC{luaL_Buffer}.
Pops the value.

This is the only function on string buffers that can (and must)
be called with an extra element on the stack,
which is the value to be added to the buffer.

}

@APIEntry{
void luaL_argcheck (lua_State *L,
		int cond,
		int arg,
		const char *extramsg);|
@apii{0,0,v}

Checks whether @id{cond} is true.
If it is not, raises an error with a standard message @seeF{luaL_argerror}.

}

@APIEntry{int
 luaL_argerror (lua_State *L, int arg, const char *extramsg);|
@apii{0,0,v}

Raises an error reporting a problem with argument @id{arg}
of the @N{C function} that called it,
using a standard message
that includes @id{extramsg} as a comment:
@verbatim{
bad argument #@rep{arg} to '@rep{funcname}' (@rep{extramsg})
}
This function never returns.

}

@APIEntry{
void luaL_argexpected (lua_State *L,
int cond,
int arg,
const char *tname);|
@apii{0,0,v}

Checks whether @id{cond} is true.
If it is not, raises an error about the type of the argument @id{arg}
with a standard message @seeF{luaL_typeerror}.

}

@APIEntry{typedef struct luaL_Buffer luaL_Buffer;|

Type for a @def{string buffer}.

A string buffer allows @N{C code} to build Lua strings piecemeal.
Its pattern of use is as follows:
@itemize{

@item{First declare a variable @id{b} of type @Lid{luaL_Buffer}.}

@item{Then initialize it with a call @T{luaL_buffinit(L,
&b)}.}

@item{
Then add string pieces to the buffer calling any of
the @id{luaL_add*} functions.
}

@item{
Finish by calling @T{luaL_pushresult(&b)}.
This call leaves the final string on the top of the stack.
}

}

If you know beforehand the maximum size of the resulting string,
you can use the buffer like this:
@itemize{

@item{First declare a variable @id{b} of type @Lid{luaL_Buffer}.}

@item{Then initialize it and preallocate a space of
size @id{sz} with a call @T{luaL_buffinitsize(L, &b, sz)}.}

@item{Then produce the string into that space.}

@item{
Finish by calling @T{luaL_pushresultsize(&b, sz)},
where @id{sz} is the total size of the resulting string
copied into that space (which may be less than or
equal to the preallocated size).
}

}

During its normal operation,
a string buffer uses a variable number of stack slots.
So, while using a buffer, you cannot assume that you know where
the top of the stack is.
You can use the stack between successive calls to buffer
operations
as long as that use is balanced;
that is,
when you call a buffer operation,
the stack is at the same level
it was immediately after the previous buffer operation.
(The only exception to this rule is @Lid{luaL_addvalue}.)
After calling @Lid{luaL_pushresult},
the stack is back to its level when the buffer was initialized,
plus the final string on its top.

}

@APIEntry{char *luaL_buffaddr (luaL_Buffer *B);|
@apii{0,0,-}

Returns the address of the current content of buffer @id{B}
@seeC{luaL_Buffer}.
Note that any addition to the buffer may invalidate this address.

}

@APIEntry{void luaL_buffinit (lua_State *L, luaL_Buffer *B);|
@apii{0,?,-}

Initializes a buffer @id{B}
@seeC{luaL_Buffer}.
This function does not allocate any space;
the buffer must be declared as a variable.

}

@APIEntry{size_t luaL_bufflen (luaL_Buffer *B);|
@apii{0,0,-}

Returns the length of the current content of buffer @id{B}
@seeC{luaL_Buffer}.

}

@APIEntry{char *luaL_buffinitsize (lua_State *L, luaL_Buffer
 *B, size_t sz);|
@apii{?,?,m}

Equivalent to the sequence
@Lid{luaL_buffinit}, @Lid{luaL_prepbuffsize}.

}

@APIEntry{void luaL_buffsub (luaL_Buffer *B, int n);|
@apii{?,?,-}

Removes @id{n} bytes from the buffer @id{B}
@seeC{luaL_Buffer}.
The buffer must have at least that many bytes.

}

@APIEntry{int luaL_callmeta (lua_State *L, int obj, const char *e);|
@apii{0,0|1,e}

Calls a metamethod.

If the object at index @id{obj} has a metatable and this
metatable has a field @id{e},
this function calls this field passing the object as its only argument.
In this case this function returns true and pushes onto the
stack the value returned by the call.
If there is no metatable or no metamethod,
this function returns false without pushing any value on the stack.

}

@APIEntry{void luaL_checkany (lua_State *L, int arg);|
@apii{0,0,v}

Checks whether the function has an argument
of any type (including @nil) at position @id{arg}.

}

@APIEntry{lua_Integer luaL_checkinteger (lua_State *L,
 int arg);|
@apii{0,0,v}

Checks whether the function argument @id{arg} is an integer
(or can be converted to an integer)
and returns this integer.

}

@APIEntry{const char *luaL_checklstring (lua_State *L, int arg, size_t *l);|
@apii{0,0,v}

Checks whether the function argument @id{arg} is a string
and returns this string;
if @id{l} is not @id{NULL} fills its referent
with the string's length.

This function uses @Lid{lua_tolstring} to get its result,
so all conversions and caveats of that function apply here.

}

@APIEntry{lua_Number luaL_checknumber (lua_State *L, int arg);|
@apii{0,0,v}

Checks whether the function argument @id{arg} is a number
and returns this number converted to a @id{lua_Number}.

}

@APIEntry{
int luaL_checkoption (lua_State *L,
                      int arg,
                      const char *def,
                      const char *const lst[]);|
@apii{0,0,v}

Checks whether the function argument @id{arg} is a string and
searches for this string in the array @id{lst}
(which
 must be NULL-terminated).
Returns the index in the array where the string was found.
Raises an error if the argument is not a string or
if the string cannot be found.

If @id{def} is not @id{NULL},
the function uses @id{def} as a default value when
there is no argument @id{arg} or when this argument is @nil.

This is a useful function for mapping strings to @N{C enums}.
(The usual convention in Lua libraries is
to use strings instead of numbers to select options.)

}

@APIEntry{void luaL_checkstack (lua_State *L, int sz, const char *msg);|
@apii{0,0,v}

Grows the stack size to @T{top + sz} elements,
raising an error if the stack cannot grow to that size.
@id{msg} is an additional text to go into the error message
(or @id{NULL} for no additional text).

}

@APIEntry{const char *luaL_checkstring (lua_State *L, int arg);|
@apii{0,0,v}

Checks whether the function argument @id{arg} is a string
and returns this string.

This function uses @Lid{lua_tolstring} to get its result,
so
 all conversions and caveats of that function apply here.

}

@APIEntry{void luaL_checktype (lua_State *L, int arg, int t);|
@apii{0,0,v}

Checks whether the function argument @id{arg} has type @id{t}.
See @Lid{lua_type} for the encoding of types for @id{t}.

}

@APIEntry{void *luaL_checkudata (lua_State *L, int arg, const char *tname);|
@apii{0,0,v}

Checks whether the function argument @id{arg} is a userdata
of the type @id{tname} @seeC{luaL_newmetatable} and
returns the userdata's memory-block address @seeC{lua_touserdata}.

}

@APIEntry{void luaL_checkversion (lua_State *L);|
@apii{0,0,v}

Checks whether the code making the call and the Lua library being called
are using the same version of Lua and the same numeric types.

}

@APIEntry{int luaL_dofile (lua_State *L, const char *filename);|
@apii{0,?,m}

Loads and runs the given file.
It is defined as the following macro:
@verbatim{
(luaL_loadfile(L, filename) || lua_pcall(L, 0, LUA_MULTRET, 0))
}
It @N{returns 0} (@Lid{LUA_OK})
 if there are no errors,
or 1 in case of errors.

}

@APIEntry{int luaL_dostring (lua_State *L, const char *str);|
@apii{0,?,-}

Loads and runs the given string.
It is defined as the following macro:
@verbatim{
(luaL_loadstring(L, str) || lua_pcall(L, 0, LUA_MULTRET, 0))
}
It @N{returns 0} (@Lid{LUA_OK}) if there are no errors,
or 1 in case of errors.

}

@APIEntry{int luaL_error (lua_State *L, const char *fmt, ...);|
@apii{0,0,v}

Raises an error.
The error message format is given by @id{fmt}
plus any extra arguments,
following the same rules of @Lid{lua_pushfstring}.
It also adds at the beginning of the message the file name and
the line number where the error occurred,
if this information is available.

This function never returns,

but it is an idiom to use it in @N{C functions}
as @T{return luaL_error(@rep{args})}.

}

@APIEntry{int luaL_execresult (lua_State *L, int stat);|
@apii{0,3,m}

This function produces the return values for
process-related functions in the standard library
(@Lid{os.execute}
 and @Lid{io.close}).

}

@APIEntry{
int luaL_fileresult (lua_State *L, int stat, const char *fname);|
@apii{0,1|3,m}

This function produces the return values for
file-related functions in the standard library
(@Lid{io.open}, @Lid{os.rename}, @Lid{file:seek}, etc.).

}

@APIEntry{int luaL_getmetafield (lua_State *L, int obj, const char *e);|
@apii{0,0|1,m}

Pushes onto the stack the field @id{e} from the metatable
of the object at index @id{obj} and returns the type of the pushed value.
If the object does not have a metatable,
or if the metatable does not have this field,
pushes nothing and returns @id{LUA_TNIL}.

}

@APIEntry{int luaL_getmetatable (lua_State *L, const char *tname);|
@apii{0,1,m}

Pushes onto the stack the metatable associated with the name @id{tname}
in the registry @seeC{luaL_newmetatable},
or @nil if there is no metatable associated with that name.
Returns the type of the pushed value.

}

@APIEntry{int luaL_getsubtable (lua_State *L, int idx, const

char *fname);|
@apii{0,1,e}

Ensures that the value @T{t[fname]},
where @id{t} is the value at index @id{idx},
is a table,
and pushes that table onto the stack.
Returns true if it finds a previous table there
and false if it creates a new table.

}

@APIEntry{
const char *luaL_gsub (lua_State *L,
const char *s,
const char *p,
const char *r);|
@apii{0,1,m}

Creates a copy of string @id{s},
replacing any occurrence of the string @id{p}
with the string @id{r}.
Pushes the resulting string on the stack and returns it.

}

@APIEntry{lua_Integer luaL_len (lua_State *L, int index);|
@apii{0,0,e}

Returns the @Q{length} of the value at the given index
as a number;
it is equivalent to the @Char{#} operator in Lua @see{len-op}.
Raises an error if the result of the operation is not an integer.
(This case can only happen through metamethods.)

}

@APIEntry{
int luaL_loadbuffer (lua_State *L,
const char *buff,
size_t sz,
const char *name);|
@apii{0,1,-}

Equivalent to @Lid{luaL_loadbufferx} with @id{mode} equal to @id{NULL}.

}

```
@APIEntry{
int luaL_loadbufferx (lua_State *L,
                      const char *buff,
                      size_t sz,
                      const char *name,
                      const char *mode);|
@apii{0,1,-}
```

Loads a buffer as a Lua chunk.
This function uses @Lid{lua_load} to load the chunk in the
buffer pointed to by @id{buff} with size @id{sz}.

This function returns the same results as @Lid{lua_load}.
@id{name} is the chunk name,
used for debug information and error messages.
The string @id{mode} works as in the function @Lid{lua_load}.

}

```
@APIEntry{int luaL_loadfile (lua_State *L, const char *filename);|
@apii{0,1,m}
```

Equivalent to @Lid{luaL_loadfilex} with @id{mode} equal to @id{NULL}.

}

```
@APIEntry{int luaL_loadfilex (lua_State *L, const char *filename,
                              const char
 *mode);|
@apii{0,1,m}
```

Loads a file as a Lua chunk.
This function uses @Lid{lua_load} to load the chunk in the file
named @id{filename}.
If @id{filename} is @id{NULL},
then it loads from the standard input.
The first line in the file is ignored if it starts with a @T{#}.

The string @id{mode} works as in the function @Lid{lua_load}.

This function returns the same results as @Lid{lua_load}
or @Lid{LUA_ERRFILE} for file-related errors.

As @Lid{lua_load}, this function only loads the chunk;
it does not run it.

}

@APIEntry{int luaL_loadstring (lua_State *L, const char *s);|
@apii{0,1,-}

Loads a string as a Lua chunk.
This function uses @Lid{lua_load} to load the chunk in
the zero-terminated string @id{s}.

This function returns the same results as @Lid{lua_load}.

Also as @Lid{lua_load}, this function only loads the chunk;
it does not run it.

}

@APIEntry{void luaL_newlib (lua_State *L, const luaL_Reg l[]);|
@apii{0,1,m}

Creates a new table and registers there
the functions in the
list @id{l}.

It is implemented as the following macro:
@verbatim{
(luaL_newlibtable(L,l), luaL_setfuncs(L,l,0))
}
The array @id{l} must be the actual array,
not a pointer to it.

}

@APIEntry{void luaL_newlibtable (lua_State *L, const luaL_Reg l[]);|
@apii{0,1,m}

Creates a new table with a size optimized
to store all entries in the array @id{l}
(but does not actually store them).
It is intended to be used in conjunction with @Lid{luaL_setfuncs}
@seeF{luaL_newlib}.

It is implemented as a macro.
The array @id{l} must be the actual array,
not a pointer to it.

}

@APIEntry{int luaL_newmetatable (lua_State *L, const char *tname);|
@apii{0,1,m}

If the registry already has the key @id{tname},
returns 0.
Otherwise,
creates a new table to be used as a metatable for userdata,
adds to this new table the pair @T{__name = tname},
adds to the registry the pair @T{[tname] = new table},
and returns 1.

In both cases,
the function pushes onto the stack the final value associated
with @id{tname} in
the registry.

}

@APIEntry{lua_State *luaL_newstate (void);|
@apii{0,0,-}

Creates a new Lua state.
It calls @Lid{lua_newstate} with an
allocator based on the @N{ISO C} allocation functions
and then sets a warning function and a panic function @see{C-error}
that print messages to the standard error output.

Returns the new state,
or @id{NULL} if there is a @x{memory allocation error}.

}

@APIEntry{void luaL_openlibs (lua_State *L);|
@apii{0,0,e}

Opens all standard Lua libraries into the given state.

}

@APIEntry{
T luaL_opt (L, func, arg, dflt);|
@apii{0,0,-}

This macro is defined as follows:
@verbatim{
(lua_isnoneornil(L,(arg)) ? (dflt) : func(L,(arg)))
}
In words, if the argument @id{arg} is nil or absent,

the macro results in the default @id{dflt}.
Otherwise, it results in the result of calling @id{func}
with the state @id{L} and the argument index @id{arg} as
arguments.
Note that it evaluates the expression @id{dflt} only if needed.

}

@APIEntry{
lua_Integer luaL_optinteger
 (lua_State *L,
                  int arg,
                  lua_Integer d);|
@apii{0,0,v}

If the function argument @id{arg} is an integer
(or it is convertible to an integer),
returns this integer.
If this argument is absent or is @nil,
returns @id{d}.
Otherwise, raises an error.

}

@APIEntry{
const char *luaL_optlstring (lua_State *L,
                  int arg,
                  const char *d,
                  size_t *l);|
@apii{0,0,v}

If the function argument @id{arg} is a string,
returns this string.
If this argument is absent or is @nil,
returns @id{d}.
Otherwise, raises an error.

If @id{l} is not @id{NULL},
fills its referent with the result's length.
If the result is @id{NULL}
(only possible when returning @id{d} and @T{d == NULL}),
its length is considered zero.

This function uses @Lid{lua_tolstring} to get its result,
so all conversions and caveats of that function apply here.

}

@APIEntry{lua_Number luaL_optnumber
 (lua_State *L, int arg, lua_Number d);|
@apii{0,0,v}

If the function argument @id{arg} is a number,
returns this number as a @id{lua_Number}.
If this argument is absent or is @nil,
returns @id{d}.
Otherwise, raises an error.

}

@APIEntry{
const char *luaL_optstring (lua_State *L,
                            int arg,
                            const char *d);|
@apii{0,0,v}

If the function argument @id{arg} is a string,
returns this string.
If this argument is absent or is @nil,
returns @id{d}.
Otherwise, raises an error.

}

@APIEntry{char *luaL_prepbuffer (luaL_Buffer *B);|
@apii{?,?,m}

Equivalent to @Lid{luaL_prepbuffsize}
with the predefined size @defid{LUAL_BUFFERSIZE}.

}

@APIEntry{char *luaL_prepbuffsize (luaL_Buffer *B, size_t sz);|
@apii{?,?,m}

Returns an address to a space of size @id{sz}
where you can copy a string to be added to buffer @id{B}
@seeC{luaL_Buffer}.
After copying the string into this space you must call
@Lid{luaL_addsize} with the size of the string to actually
 add
it to the buffer.

}

@APIEntry{void luaL_pushfail (lua_State *L);|

@apii{0,1,-}

Pushes the @fail value onto the stack @see{libraries}.

}

@APIEntry{void luaL_pushresult (luaL_Buffer *B);|
@apii{?,1,m}

Finishes the use of buffer @id{B} leaving the final string on
the top of the stack.

}

@APIEntry{void luaL_pushresultsize (luaL_Buffer *B, size_t sz);|
@apii{?,1,m}

Equivalent to the sequence @Lid{luaL_addsize}, @Lid{luaL_pushresult}.

}

@APIEntry{int luaL_ref (lua_State *L, int t);|
@apii{1,0,m}

Creates and returns a @def{reference},
in the table at index @id{t},
for the object on the top of the stack (and pops the object).

A reference is a unique integer key.
As long as you do not manually add integer keys into the table @id{t},
@Lid{luaL_ref} ensures the uniqueness of the key it returns.
You can retrieve an object referred by the reference @id{r}
by calling @T{lua_rawgeti(L, t, r)}.
The function @Lid{luaL_unref} frees a reference.

If the object on the top of the stack
 is @nil,
@Lid{luaL_ref} returns the constant @defid{LUA_REFNIL}.
The constant @defid{LUA_NOREF} is guaranteed to be different
from any reference returned by @Lid{luaL_ref}.

}

@APIEntry{
typedef struct luaL_Reg {
 const char *name;
 lua_CFunction func;
} luaL_Reg;

|

Type for arrays of functions to be registered by
@Lid{luaL_setfuncs}.
@id{name} is the function name and @id{func} is a pointer to
the function.
Any array of @Lid{luaL_Reg} must end with a sentinel entry
in which both @id{name} and @id{func} are @id{NULL}.

}

@APIEntry{
void luaL_requiref (lua_State *L, const char *modname,
                    lua_CFunction openf, int glb);|
@apii{0,1,e}

If @T{package.loaded[modname]} is not true,
calls the function @id{openf} with the string @id{modname} as an argument
and sets the call result to @T{package.loaded[modname]},
as if that function has been called through @Lid{require}.

If @id{glb} is true,
also stores the module into the global @id{modname}.

Leaves a copy of the module
 on the stack.

}

@APIEntry{void luaL_setfuncs (lua_State *L, const luaL_Reg *l, int nup);|
@apii{nup,0,m}

Registers all functions in the array @id{l}
@seeC{luaL_Reg} into the table on the top of the stack
(below optional upvalues, see next).

When @id{nup} is not zero,
all functions are created with @id{nup} upvalues,
initialized with copies of the @id{nup} values
previously pushed on the stack
on top of the library table.
These values are popped from the stack after the registration.

A function with a @id{NULL} value represents a placeholder,
which is filled with @false.

}

@APIEntry{void luaL_setmetatable (lua_State *L, const char *tname);|
@apii{0,0,-}

Sets the metatable of the object on the top of the stack
as the metatable associated with name @id{tname}
in the registry @seeC{luaL_newmetatable}.

}

@APIEntry{
typedef struct luaL_Stream {
 FILE *f;
 lua_CFunction closef;
} luaL_Stream;
|

The standard representation for @x{file handles}
used by the standard I/O library.

A
 file handle is implemented as a full userdata,
with a metatable called @id{LUA_FILEHANDLE}
(where @id{LUA_FILEHANDLE} is a macro with the actual metatable's name).
The metatable is created by the I/O library
@seeF{luaL_newmetatable}.

This userdata must start with the structure @id{luaL_Stream};
it can contain other data after this initial structure.
The field @id{f} points to the corresponding C stream
(or it can be @id{NULL} to indicate an incompletely created handle).
The field @id{closef} points to a Lua function
that will be called to close the stream
when the handle is closed or collected;
this function receives the file handle as its sole argument and
must return either a true value, in case of success,
or a false value plus an error message, in case of error.
Once Lua calls this field,
it changes the field value to @id{NULL}
to signal that the handle is closed.

}

@APIEntry{void *luaL_testudata (lua_State *L, int arg, const char *tname);|
@apii{0,0,m}

This function works
 like @Lid{luaL_checkudata},
except that, when the test fails,

it returns @id{NULL} instead of raising an error.

}

@APIEntry{const char *luaL_tolstring (lua_State *L, int idx, size_t *len);|
@apii{0,1,e}

Converts any Lua value at the given index to a @N{C string}
in a reasonable format.
The resulting string is pushed onto the stack and also
returned by the function @see{constchar}.
If @id{len} is not @id{NULL},
the function also sets @T{*len} with the string length.

If the value has a metatable with a @idx{__tostring} field,
then @id{luaL_tolstring} calls the corresponding metamethod
with the value as argument,
and uses the result of the call as its result.

}

@APIEntry{
void luaL_traceback (lua_State *L, lua_State *L1, const char *msg,
                     int level);|
@apii{0,1,m}

Creates and pushes a traceback of the stack @id{L1}.
If @id{msg} is not @id{NULL}, it is appended
at the beginning of the traceback.
The @id{level} parameter tells at which level
to start the traceback.

}

@APIEntry{int
 luaL_typeerror (lua_State *L, int arg, const char *tname);|
@apii{0,0,v}

Raises a type error for the argument @id{arg}
of the @N{C function} that called it,
using a standard message;
@id{tname} is a @Q{name} for the expected type.
This function never returns.

}

@APIEntry{const char *luaL_typename (lua_State *L, int index);|
@apii{0,0,-}

Returns the name of the type of the value at the given index.

}

@APIEntry{void luaL_unref (lua_State *L, int t, int ref);|
@apii{0,0,-}

Releases the reference @id{ref} from the table at index @id{t}
@seeC{luaL_ref}.
The entry is removed from the table,
so that the referred object can be collected.
The reference @id{ref} is also freed to be used again.

If @id{ref} is @Lid{LUA_NOREF} or @Lid{LUA_REFNIL},
@Lid{luaL_unref} does nothing.

}

@APIEntry{void luaL_where (lua_State *L, int lvl);|
@apii{0,1,m}

Pushes onto the stack a string identifying the current position
of the control at level @id{lvl} in the call stack.
Typically
 this string has the following format:
@verbatim{
@rep{chunkname}:@rep{currentline}:
}
@N{Level 0} is the running function,
@N{level 1} is the function that called the running function,
etc.

This function is used to build a prefix for error messages.

}

}

}

@C{--}
@sect1{libraries| @title{The Standard Libraries}

@simplesect{

The standard Lua libraries provide useful functions

that are implemented @N{in C} through the @N{C API}.
Some of these functions provide essential services to the language
(e.g., @Lid{type} and @Lid{getmetatable});
others provide access to outside services (e.g., I/O);
and others could be implemented in Lua itself,
but that for different reasons
deserve an implementation in C (e.g., @Lid{table.sort}).

All libraries are implemented through the official @N{C API}
and are provided as separate @N{C modules}.
Unless otherwise noted,
these library functions do not adjust its number of arguments
to
its expected parameters.
For instance, a function documented as @T{foo(arg)}
should not be called without an argument.

The notation @fail means a false value representing
some kind of failure.
(Currently, @fail is equal to @nil,
but that may change in future versions.
The recommendation is to always test the success of these functions
with @T{(not status)}, instead of @T{(status == nil)}.)

Currently, Lua has the following standard libraries:
@itemize{

@item{@link{predefined|basic library};}

@item{@link{corolib|coroutine library};}

@item{@link{packlib|package library};}

@item{@link{strlib|string manipulation};}

@item{@link{utf8|basic UTF-8 support};}

@item{@link{tablib|table manipulation};}

@item{@link{mathlib|mathematical functions} (sin, log, etc.);}

@item{@link{iolib|input and output};}

@item{@link{oslib|operating system facilities};}

@item{@link{debuglib|debug facilities}.}

}
Except for the basic and the package libraries,
each library provides all its functions as
fields of a global table
or as methods of its objects.

To have access to these libraries,
the @N{C host} program should call the @Lid{luaL_openlibs} function,
which opens all standard libraries.
Alternatively,
the host program can open them individually by using
@Lid{luaL_requiref} to call
@defid{luaopen_base} (for the basic library),
@defid{luaopen_package} (for the package library),
@defid{luaopen_coroutine} (for the coroutine library),
@defid{luaopen_string} (for the string library),
@defid{luaopen_utf8} (for the UTF-8 library),
@defid{luaopen_table} (for the table library),
@defid{luaopen_math} (for the mathematical library),
@defid{luaopen_io} (for the I/O library),
@defid{luaopen_os} (for the operating system library),
and @defid{luaopen_debug} (for the debug library).
These functions are declared in @defid{lualib.h}.

}

@sect2{predefined| @title{Basic Functions}

The basic library provides core functions to Lua.
If you do not include this library in your application,
you should
check carefully whether you need to provide
implementations for some of its facilities.

@LibEntry{assert (v [, message])|

Raises an error if
the value of its argument @id{v} is false (i.e., @nil or @false);
otherwise, returns all its arguments.
In case of error,
@id{message} is the error object;
when absent, it defaults to @St{assertion failed!}

}

@LibEntry{collectgarbage ([opt [, arg]])|

This function is a generic interface to the garbage collector.
It performs different functions according to its first argument, @id{opt}:
@description{

@item{@St{collect}|
Performs a full garbage-collection cycle.
This is the default option.
}

@item{@St{stop}|
Stops automatic execution of the garbage collector.
The collector will run only when explicitly invoked,
until a call to restart it.
}

@item{@St{restart}|
Restarts automatic execution of the garbage collector.
}

@item{@St{count}|
Returns the total memory in use by Lua in Kbytes.
The value has a fractional part,
so that it multiplied
by 1024
gives the exact number of bytes in use by Lua.
}

@item{@St{step}|
Performs a garbage-collection step.
The step @Q{size} is controlled by @id{arg}.
With a zero value,
the collector will perform one basic (indivisible) step.
For non-zero values,
the collector will perform as if that amount of memory
(in Kbytes) had been allocated by Lua.
Returns @true if the step finished a collection cycle.
}

@item{@St{isrunning}|
Returns a boolean that tells whether the collector is running
(i.e., not stopped).
}

@item{@St{incremental}|
Change the collector mode to incremental.
This option can be followed by three numbers:
the garbage-collector pause,

the step multiplier,
and the step size @see{incmode}.
A zero means to not change that value.
}

@item{@St{generational}|
Change the collector mode to generational.
This option can be followed by two numbers:
the garbage-collector minor multiplier
and the major multiplier @see{genmode}.
A zero means to not change that value.
}

}
See @See{GC}
for more details about garbage collection
and some of these options.

This function should not be called by a finalizer.

}

@LibEntry{dofile ([filename])|
Opens the named file and executes its content as a Lua chunk.
When called without arguments,
@id{dofile} executes the content of the standard input (@id{stdin}).
Returns all values returned by the chunk.
In case of errors, @id{dofile} propagates the error
to its caller.
(That is, @id{dofile} does not run in protected mode.)

}

@LibEntry{error (message [, level])|
Raises an error @see{error} with @id{message} as the error object.
This function never returns.

Usually, @id{error} adds some information about the error position
at the beginning of the message, if the message is a string.
The @id{level} argument specifies how to get the error position.
With @N{level 1} (the default), the error position is where the
@id{error} function was called.
@N{Level 2} points the error to where the function
that called @id{error} was called; and
so on.
Passing a @N{level 0} avoids the addition of error position information
to the message.

}

@LibEntry{_G|
A global variable (not a function) that
holds the @x{global environment} @see{globalenv}.
Lua itself does not use this variable;
changing its value does not affect any environment,
nor vice versa.

}

@LibEntry{getmetatable (object)|

If @id{object} does not have a metatable, returns @nil.
Otherwise,
if the object's metatable has a @idx{__metatable} field,
returns the associated value.
Otherwise, returns the metatable of the given object.

}

@LibEntry{ipairs (t)|

Returns three values (an iterator function, the table @id{t}, and 0)
so that the construction
@verbatim{
for i,v in ipairs(t) do @rep{body} end
}
will iterate over the key@En{}value pairs
(@T{1,t[1]}), (@T{2,t[2]}), @ldots,
up to the first absent index.

}

@LibEntry{load (chunk [, chunkname [, mode [, env]]])|

Loads a chunk.

If @id{chunk} is a string, the chunk is this string.
If @id{chunk} is a function,
@id{load}
 calls it repeatedly to get the chunk pieces.
Each call to @id{chunk} must return a string that concatenates
with previous results.
A return of an empty string, @nil, or no value signals the end of the chunk.

If there are no syntactic errors,
@id{load} returns the compiled chunk as a function;

otherwise, it returns @fail plus the error message.

When you load a main chunk,
the resulting function will always have exactly one upvalue,
the @id{_ENV} variable @see{globalenv}.
However,
when you load a binary chunk created from a function @seeF{string.dump},
the resulting function can have an arbitrary number of upvalues,
and there is no guarantee that its first upvalue will be
the @id{_ENV} variable.
(A non-main function may not even have an @id{_ENV} upvalue.)

Regardless, if the resulting function has any upvalues,
its first upvalue is set to the value of @id{env},
if that parameter is given,
or to the value of the @x{global environment}.
Other upvalues are initialized with @nil.
All
 upvalues are fresh, that is,
they are not shared with any other function.

@id{chunkname} is used as the name of the chunk for error messages
and debug information @see{debugI}.
When absent,
it defaults to @id{chunk}, if @id{chunk} is a string,
or to @St{=(load)} otherwise.

The string @id{mode} controls whether the chunk can be text or binary
(that is, a precompiled chunk).
It may be the string @St{b} (only @x{binary chunk}s),
@St{t} (only text chunks),
or @St{bt} (both binary and text).
The default is @St{bt}.

It is safe to load malformed binary chunks;
@id{load} signals an appropriate error.
However,
Lua does not check the consistency of the code inside binary chunks;
running maliciously crafted bytecode can crash the interpreter.

}

@LibEntry{loadfile ([filename [, mode [, env]]])|

Similar to @Lid{load},
but gets the chunk from file @id{filename}
or from the standard input,
if no file name is given.

}

@LibEntry{next (table [, index])|

Allows a program to traverse all fields
of a table.
Its first argument is a table and its second argument
is an index in this table.
A call to @id{next} returns the next index of the table
and its associated value.
When called with @nil as its second argument,
@id{next} returns an initial index
and its associated value.
When called with the last index,
or with @nil in an empty table,
@id{next} returns @nil.
If the second argument is absent, then it is interpreted as @nil.
In particular,
you can use @T{next(t)} to check whether a table is empty.

The order in which the indices are enumerated is not specified,
@emph{even for numeric indices}.
(To traverse a table in numerical order,
use a numerical @Rw{for}.)

You should not assign any value to a non-existent field in a table
during its traversal.
You may however modify existing fields.
In particular, you may set existing fields to nil.

}

@LibEntry{pairs (t)|

If @id{t} has a metamethod @idx{__pairs},
calls it with @id{t} as argument and returns the first three
results from
the call.

Otherwise,
returns three values: the @Lid{next} function, the table @id{t}, and @nil,
so that the construction
@verbatim{
for k,v in pairs(t) do @rep{body} end
}
will iterate over all key@En{}value pairs of table @id{t}.

See function @Lid{next} for the caveats of modifying
the table during its traversal.

}

@LibEntry{pcall (f [, arg1, @Cdots])|

Calls the function @id{f} with
the given arguments in @emphx{protected mode}.
This means that any error @N{inside @T{f}} is not propagated;
instead, @id{pcall} catches the error
and returns a status code.
Its first result is the status code (a boolean),
which is @true if the call succeeds without errors.
In such case, @id{pcall} also returns all results from the call,
after this first result.
In case of any error, @id{pcall} returns @false plus the error object.
Note that errors caught by @id{pcall} do not call a message handler.

}

@LibEntry{print (@Cdots)|
Receives any number of arguments
and prints their values to @id{stdout},
converting
 each argument to a string
following the same rules of @Lid{tostring}.

The function @id{print} is not intended for formatted output,
but only as a quick way to show a value,
for instance for debugging.
For complete control over the output,
use @Lid{string.format} and @Lid{io.write}.

}

@LibEntry{rawequal (v1, v2)|
Checks whether @id{v1} is equal to @id{v2},
without invoking the @idx{__eq} metamethod.
Returns a boolean.

}

@LibEntry{rawget (table, index)|
Gets the real value of @T{table[index]},
without using the @idx{__index} metavalue.
@id{table} must be a table;
@id{index} may be any value.

}

@LibEntry{rawlen (v)|
Returns the length of the object @id{v},
which must be a table or a string,
without invoking the @idx{__len} metamethod.
Returns an integer.

}

@LibEntry{rawset (table, index, value)|
Sets the real value of @T{table[index]} to @id{value},
without using the @idx{__newindex} metavalue.
@id{table} must be a table,
@id{index} any value different from @nil and @x{NaN},
and
@id{value} any Lua value.

This function returns @id{table}.

}

@LibEntry{select (index, @Cdots)|

If @id{index} is a number,
returns all arguments after argument number @id{index};
a negative number indexes from the end (@num{-1} is the last argument).
Otherwise, @id{index} must be the string @T{"#"},
and @id{select} returns the total number of extra arguments it received.

}

@LibEntry{setmetatable (table, metatable)|

Sets the metatable for the given table.
If @id{metatable} is @nil,
removes the metatable of the given table.
If the original metatable has a @idx{__metatable} field,
raises an error.

This function returns @id{table}.

To change the metatable of other types from Lua code,
you must use the @link{debuglib|debug library}.

}

@LibEntry{tonumber (e [, base])|

When called with no @id{base},
@id{tonumber} tries to convert its argument to a number.
If the argument is already a number or
a string convertible to a number,
then @id{tonumber} returns this number;
otherwise,
it returns @fail.

The conversion of strings can result in integers or floats,
according to the lexical conventions of Lua @see{lexical}.
The string may have leading and trailing spaces and a sign.

When called with @id{base},
then @id{e} must be a string to be interpreted as
an integer numeral in that base.
The base may be any integer between 2 and 36, inclusive.
In bases @N{above 10}, the letter @Char{A} (in either upper or lower case)
@N{represents 10}, @Char{B} @N{represents 11}, and so forth,
with @Char{Z} representing 35.
If the string @id{e} is not a valid numeral in the given base,
the function returns @fail.

}

@LibEntry{tostring (v)|

Receives a value of any type and
converts it to a string in a human-readable format.

If the metatable of @id{v} has a @idx{__tostring} field,
then @id{tostring} calls the corresponding value
with @id{v} as argument,
and uses the result of the call as its result.
Otherwise, if the metatable of @id{v} has a @idx{__name} field
with a string
value,
@id{tostring} may use that string in its final result.

For complete control of how numbers are converted,
use @Lid{string.format}.

}

@LibEntry{type (v)|

Returns the type of its only argument, coded as a string.

The possible results of this function are
@St{nil} (a string, not the value @nil),
@St{number},
@St{string},
@St{boolean},
@St{table},
@St{function},
@St{thread},
and @St{userdata}.

}

@LibEntry{_VERSION|

A global variable (not a function) that
holds a string containing the running Lua version.
The current value of this variable is @St{Lua 5.4}.

}

@LibEntry{warn (msg1, @Cdots)|

Emits a warning with a message composed by the concatenation
of all its arguments (which should be strings).

By convention,
a one-piece message starting with @Char{@At}
is intended to be a @emph{control message},
which is a message to the warning system itself.
In particular, the standard warning function in Lua
recognizes the control messages @St{@At{}off},
to stop the emission of warnings,
and
@St{@At{}on}, to (re)start the emission;
it ignores unknown control messages.

}

@LibEntry{xpcall (f, msgh [, arg1, @Cdots])|

This function is similar to @Lid{pcall},
except that it sets a new @x{message handler} @id{msgh}.

}

}

@sect2{corolib| @title{Coroutine Manipulation}

This library comprises the operations to manipulate coroutines,
which come inside the table @defid{coroutine}.
See @See{coroutine} for a general description of coroutines.

@LibEntry{coroutine.close (co)|

Closes coroutine @id{co},
that is,
closes all its pending to-be-closed variables
and puts the coroutine in a dead state.
The given coroutine must be dead or suspended.
In case of error
(either the original error that stopped the coroutine or
errors in closing methods),
returns @false plus the error object;
otherwise returns @true.

}

@LibEntry{coroutine.create (f)|

Creates a new coroutine, with body @id{f}.
@id{f} must be a function.
Returns this new coroutine,
an object with type @T{"thread"}.

}

@LibEntry{coroutine.isyieldable
([co])|

Returns @true when the coroutine @id{co} can yield.
The default for @id{co} is the running coroutine.

A coroutine is yieldable if it is not the main thread and
it is not inside a non-yieldable @N{C function}.

}

@LibEntry{coroutine.resume (co [, val1, @Cdots])|

Starts or continues the execution of coroutine @id{co}.
The first time you resume a coroutine,
it starts running its body.
The values @id{val1}, @ldots are passed
as the arguments to the body function.

If the coroutine has yielded,
@id{resume} restarts it;
the values @id{val1}, @ldots are passed
as the results from the yield.

If the coroutine runs without any errors,
@id{resume} returns @true plus any values passed to @id{yield}
(when the coroutine yields) or any values returned by the body function
(when the coroutine terminates).
If there is any error,
@id{resume} returns @false plus the error message.

}

@LibEntry{coroutine.running ()|

Returns the running coroutine plus a boolean,
@true
 when the running coroutine is the main one.

}

@LibEntry{coroutine.status (co)|

Returns the status of the coroutine @id{co}, as a string:
@T{"running"},
if the coroutine is running
(that is, it is the one that called @id{status});
@T{"suspended"}, if the coroutine is suspended in a call to @id{yield},
or if it has not started running yet;
@T{"normal"} if the coroutine is active but not running
(that is, it has resumed another coroutine);
and @T{"dead"} if the coroutine has finished its body function,
or if it has stopped with an error.

}

@LibEntry{coroutine.wrap (f)|

Creates a new coroutine, with body @id{f};
@id{f} must be a function.
Returns a function that resumes the coroutine each time it is called.
Any arguments passed to this function behave as the
extra arguments to @id{resume}.
The function returns the same values returned by @id{resume},
except the first boolean.
In case of error,
the function closes the coroutine and propagates the error.

}

@LibEntry{coroutine.yield
 (@Cdots)|

Suspends the execution of the calling coroutine.
Any arguments to @id{yield} are passed as extra results to @id{resume}.

}

}

@sect2{packlib| @title{Modules}

The package library provides basic
facilities for loading modules in Lua.
It exports one function directly in the global environment:
@Lid{require}.
Everything else is exported in the table @defid{package}.

@LibEntry{require (modname)|

Loads the given module.
The function starts by looking into the @Lid{package.loaded} table
to determine whether @id{modname} is already loaded.
If it is, then @id{require} returns the value stored
at @T{package.loaded[modname]}.
(The absence of a second result in this case
signals that this call did not have to load the module.)
Otherwise, it tries to find a @emph{loader} for the module.

To find a loader,
@id{require} is guided by the table @Lid{package.searchers}.
Each item in this table is a search function,
that searches for the module in a particular way.
By changing
 this table,
we can change how @id{require} looks for a module.
The following explanation is based on the default configuration
for @Lid{package.searchers}.

First @id{require} queries @T{package.preload[modname]}.
If it has a value,
this value (which must be a function) is the loader.
Otherwise @id{require} searches for a Lua loader using the
path stored in @Lid{package.path}.

If that also fails, it searches for a @N{C loader} using the
path stored in @Lid{package.cpath}.
If that also fails,
it tries an @emph{all-in-one} loader @seeF{package.searchers}.

Once a loader is found,
@id{require} calls the loader with two arguments:
@id{modname} and an extra value,
a @emph{loader data},
also returned by the searcher.
The loader data can be any value useful to the module;
for the default searchers,
it indicates where the loader was found.
(For instance, if the loader came from a file,
this extra value is the file path.)
If the loader returns any non-nil value,
@id{require} assigns the returned
value to @T{package.loaded[modname]}.
If the loader does not return a non-nil value and
has not assigned any value to @T{package.loaded[modname]},
then @id{require} assigns @true to this entry.
In any case, @id{require} returns the
final value of @T{package.loaded[modname]}.
Besides that value, @id{require} also returns as a second result
the loader data returned by the searcher,
which indicates how @id{require} found the module.

If there is any error loading or running the module,
or if it cannot find any loader for the module,
then @id{require} raises an error.

}

@LibEntry{package.config|

A string describing some compile-time configurations for packages.
This string is a sequence of lines:
@itemize{

@item{The first line is the @x{directory separator} string.
Default is @Char{\} for @x{Windows} and @Char{/} for all other systems.}

@item{The second line is the character that separates templates in a path.
Default is @Char{;}.}

@item{The third line is the string that marks the
substitution

points in a template.
Default is @Char{?}.}

@item{The fourth line is a string that, in a path in @x{Windows},
is replaced by the executable's directory.
Default is @Char{!}.}

@item{The fifth line is a mark to ignore all text after it
when building the @id{luaopen_} function name.
Default is @Char{-}.}

}

}

@LibEntry{package.cpath|

A string with the path used by @Lid{require}
to search for a @N{C loader}.

Lua initializes the @N{C path} @Lid{package.cpath} in the same way
it initializes the Lua path @Lid{package.path},
using the environment variable @defid{LUA_CPATH_5_4},
or the environment variable @defid{LUA_CPATH},
or a default path defined in @id{luaconf.h}.

}

@LibEntry{package.loaded|

A table used by @Lid{require} to control which
modules are already loaded.
When you require a module @id{modname} and
@T{package.loaded[modname]} is not false,
@Lid{require} simply returns the value stored there.

This variable is only a reference to the real table;
assignments
to this variable do not change the
table used by @Lid{require}.
The real table is stored in the C registry @see{registry},
indexed by the key @defid{LUA_LOADED_TABLE}, a string.

}

@LibEntry{package.loadlib (libname, funcname)|

Dynamically links the host program with the @N{C library} @id{libname}.

If @id{funcname} is @St{*},
then it only links with the library,
making the symbols exported by the library
available to other dynamically linked libraries.
Otherwise,
it looks for a function @id{funcname} inside the library
and returns this function as a @N{C function}.
So, @id{funcname} must follow the @Lid{lua_CFunction} prototype
@seeC{lua_CFunction}.

This is a low-level function.
It completely bypasses the package and module system.
Unlike @Lid{require},
it does not perform any path searching and
does not automatically adds extensions.
@id{libname} must be the complete file name of the @N{C library},
including if necessary a path and an extension.
@id{funcname} must be the exact name
 exported by the @N{C library}
(which may depend on the @N{C compiler} and linker used).

This functionality is not supported by @N{ISO C}.
As such, it is only available on some platforms
(Windows, Linux, Mac OS X, Solaris, BSD,
plus other Unix systems that support the @id{dlfcn} standard).

This function is inherently insecure,
as it allows Lua to call any function in any readable dynamic
library in the system.
(Lua calls any function assuming the function
has a proper prototype and respects a proper protocol
@see{lua_CFunction}.
Therefore,
calling an arbitrary function in an arbitrary dynamic library
more often than not results in an access violation.)

}

@LibEntry{package.path|

A string with the path used by @Lid{require}
to search for a Lua loader.

At start-up, Lua initializes this variable with
the value of the environment variable @defid{LUA_PATH_5_4} or
the environment variable @defid{LUA_PATH} or
with a default path defined in @id{luaconf.h},

if those environment variables
are not defined.
A @St{;;} in the value of the environment variable
is replaced by the default path.

}

@LibEntry{package.preload|

A table to store loaders for specific modules
@seeF{require}.

This variable is only a reference to the real table;
assignments to this variable do not change the
table used by @Lid{require}.
The real table is stored in the C registry @see{registry},
indexed by the key @defid{LUA_PRELOAD_TABLE}, a string.

}

@LibEntry{package.searchers|

A table used by @Lid{require} to control how to find modules.

Each entry in this table is a @def{searcher function}.
When looking for a module,
@Lid{require} calls each of these searchers in ascending order,
with the module name (the argument given to @Lid{require}) as its
sole argument.
If the searcher finds the module,
it returns another function, the module @def{loader},
plus an extra value, a @emph{loader data},
that will be passed to that loader and
returned as a second result by @Lid{require}.
If it cannot find the
module,
it returns a string explaining why
(or @nil if it has nothing to say).

Lua initializes this table with four searcher functions.

The first searcher simply looks for a loader in the
@Lid{package.preload} table.

The second searcher looks for a loader as a Lua library,
using the path stored at @Lid{package.path}.
The search is done as described in function @Lid{package.searchpath}.

The third searcher looks for a loader as a @N{C library},
using the path given by the variable @Lid{package.cpath}.
Again,
the search is done as described in function @Lid{package.searchpath}.
For instance,
if the @N{C path} is the string
@verbatim{
"./?.so;./?.dll;/usr/local/?/init.so"
}
the searcher for module @id{foo}
will try to open the files @T{./foo.so}, @T{./foo.dll},
and @T{/usr/local/foo/init.so}, in that order.
Once it finds a @N{C library},
this searcher first uses a dynamic link facility to link the
application with the library.
Then it tries to find a @N{C function} inside the library
to
be used as the loader.
The name of this @N{C function} is the string @St{luaopen_}
concatenated with a copy of the module name where each dot
is replaced by an underscore.
Moreover, if the module name has a hyphen,
its suffix after (and including) the first hyphen is removed.
For instance, if the module name is @id{a.b.c-v2.1},
the function name will be @id{luaopen_a_b_c}.

The fourth searcher tries an @def{all-in-one loader}.
It searches the @N{C path} for a library for
the root name of the given module.
For instance, when requiring @id{a.b.c},
it will search for a @N{C library} for @id{a}.
If found, it looks into it for an open function for
the submodule;
in our example, that would be @id{luaopen_a_b_c}.
With this facility, a package can pack several @N{C submodules}
into one single library,
with each submodule keeping its original open function.

All searchers except the first one (preload) return as the extra value
the file path where the module was found,
as returned by @Lid{package.searchpath}.
The
first searcher always returns the string @St{:preload:}.

Searchers should raise no errors and have no side effects in Lua.
(They may have side effects in C,
for instance by linking the application with a library.)

}

@LibEntry{package.searchpath (name, path [, sep [, rep]])|

Searches for the given @id{name} in the given @id{path}.

A path is a string containing a sequence of
@emph{templates} separated by semicolons.
For each template,
the function replaces each interrogation mark (if any)
in the template with a copy of @id{name}
wherein all occurrences of @id{sep}
(a dot, by default)
were replaced by @id{rep}
(the system's directory separator, by default),
and then tries to open the resulting file name.

For instance, if the path is the string
@verbatim{
"./?.lua;./?.lc;/usr/local/?/init.lua"
}
the search for the name @id{foo.a}
will try to open the files
@T{./foo/a.lua}, @T{./foo/a.lc}, and
@T{/usr/local/foo/a/init.lua}, in that order.

Returns the resulting
 name of the first file that it can
open in read mode (after closing the file),
or @fail plus an error message if none succeeds.
(This error message lists all file names it tried to open.)

}

}

@sect2{strlib| @title{String Manipulation}

@simplesect{

This library provides generic functions for string manipulation,
such as finding and extracting substrings, and pattern matching.
When indexing a string in Lua, the first character is at @N{position 1}
(not @N{at 0}, as in C).
Indices are allowed to be negative and are interpreted as indexing backwards,
from the end of the string.
Thus, the last character is at position @num{-1}, and so on.

The string library provides all its functions inside the table
@defid{string}.
It also sets a @x{metatable for strings}
where the @idx{__index} field points to the @id{string} table.
Therefore, you can use the string functions in object-oriented style.
For instance, @T{string.byte(s,i)}
can be written as @T{s:byte(i)}.

The string library assumes one-byte
character encodings.

@LibEntry{string.byte (s [, i [, j]])|
Returns the internal numeric codes of the characters @T{s[i]},
@T{s[i+1]}, @ldots, @T{s[j]}.
The default value for @id{i} @N{is 1};
the default value for @id{j} @N{is @id{i}}.
These indices are corrected
following the same rules of function @Lid{string.sub}.

Numeric codes are not necessarily portable across platforms.

}

@LibEntry{string.char (@Cdots)|
Receives zero or more integers.
Returns a string with length equal to the number of arguments,
in which each character has the internal numeric code equal
to its corresponding argument.

Numeric codes are not necessarily portable across platforms.

}

@LibEntry{string.dump (function [, strip])|

Returns a string containing a binary representation
(a @emph{binary chunk})
of the given function,
so that a later @Lid{load} on this string returns
a copy of the function (but with new upvalues).
If @id{strip} is a true value,
the binary representation may not include all debug
information
about the function,
to save space.

Functions with upvalues have only their number of upvalues saved.

When (re)loaded,
those upvalues receive fresh instances.
(See the @Lid{load} function for details about
how these upvalues are initialized.
You can use the debug library to serialize
and reload the upvalues of a function
in a way adequate to your needs.)

}

@LibEntry{string.find (s, pattern [, init [, plain]])|

Looks for the first match of
@id{pattern} @see{pm} in the string @id{s}.
If it finds a match, then @id{find} returns the indices @N{of @T{s}}
where this occurrence starts and ends;
otherwise, it returns @fail.
A third, optional numeric argument @id{init} specifies
where to start the search;
its default value @N{is 1} and can be negative.
A @true as a fourth, optional argument @id{plain}
turns off the pattern matching facilities,
so the function does a plain @Q{find substring} operation,
with no characters in @id{pattern} being considered magic.

If the pattern has
captures,
then in a successful match
the captured values are also returned,
after the two indices.

}

@LibEntry{string.format (formatstring, @Cdots)|

Returns a formatted version of its variable number of arguments
following the description given in its first argument,
which must be a string.
The format string follows the same rules as the @ANSI{sprintf}.
The only differences are that the conversion specifiers and modifiers
@id{F}, @id{n}, @T{*}, @id{h}, @id{L}, and @id{l} are not supported
and that there is an extra specifier, @id{q}.
Both width and precision, when present,
are limited to two digits.

The specifier @id{q} formats booleans, nil, numbers, and strings
in a way that the result is a valid constant in Lua source code.
Booleans and nil are written in the obvious way

(@id{true}, @id{false}, @id{nil}).
Floats are written in hexadecimal,
to preserve full precision.
A string is written between double quotes,
using escape sequences when necessary to ensure that
it can safely
be read back by the Lua interpreter.
For instance, the call
@verbatim{
string.format('%q', 'a string with "quotes" and \n new line')
}
may produce the string:
@verbatim{
"a string with \"quotes\" and \
new line"
}
This specifier does not support modifiers (flags, width, precision).

The conversion specifiers
@id{A}, @id{a}, @id{E}, @id{e}, @id{f},
@id{G}, and @id{g} all expect a number as argument.
The specifiers @id{c}, @id{d},
@id{i}, @id{o}, @id{u}, @id{X}, and @id{x}
expect an integer.
When Lua is compiled with a C89 compiler,
the specifiers @id{A} and @id{a} (hexadecimal floats)
do not support modifiers.

The specifier @id{s} expects a string;
if its argument is not a string,
it is converted to one following the same rules of @Lid{tostring}.
If the specifier has any modifier,
the corresponding string argument should not contain @x{embedded zeros}.

The specifier @id{p} formats the pointer
returned by @Lid{lua_topointer}.
That gives a unique string identifier for tables, userdata,
threads,
strings, and functions.
For other values (numbers, nil, booleans),
this specifier results in a string representing
the pointer @id{NULL}.

}

@LibEntry{string.gmatch (s, pattern [, init])|
Returns an iterator function that,
each time it is called,

returns the next captures from @id{pattern} @see{pm}
over the string @id{s}.
If @id{pattern} specifies no captures,
then the whole match is produced in each call.
A third, optional numeric argument @id{init} specifies
where to start the search;
its default value @N{is 1} and can be negative.

As an example, the following loop
will iterate over all the words from string @id{s},
printing one per line:
@verbatim{
s = "hello world from Lua"
for w in string.gmatch(s, "%a+") do
 print(w)
end
}
The next example collects all pairs @T{key=value} from the
given string into a table:
@verbatim{
t = {}
s = "from=world, to=Lua"
for k, v in string.gmatch(s, "(%w+)=(%w+)") do
 t[k] = v
end
}

For this function, a caret @Char{^} at the start of a
 pattern does not
work as an anchor, as this would prevent the iteration.

}

@LibEntry{string.gsub (s, pattern, repl [, n])|
Returns a copy of @id{s}
in which all (or the first @id{n}, if given)
occurrences of the @id{pattern} @see{pm} have been
replaced by a replacement string specified by @id{repl},
which can be a string, a table, or a function.
@id{gsub} also returns, as its second value,
the total number of matches that occurred.
The name @id{gsub} comes from @emph{Global SUBstitution}.

If @id{repl} is a string, then its value is used for replacement.
The @N{character @T{%}} works as an escape character:
any sequence in @id{repl} of the form @T{%@rep{d}},
with @rep{d} between 1 and 9,
stands for the value of the @rep{d}-th captured substring;

the sequence @T{%0} stands for the whole match;
the sequence @T{%%} stands for a @N{single @T{%}}.

If @id{repl} is a table, then the table is queried for every match,
using the first capture as the key.

If @id{repl} is a function, then this
 function is called every time a
match occurs, with all captured substrings passed as arguments,
in order.

In any case,
if the pattern specifies no captures,
then it behaves as if the whole pattern was inside a capture.

If the value returned by the table query or by the function call
is a string or a number,
then it is used as the replacement string;
otherwise, if it is @Rw{false} or @nil,
then there is no replacement
(that is, the original match is kept in the string).

Here are some examples:
@verbatim{
```
x = string.gsub("hello world", "(%w+)", "%1 %1")
--> x="hello hello world world"

x = string.gsub("hello world", "%w+", "%0 %0", 1)
--> x="hello hello world"

x = string.gsub("hello world from Lua", "(%w+)%s*(%w+)", "%2 %1")
--> x="world hello Lua from"

x = string.gsub("home = $HOME, user = $USER", "%$(%w+)", os.getenv)
--> x="home = /home/roberto, user = roberto"

x = string.gsub("4+5 = $return 4+5$", "%$(.-)%$", function (s)
     return load(s)()
   end)
--> x="4+5 = 9"

local
 t = {name="lua", version="5.4"}
x = string.gsub("$name-$version.tar.gz", "%$(%w+)", t)
--> x="lua-5.4.tar.gz"
```
}

}

@LibEntry{string.len (s)|

Receives a string and returns its length.
The empty string @T{""} has length 0.
Embedded zeros are counted,
so @T{"a\000bc\000"} has length 5.

}

@LibEntry{string.lower (s)|

Receives a string and returns a copy of this string with all
uppercase letters changed to lowercase.
All other characters are left unchanged.
The definition of what an uppercase letter is depends on the current locale.

}

@LibEntry{string.match (s, pattern [, init])|

Looks for the first @emph{match} of
the @id{pattern} @see{pm} in the string @id{s}.
If it finds one, then @id{match} returns
the captures from the pattern;
otherwise it returns @fail.
If @id{pattern} specifies no captures,
then the whole match is returned.
A third, optional numeric argument @id{init} specifies
where to start the search;
its default value @N{is 1} and can be negative.

}

@LibEntry{string.pack
 (fmt, v1, v2, @Cdots)|

Returns a binary string containing the values @id{v1}, @id{v2}, etc.
serialized in binary form (packed)
according to the format string @id{fmt} @see{pack}.

}

@LibEntry{string.packsize (fmt)|

Returns the length of a string resulting from @Lid{string.pack}
with the given format.
The format string cannot have the variable-length options

@Char{s} or @Char{z} @see{pack}.

}

@LibEntry{string.rep (s, n [, sep])|

Returns a string that is the concatenation of @id{n} copies of
the string @id{s} separated by the string @id{sep}.
The default value for @id{sep} is the empty string
(that is, no separator).
Returns the empty string if @id{n} is not positive.

(Note that it is very easy to exhaust the memory of your machine
with a single call to this function.)

}

@LibEntry{string.reverse (s)|

Returns a string that is the string @id{s} reversed.

}

@LibEntry{string.sub (s, i [, j])|

Returns the substring of @id{s} that
starts at @id{i} and continues until @id{j};
@id{i}
 and @id{j} can be negative.
If @id{j} is absent, then it is assumed to be equal to @num{-1}
(which is the same as the string length).
In particular,
the call @T{string.sub(s,1,j)} returns a prefix of @id{s}
with length @id{j},
and @T{string.sub(s, -i)} (for a positive @id{i})
returns a suffix of @id{s}
with length @id{i}.

If, after the translation of negative indices,
@id{i} is less than 1,
it is corrected to 1.
If @id{j} is greater than the string length,
it is corrected to that length.
If, after these corrections,
@id{i} is greater than @id{j},
the function returns the empty string.

}

@LibEntry{string.unpack (fmt, s [, pos])|

Returns the values packed in string @id{s} @seeF{string.pack}
according to the format string @id{fmt} @see{pack}.
An optional @id{pos} marks where
to start reading in @id{s} (default is 1).
After the read values,
this function also returns the index of the first unread byte in @id{s}.

}

@LibEntry{string.upper (s)|

Receives a string and returns a copy
of this string with all
lowercase letters changed to uppercase.
All other characters are left unchanged.
The definition of what a lowercase letter is depends on the current locale.

}

}

@sect3{pm| @title{Patterns}

@simplesect{

Patterns in Lua are described by regular strings,
which are interpreted as patterns by the pattern-matching functions
@Lid{string.find},
@Lid{string.gmatch},
@Lid{string.gsub},
and @Lid{string.match}.
This section describes the syntax and the meaning
(that is, what they match) of these strings.

}

@sect4{@title{Character Class:}
A @def{character class} is used to represent a set of characters.
The following combinations are allowed in describing a character class:
@description{

@item{@rep{x}|
(where @rep{x} is not one of the @emphx{magic characters}
@T{^$()%.[]*+-?})

represents the character @emph{x} itself.
}

@item{@T{.}| (a dot) represents all characters.}

@item{@T{%a}| represents all letters.}

@item{@T{%c}| represents all control characters.}

@item{@T{%d}|
represents all digits.}

@item{@T{%g}| represents all printable characters except space.}

@item{@T{%l}| represents all lowercase letters.}

@item{@T{%p}| represents all punctuation characters.}

@item{@T{%s}| represents all space characters.}

@item{@T{%u}| represents all uppercase letters.}

@item{@T{%w}| represents all alphanumeric characters.}

@item{@T{%x}| represents all hexadecimal digits.}

@item{@T{%@rep{x}}| (where @rep{x} is any non-alphanumeric character)
represents the character @rep{x}.
This is the standard way to escape the magic characters.
Any non-alphanumeric character
(including all punctuation characters, even the non-magical)
can be preceded by a @Char{%} to represent itself in a pattern.
}

@item{@T{[@rep{set}]}|
represents the class which is the union of all
characters in @rep{set}.
A range of characters can be specified by
separating the end characters of the range,
in ascending order, with a @Char{-}.
All classes @T{%}@emph{x} described above can also
be used as
components in @rep{set}.
All other characters in @rep{set} represent themselves.
For example, @T{[%w_]} (or @T{[_%w]})
represents all alphanumeric characters plus the underscore,
@T{[0-7]} represents the octal digits,
and @T{[0-7%l%-]} represents the octal digits plus

the lowercase letters plus the @Char{-} character.

You can put a closing square bracket in a set
by positioning it as the first character in the set.
You can put a hyphen in a set
by positioning it as the first or the last character in the set.
(You can also use an escape for both cases.)

The interaction between ranges and classes is not defined.
Therefore, patterns like @T{[%a-z]} or @T{[a-%%]}
have no meaning.
}

@item{@T{[^@rep{set}]}|
represents the complement of @rep{set},
where @rep{set} is interpreted as above.
}

}
For all classes represented by single letters (@T{%a}, @T{%c}, etc.),
the corresponding uppercase letter represents the complement of the class.
For instance, @T{%S} represents all non-space
characters.

The definitions of letter, space, and other character groups
depend on the current locale.
In particular, the class @T{[a-z]} may not be equivalent to @T{%l}.

}

@sect4{@title{Pattern Item:}
A @def{pattern item} can be
@itemize{

@item{
a single character class,
which matches any single character in the class;
}

@item{
a single character class followed by @Char{*},
which matches sequences of zero or more characters in the class.
These repetition items will always match the longest possible sequence;
}

@item{
a single character class followed by @Char{+},
which matches sequences of one or more characters in the class.

These repetition items will always match the longest possible sequence;
}

@item{
a single character class followed by @Char{-},
which also matches sequences of zero or more characters in the class.
Unlike @Char{*},
these repetition items will always match the shortest possible sequence;
}

@item{
a single character class followed by @Char{?},
which matches
zero or one occurrence of a character in the class.
It always matches one occurrence if possible;
}

@item{
@T{%@rep{n}}, for @rep{n} between 1 and 9;
such item matches a substring equal to the @rep{n}-th captured string
(see below);
}

@item{
@T{%b@rep{xy}}, where @rep{x} and @rep{y} are two distinct characters;
such item matches strings that start @N{with @rep{x}}, end @N{with @rep{y}},
and where the @rep{x} and @rep{y} are @emph{balanced}.
This means that, if one reads the string from left to right,
counting @M{+1} for an @rep{x} and @M{-1} for a @rep{y},
the ending @rep{y} is the first @rep{y} where the count reaches 0.
For instance, the item @T{%b()} matches expressions with
balanced parentheses.
}

@item{
@T{%f[@rep{set}]}, a @def{frontier pattern};
such item matches an empty string at any position such that
the next character belongs to @rep{set}
and the previous character does not belong to @rep{set}.
The set @rep{set} is interpreted as previously described.
The beginning and
the end of the subject are handled as if
they were the character @Char{\0}.
}

}

}

@sect4{@title{Pattern:}
A @def{pattern} is a sequence of pattern items.
A caret @Char{^} at the beginning of a pattern anchors the match at the
beginning of the subject string.
A @Char{$} at the end of a pattern anchors the match at the
end of the subject string.
At other positions,
@Char{^} and @Char{$} have no special meaning and represent themselves.

}

@sect4{@title{Captures:}
A pattern can contain sub-patterns enclosed in parentheses;
they describe @def{captures}.
When a match succeeds, the substrings of the subject string
that match captures are stored (@emph{captured}) for future use.
Captures are numbered according to their left parentheses.
For instance, in the pattern @T{"(a*(.)%w(%s*))"},
the part of the string matching @T{"a*(.)%w(%s*)"} is
stored as the first capture, and therefore has @N{number 1};
the character matching @St{.} is captured with @N{number 2},
and the part matching @St{%s*}
has @N{number 3}.

As a special case, the capture @T{()} captures
the current string position (a number).
For instance, if we apply the pattern @T{"()aa()"} on the
string @T{"flaaap"}, there will be two captures: @N{3 and 5}.

}

@sect4{@title{Multiple matches:}
The function @Lid{string.gsub} and the iterator @Lid{string.gmatch}
match multiple occurrences of the given pattern in the subject.
For these functions,
a new match is considered valid only
if it ends at least one byte after the end of the previous match.
In other words, the pattern machine never accepts the
empty string as a match immediately after another match.
As an example,
consider the results of the following code:
@verbatim{
> string.gsub("abc", "()a*()", print);
--> 1 2
--> 3 3
--> 4 4
}

The second and third results come from Lua matching an empty
string after @Char{b} and another one after @Char{c}.
Lua does not match an empty string after @Char{a},
because it would end at the same position of the previous match.

}

}

@sect3{pack|
 @title{Format Strings for Pack and Unpack}

The first argument to @Lid{string.pack},
@Lid{string.packsize}, and @Lid{string.unpack}
is a format string,
which describes the layout of the structure being created or read.

A format string is a sequence of conversion options.
The conversion options are as follows:
@description{
@item{@T{<}|sets little endian}
@item{@T{>}|sets big endian}
@item{@T{=}|sets native endian}
@item{@T{![@rep{n}]}|sets maximum alignment to @id{n}
(default is native alignment)}
@item{@T{b}|a signed byte (@id{char})}
@item{@T{B}|an unsigned byte (@id{char})}
@item{@T{h}|a signed @id{short} (native size)}
@item{@T{H}|an unsigned @id{short} (native size)}
@item{@T{l}|a signed @id{long} (native size)}
@item{@T{L}|an unsigned @id{long} (native size)}
@item{@T{j}|a @id{lua_Integer}}
@item{@T{J}|a @id{lua_Unsigned}}
@item{@T{T}|a @id{size_t} (native size)}
@item{@T{i[@rep{n}]}|a signed @id{int} with @id{n} bytes
(default is native size)}
@item{@T{I[@rep{n}]}|an
 unsigned @id{int} with @id{n} bytes
(default is native size)}
@item{@T{f}|a @id{float} (native size)}
@item{@T{d}|a @id{double} (native size)}
@item{@T{n}|a @id{lua_Number}}
@item{@T{c@rep{n}}|a fixed-sized string with @id{n} bytes}
@item{@T{z}|a zero-terminated string}
@item{@T{s[@emph{n}]}|a string preceded by its length
coded as an unsigned integer with @id{n} bytes
(default is a @id{size_t})}
@item{@T{x}|one byte of padding}

@item{@T{X@rep{op}}|an empty item that aligns
according to option @id{op}
(which is otherwise ignored)}
@item{@Char{ }|(space) ignored}
}
(A @St{[@rep{n}]} means an optional integral numeral.)
Except for padding, spaces, and configurations
(options @St{xX <=>!}),
each option corresponds to an argument in @Lid{string.pack}
or a result in @Lid{string.unpack}.

For options @St{!@rep{n}}, @St{s@rep{n}}, @St{i@rep{n}}, and @St{I@rep{n}},
@id{n} can be any integer between 1 and 16.
All integral options check overflows;
@Lid{string.pack} checks whether
the given value fits in the given size;
@Lid{string.unpack} checks whether the read value fits in a Lua integer.
For the unsigned options,
Lua integers are treated as unsigned values too.

Any format string starts as if prefixed by @St{!1=},
that is,
with maximum alignment of 1 (no alignment)
and native endianness.

Native endianness assumes that the whole system is
either big or little endian.
The packing functions will not emulate correctly the behavior
of mixed-endian formats.

Alignment works as follows:
For each option,
the format gets extra padding until the data starts
at an offset that is a multiple of the minimum between the
option size and the maximum alignment;
this minimum must be a power of 2.
Options @St{c} and @St{z} are not aligned;
option @St{s} follows the alignment of its starting integer.

All padding is filled with zeros by @Lid{string.pack}
and ignored by @Lid{string.unpack}.

}

}

@sect2{utf8| @title{UTF-8 Support}

This library provides basic support for @x{UTF-8}
encoding.
It provides all its functions inside the table @defid{utf8}.
This library does not provide any support for @x{Unicode} other
than the handling of the encoding.
Any operation that needs the meaning of a character,
such as character classification, is outside its scope.

Unless stated otherwise,
all functions that expect a byte position as a parameter
assume that the given position is either the start of a byte sequence
or one plus the length of the subject string.
As in the string library,
negative indices count from the end of the string.

Functions that create byte sequences
accept all values up to @T{0x7FFFFFFF},
as defined in the original UTF-8 specification;
that implies byte sequences of up to six bytes.

Functions that interpret byte sequences only accept
valid sequences (well formed and not overlong).
By default, they only accept byte sequences
that result in valid Unicode code points,
rejecting values greater than @T{10FFFF} and surrogates.
A boolean argument @id{lax},
when available,
lifts these checks,
so that all values up to @T{0x7FFFFFFF} are accepted.
(Not well formed and overlong sequences are still rejected.)

@LibEntry{utf8.char (@Cdots)|

Receives zero or more integers,
converts each one to its corresponding UTF-8 byte sequence
and returns a string with the concatenation of all these sequences.

}

@LibEntry{utf8.charpattern|

The pattern (a string, not a function) @St{[\0-\x7F\xC2-\xFD][\x80-\xBF]*}
@see{pm},
which matches exactly one UTF-8 byte sequence,
assuming that the subject is a valid UTF-8 string.

}

@LibEntry{utf8.codes (s [, lax])|

Returns values so that the construction
@verbatim{
for p, c in utf8.codes(s) do @rep{body} end
}
will iterate over all UTF-8 characters in string @id{s},
with @id{p} being the position (in bytes) and @id{c} the code point
of each character.
It raises an error if it meets any invalid byte sequence.

}

@LibEntry{utf8.codepoint (s [, i [, j [, lax]]])|

Returns the code points (as integers) from
all characters in @id{s}
that start between byte position @id{i} and @id{j} (both included).
The default for @id{i} is 1 and for @id{j} is @id{i}.
It raises an error if it meets any invalid byte sequence.

}

@LibEntry{utf8.len (s [, i [, j [, lax]]])|

Returns the number of UTF-8 characters in string @id{s}
that start between positions @id{i} and @id{j} (both inclusive).
The default for @id{i} is @num{1} and for @id{j} is @num{-1}.
If it finds any invalid byte sequence,
returns @fail plus the position of the first invalid byte.

}

@LibEntry{utf8.offset (s, n [, i])|

Returns the position (in bytes) where the encoding of the
@id{n}-th character of @id{s}
(counting from position @id{i}) starts.
A negative @id{n} gets characters before position @id{i}.
The default for @id{i} is 1 when @id{n} is non-negative
and @T{#s + 1} otherwise,
so that @T{utf8.offset(s, -n)} gets the offset of the
@id{n}-th character from the end of the string.
If the specified character is neither in the subject
nor

right after its end,
the function returns @fail.

As a special case,
when @id{n} is 0 the function returns the start of the encoding
of the character that contains the @id{i}-th byte of @id{s}.

This function assumes that @id{s} is a valid UTF-8 string.

}

}

@sect2{tablib| @title{Table Manipulation}

This library provides generic functions for table manipulation.
It provides all its functions inside the table @defid{table}.

Remember that, whenever an operation needs the length of a table,
all caveats about the length operator apply @see{len-op}.
All functions ignore non-numeric keys
in the tables given as arguments.

@LibEntry{table.concat (list [, sep [, i [, j]]])|

Given a list where all elements are strings or numbers,
returns the string @T{list[i]..sep..list[i+1] @Cdots sep..list[j]}.
The default value for @id{sep} is the empty string,
the default for @id{i} is 1,
and the default for @id{j} is @T{#list}.
If @id{i} is greater than @id{j}, returns the empty string.

}

@LibEntry{table.insert
(list, [pos,] value)|

Inserts element @id{value} at position @id{pos} in @id{list},
shifting up the elements
@T{list[pos], list[pos+1], @Cdots, list[#list]}.
The default value for @id{pos} is @T{#list+1},
so that a call @T{table.insert(t,x)} inserts @id{x} at the end
of the list @id{t}.

}

@LibEntry{table.move (a1, f, e, t [,a2])|

Moves elements from the table @id{a1} to the table @id{a2},
performing the equivalent to the following
multiple assignment:
@T{a2[t],@Cdots = a1[f],@Cdots,a1[e]}.
The default for @id{a2} is @id{a1}.
The destination range can overlap with the source range.
The number of elements to be moved must fit in a Lua integer.

Returns the destination table @id{a2}.

}

@LibEntry{table.pack (@Cdots)|

Returns a new table with all arguments stored into keys 1, 2, etc.
and with a field @St{n} with the total number of arguments.
Note that the resulting table may not be a sequence,
if some arguments are @nil.

}

@LibEntry{table.remove (list [, pos])|

Removes
 from @id{list} the element at position @id{pos},
returning the value of the removed element.
When @id{pos} is an integer between 1 and @T{#list},
it shifts down the elements
@T{list[pos+1], list[pos+2], @Cdots, list[#list]}
and erases element @T{list[#list]};
The index @id{pos} can also be 0 when @T{#list} is 0,
or @T{#list + 1}.

The default value for @id{pos} is @T{#list},
so that a call @T{table.remove(l)} removes the last element
of the list @id{l}.

}

@LibEntry{table.sort (list [, comp])|

Sorts the list elements in a given order, @emph{in-place},
from @T{list[1]} to @T{list[#list]}.
If @id{comp} is given,
then it must be a function that receives two list elements
and returns true when the first element must come
before the second in the final order,

so that, after the sort,
@T{i <= j} implies @T{not comp(list[j],list[i])}.
If @id{comp} is not given,
then the standard Lua operator @T{<} is used instead.

The @id{comp} function must define a consistent order;
more formally,
 the function must define a strict weak order.
(A weak order is similar to a total order,
but it can equate different elements for comparison purposes.)

The sort algorithm is not stable:
Different elements considered equal by the given order
may have their relative positions changed by the sort.

}

@LibEntry{table.unpack (list [, i [, j]])|

Returns the elements from the given list.
This function is equivalent to
@verbatim{
return list[i], list[i+1], @Cdots, list[j]
}
By default, @id{i} @N{is 1} and @id{j} is @T{#list}.

}

}

@sect2{mathlib| @title{Mathematical Functions}

This library provides basic mathematical functions.
It provides all its functions and constants inside the table @defid{math}.
Functions with the annotation @St{integer/float} give
integer results for integer arguments
and float results for non-integer arguments.
The rounding functions
@Lid{math.ceil}, @Lid{math.floor}, and @Lid{math.modf}
return an integer when the result fits in the range of an integer,
or a
 float otherwise.

@LibEntry{math.abs (x)|

Returns the maximum value between @id{x} and @id{-x}. (integer/float)

}

@LibEntry{math.acos (x)|

Returns the arc cosine of @id{x} (in radians).

}

@LibEntry{math.asin (x)|

Returns the arc sine of @id{x} (in radians).

}

@LibEntry{math.atan (y [, x])|

@index{atan} @index{atan2}
Returns the arc tangent of @T{y/x} (in radians),
using the signs of both arguments to find the
quadrant of the result.
It also handles correctly the case of @id{x} being zero.

The default value for @id{x} is 1,
so that the call @T{math.atan(y)}
returns the arc tangent of @id{y}.

}

@LibEntry{math.ceil (x)|

Returns the smallest integral value greater than or equal to @id{x}.

}

@LibEntry{math.cos (x)|

Returns the cosine of @id{x} (assumed to be in radians).

}

@LibEntry{math.deg (x)|

Converts the angle @id{x} from radians to degrees.

}

@LibEntry{math.exp (x)|

Returns the value @M{e@sp{x}}

(where @id{e} is the base of natural logarithms).

}

@LibEntry{math.floor
(x)|

Returns the largest integral value less than or equal to @id{x}.

}

@LibEntry{math.fmod (x, y)|

Returns the remainder of the division of @id{x} by @id{y}
that rounds the quotient towards zero. (integer/float)

}

@LibEntry{math.huge|

The float value @idx{HUGE_VAL},
a value greater than any other numeric value.

}

@LibEntry{math.log (x [, base])|

Returns the logarithm of @id{x} in the given base.
The default for @id{base} is @M{e}
(so that the function returns the natural logarithm of @id{x}).

}

@LibEntry{math.max (x, @Cdots)|

Returns the argument with the maximum value,
according to the Lua operator @T{<}.

}

@LibEntry{math.maxinteger|
An integer with the maximum value for an integer.

}

@LibEntry{math.min (x, @Cdots)|

Returns the argument with the minimum value,

according to the Lua operator @T{<}.

}

@LibEntry{math.mininteger|
An integer with the minimum value for an integer.

}

@LibEntry{math.modf (x)|

Returns the integral part of @id{x} and the fractional
part of @id{x}.
Its second result is always a float.

}

@LibEntry{math.pi|

The value of @M{@pi}.

}

@LibEntry{math.rad (x)|

Converts the angle @id{x} from degrees to radians.

}

@LibEntry{math.random ([m [, n]])|

When called without arguments,
returns a pseudo-random float with uniform distribution
in the range @C{(} @M{[0,1)}. @C{]}
When called with two integers @id{m} and @id{n},
@id{math.random} returns a pseudo-random integer
with uniform distribution in the range @M{[m, n]}.
The call @T{math.random(n)}, for a positive @id{n},
is equivalent to @T{math.random(1,n)}.
The call @T{math.random(0)} produces an integer with
all bits (pseudo)random.

This function uses the @idx{xoshiro256**} algorithm to produce
pseudo-random 64-bit integers,
which are the results of calls with @N{argument 0}.
Other results (ranges and floats)
are unbiased extracted from these integers.

Lua initializes its pseudo-random generator with the equivalent of
a call to @Lid{math.randomseed} with no arguments,
so
 that @id{math.random} should generate
different sequences of results each time the program runs.

}

@LibEntry{math.randomseed ([x [, y]])|

When called with at least one argument,
the integer parameters @id{x} and @id{y} are
joined into a 128-bit @emphx{seed} that
is used to reinitialize the pseudo-random generator;
equal seeds produce equal sequences of numbers.
The default for @id{y} is zero.

When called with no arguments,
Lua generates a seed with
a weak attempt for randomness.

This function returns the two seed components
that were effectively used,
so that setting them again repeats the sequence.

To ensure a required level of randomness to the initial state
(or contrarily, to have a deterministic sequence,
for instance when debugging a program),
you should call @Lid{math.randomseed} with explicit arguments.

}

@LibEntry{math.sin (x)|

Returns the sine of @id{x} (assumed to be in radians).

}

@LibEntry{math.sqrt (x)|

Returns the square root of @id{x}.
(You can also
 use the expression @T{x^0.5} to compute this value.)

}

@LibEntry{math.tan (x)|

Returns the tangent of @id{x} (assumed to be in radians).

}

@LibEntry{math.tointeger (x)|

If the value @id{x} is convertible to an integer,
returns that integer.
Otherwise, returns @fail.

}

@LibEntry{math.type (x)|

Returns @St{integer} if @id{x} is an integer,
@St{float} if it is a float,
or @fail if @id{x} is not a number.

}

@LibEntry{math.ult (m, n)|

Returns a boolean,
@true if and only if integer @id{m} is below integer @id{n} when
they are compared as @x{unsigned integers}.

}

}

@sect2{iolib| @title{Input and Output Facilities}

The I/O library provides two different styles for file manipulation.
The first one uses implicit file handles;
that is, there are operations to set a default input file and a
default output file,
and all input/output operations are done over these default files.
The second style uses explicit file handles.

When using implicit file handles,
all operations are supplied
by table @defid{io}.
When using explicit file handles,
the operation @Lid{io.open} returns a file handle
and then all operations are supplied as methods of the file handle.

The metatable for file handles provides metamethods
for @idx{__gc} and @idx{__close} that try

to close the file when called.

The table @id{io} also provides
three predefined file handles with their usual meanings from C:
@defid{io.stdin}, @defid{io.stdout}, and @defid{io.stderr}.
The I/O library never closes these files.

Unless otherwise stated,
all I/O functions return @fail on failure,
plus an error message as a second result and
a system-dependent error code as a third result,
and some non-false value on success.
On non-POSIX systems,
the computation of the error message and error code
in case of errors
may be not @x{thread safe},
because they rely on the global C variable @id{errno}.

@LibEntry{io.close ([file])|

Equivalent to @T{file:close()}.
Without a @id{file}, closes the default output file.

}

@LibEntry{io.flush
()|

Equivalent to @T{io.output():flush()}.

}

@LibEntry{io.input ([file])|

When called with a file name, it opens the named file (in text mode),
and sets its handle as the default input file.
When called with a file handle,
it simply sets this file handle as the default input file.
When called without arguments,
it returns the current default input file.

In case of errors this function raises the error,
instead of returning an error code.

}

@LibEntry{io.lines ([filename, @Cdots])|

Opens the given file name in read mode
and returns an iterator function that
works like @T{file:lines(@Cdots)} over the opened file.
When the iterator function fails to read any value,
it automatically closes the file.
Besides the iterator function,
@id{io.lines} returns three other values:
two @nil values as placeholders,
plus the created file handle.
Therefore, when used in a generic @Rw{for} loop,
the file is closed also if the loop is interrupted by an
error or a @Rw{break}.

The call
 @T{io.lines()} (with no file name) is equivalent
to @T{io.input():lines("l")};
that is, it iterates over the lines of the default input file.
In this case, the iterator does not close the file when the loop ends.

In case of errors opening the file,
this function raises the error,
instead of returning an error code.

}

@LibEntry{io.open (filename [, mode])|

This function opens a file,
in the mode specified in the string @id{mode}.
In case of success,
it returns a new file handle.

The @id{mode} string can be any of the following:
@description{
@item{@St{r}| read mode (the default);}
@item{@St{w}| write mode;}
@item{@St{a}| append mode;}
@item{@St{r+}| update mode, all previous data is preserved;}
@item{@St{w+}| update mode, all previous data is erased;}
@item{@St{a+}| append update mode, previous data is preserved,
 writing is only allowed at the end of file.}
}
The @id{mode} string can also have a @Char{b} at the end,
which is needed in some systems to open the file in binary mode.

}

@LibEntry{io.output

([file])|

Similar to @Lid{io.input}, but operates over the default output file.

}

@LibEntry{io.popen (prog [, mode])|

This function is system dependent and is not available
on all platforms.

Starts the program @id{prog} in a separated process and returns
a file handle that you can use to read data from this program
(if @id{mode} is @T{"r"}, the default)
or to write data to this program
(if @id{mode} is @T{"w"}).

}

@LibEntry{io.read (@Cdots)|

Equivalent to @T{io.input():read(@Cdots)}.

}

@LibEntry{io.tmpfile ()|

In case of success,
returns a handle for a temporary file.
This file is opened in update mode
and it is automatically removed when the program ends.

}

@LibEntry{io.type (obj)|

Checks whether @id{obj} is a valid file handle.
Returns the string @T{"file"} if @id{obj} is an open file handle,
@T{"closed file"} if @id{obj} is a closed file handle,
or @fail if @id{obj} is not a file handle.

}

@LibEntry{io.write (@Cdots)|

Equivalent to @T{io.output():write(@Cdots)}.

}

@LibEntry{file:close
()|

Closes @id{file}.
Note that files are automatically closed when
their handles are garbage collected,
but that takes an unpredictable amount of time to happen.

When closing a file handle created with @Lid{io.popen},
@Lid{file:close} returns the same values
returned by @Lid{os.execute}.

}

@LibEntry{file:flush ()|

Saves any written data to @id{file}.

}

@LibEntry{file:lines (@Cdots)|

Returns an iterator function that,
each time it is called,
reads the file according to the given formats.
When no format is given,
uses @St{l} as a default.
As an example, the construction
@verbatim{
for c in file:lines(1) do @rep{body} end
}
will iterate over all characters of the file,
starting at the current position.
Unlike @Lid{io.lines}, this function does not close the file
when the loop ends.

}

@LibEntry{file:read (@Cdots)|

Reads the file @id{file},
according to the given formats, which specify what to read.
For each format,
the function
returns a string or a number with the characters read,
or @fail if it cannot read data with the specified format.

(In this latter case,
the function does not read subsequent formats.)
When called without arguments,
it uses a default format that reads the next line
(see below).

The available formats are
@description{

@item{@St{n}|
reads a numeral and returns it as a float or an integer,
following the lexical conventions of Lua.
(The numeral may have leading whitespaces and a sign.)
This format always reads the longest input sequence that
is a valid prefix for a numeral;
if that prefix does not form a valid numeral
(e.g., an empty string, @St{0x}, or @St{3.4e-})
or it is too long (more than 200 characters),
it is discarded and the format returns @fail.
}

@item{@St{a}|
reads the whole file, starting at the current position.
On end of file, it returns the empty string;
this format never fails.
}

@item{@St{l}|
reads the next line skipping the end of line,
returning @fail on end of file.
This
 is the default format.
}

@item{@St{L}|
reads the next line keeping the end-of-line character (if present),
returning @fail on end of file.
}

@item{@emph{number}|
reads a string with up to this number of bytes,
returning @fail on end of file.
If @id{number} is zero,
it reads nothing and returns an empty string,
or @fail on end of file.
}

}

The formats @St{l} and @St{L} should be used only for text files.

}

@LibEntry{file:seek ([whence [, offset]])|

Sets and gets the file position,
measured from the beginning of the file,
to the position given by @id{offset} plus a base
specified by the string @id{whence}, as follows:
@description{
@item{@St{set}| base is position 0 (beginning of the file);}
@item{@St{cur}| base is current position;}
@item{@St{end}| base is end of file;}
}
In case of success, @id{seek} returns the final file position,
measured in bytes from the beginning of the file.
If @id{seek} fails, it returns @fail,
plus a string describing the error.

The default value
 for @id{whence} is @T{"cur"},
and for @id{offset} is 0.
Therefore, the call @T{file:seek()} returns the current
file position, without changing it;
the call @T{file:seek("set")} sets the position to the
beginning of the file (and returns 0);
and the call @T{file:seek("end")} sets the position to the
end of the file, and returns its size.

}

@LibEntry{file:setvbuf (mode [, size])|

Sets the buffering mode for a file.
There are three available modes:
@description{
@item{@St{no}| no buffering.}
@item{@St{full}| full buffering.}
@item{@St{line}| line buffering.}
}

For the last two cases,
@id{size} is a hint for the size of the buffer, in bytes.
The default is an appropriate size.

The specific behavior of each mode is non portable;
check the underlying @ANSI{setvbuf} in your platform for

more details.

}

@LibEntry{file:write (@Cdots)|

Writes the value of each of its arguments to @id{file}.
The arguments must be strings or numbers.

In case of success, this function returns @id{file}.

}

}

@sect2{oslib|
 @title{Operating System Facilities}

This library is implemented through table @defid{os}.

@LibEntry{os.clock ()|

Returns an approximation of the amount in seconds of CPU time
used by the program,
as returned by the underlying @ANSI{clock}.

}

@LibEntry{os.date ([format [, time]])|

Returns a string or a table containing date and time,
formatted according to the given string @id{format}.

If the @id{time} argument is present,
this is the time to be formatted
(see the @Lid{os.time} function for a description of this value).
Otherwise, @id{date} formats the current time.

If @id{format} starts with @Char{!},
then the date is formatted in Coordinated Universal Time.
After this optional character,
if @id{format} is the string @St{*t},
then @id{date} returns a table with the following fields:
@id{year}, @id{month} (1@En{}12), @id{day} (1@En{}31),
@id{hour} (0@En{}23), @id{min} (0@En{}59),
@id{sec} (0@En{}61, due to leap seconds),
@id{wday} (weekday, 1@En{}7, Sunday

@N{is 1}),
@id{yday} (day of the year, 1@En{}366),
and @id{isdst} (daylight saving flag, a boolean).
This last field may be absent
if the information is not available.

If @id{format} is not @St{*t},
then @id{date} returns the date as a string,
formatted according to the same rules as the @ANSI{strftime}.

If @id{format} is absent, it defaults to @St{%c},
which gives a human-readable date and time representation
using the current locale.

On non-POSIX systems,
this function may be not @x{thread safe}
because of its reliance on @CId{gmtime} and @CId{localtime}.

}

@LibEntry{os.difftime (t2, t1)|

Returns the difference, in seconds,
from time @id{t1} to time @id{t2}
(where the times are values returned by @Lid{os.time}).
In @x{POSIX}, @x{Windows}, and some other systems,
this value is exactly @id{t2}@M{-}@id{t1}.

}

@LibEntry{os.execute ([command])|

This function is equivalent to the @ANSI{system}.
It passes @id{command} to be executed by an operating system shell.
Its first result is
@true
if the command terminated successfully,
or @fail otherwise.
After this first result
the function returns a string plus a number,
as follows:
@description{

@item{@St{exit}|
the command terminated normally;
the following number is the exit status of the command.
}

@item{@St{signal}|
the command was terminated by a signal;
the following number is the signal that terminated the command.
}

}

When called without a @id{command},
@id{os.execute} returns a boolean that is true if a shell is available.

}

@LibEntry{os.exit ([code [, close]])|

Calls the @ANSI{exit} to terminate the host program.
If @id{code} is @true,
the returned status is @idx{EXIT_SUCCESS};
if @id{code} is @false,
the returned status is @idx{EXIT_FAILURE};
if @id{code} is a number,
the returned status is this number.
The default value for @id{code} is @true.

If the optional second argument @id{close} is true,
the function closes the Lua state before exiting @seeF{lua_close}.

}

@LibEntry{os.getenv (varname)|

Returns
the value of the process environment variable @id{varname}
or @fail if the variable is not defined.

}

@LibEntry{os.remove (filename)|

Deletes the file (or empty directory, on @x{POSIX} systems)
with the given name.
If this function fails, it returns @fail
plus a string describing the error and the error code.
Otherwise, it returns true.

}

@LibEntry{os.rename (oldname, newname)|

Renames the file or directory named @id{oldname} to @id{newname}.
If this function fails, it returns @fail,
plus a string describing the error and the error code.
Otherwise, it returns true.

}

@LibEntry{os.setlocale (locale [, category])|

Sets the current locale of the program.
@id{locale} is a system-dependent string specifying a locale;
@id{category} is an optional string describing which category to change:
@T{"all"}, @T{"collate"}, @T{"ctype"},
@T{"monetary"}, @T{"numeric"}, or @T{"time"};
the default category is @T{"all"}.
The function returns the name of the new locale,
or @fail if the request
cannot be honored.

If @id{locale} is the empty string,
the current locale is set to an implementation-defined native locale.
If @id{locale} is the string @St{C},
the current locale is set to the standard C locale.

When called with @nil as the first argument,
this function only returns the name of the current locale
for the given category.

This function may be not @x{thread safe}
because of its reliance on @CId{setlocale}.

}

@LibEntry{os.time ([table])|

Returns the current time when called without arguments,
or a time representing the local date and time specified by the given table.
This table must have fields @id{year}, @id{month}, and @id{day},
and may have fields
@id{hour} (default is 12),
@id{min} (default is 0),
@id{sec} (default is 0),
and @id{isdst} (default is @nil).
Other fields are ignored.
For a description of these fields, see the @Lid{os.date} function.

When the function is called,
the values in these fields do not need to be inside their valid ranges.

For instance,
if @id{sec} is -10,
it means 10 seconds before the time specified by the other fields;
if @id{hour} is 1000,
it means 1000 hours after the time specified by the other fields.

The returned value is a number, whose meaning depends on your system.
In @x{POSIX}, @x{Windows}, and some other systems,
this number counts the number
of seconds since some given start time (the @Q{epoch}).
In other systems, the meaning is not specified,
and the number returned by @id{time} can be used only as an argument to
@Lid{os.date} and @Lid{os.difftime}.

When called with a table,
@id{os.time} also normalizes all the fields
documented in the @Lid{os.date} function,
so that they represent the same time as before the call
but with values inside their valid ranges.

}

@LibEntry{os.tmpname ()|

Returns a string with a file name that can
be used for a temporary file.
The file must be explicitly opened before its use
and explicitly removed when no longer needed.

In @x{POSIX} systems,
this function also creates
a file with that name,
to avoid security risks.
(Someone else might create the file with wrong permissions
in the time between getting the name and creating the file.)
You still have to open the file to use it
and to remove it (even if you do not use it).

When possible,
you may prefer to use @Lid{io.tmpfile},
which automatically removes the file when the program ends.

}

}

@sect2{debuglib| @title{The Debug Library}

This library provides
the functionality of the @link{debugI|debug interface} to Lua programs.
You should exert care when using this library.
Several of its functions
violate basic assumptions about Lua code
(e.g., that variables local to a function
cannot be accessed from outside;
that userdata metatables cannot be changed by Lua code;
that Lua programs do not crash)
and therefore can compromise otherwise secure code.
Moreover, some functions in this library may be slow.

All functions in this library are provided
inside the @defid{debug} table.
All functions that operate
over a thread
have an optional first argument which is the
thread to operate over.
The default is always the current thread.

@LibEntry{debug.debug ()|

Enters an interactive mode with the user,
running each string that the user enters.
Using simple commands and other debug facilities,
the user can inspect global and local variables,
change their values, evaluate expressions, and so on.
A line containing only the word @id{cont} finishes this function,
so that the caller continues its execution.

Note that commands for @id{debug.debug} are not lexically nested
within any function and so have no direct access to local variables.

}

@LibEntry{debug.gethook ([thread])|

Returns the current hook settings of the thread, as three values:
the current hook function, the current hook mask,
and the current hook count,
as set by the @Lid{debug.sethook} function.

Returns @fail if there is no active hook.

}

@LibEntry{debug.getinfo ([thread,] f [, what])|

Returns a table with information
about a function.
You can give the function directly
or you can give a number as the value of @id{f},
which means the function running at level @id{f} of the call stack
of the given thread:
@N{level 0} is the current function (@id{getinfo} itself);
@N{level 1} is the function that called @id{getinfo}
(except for tail calls, which do not count in the stack);
and so on.
If @id{f} is a number greater than the number of active functions,
then @id{getinfo} returns @fail.

The returned table can contain all the fields returned by @Lid{lua_getinfo},
with the string @id{what} describing which fields to fill in.
The default for @id{what} is to get all information available,
except the table of valid lines.
If present,
the option @Char{f}
adds a field named @id{func} with the function itself.
If present,
the option @Char{L}
adds a field named @id{activelines} with the table of
valid lines.

For instance, the expression @T{debug.getinfo(1,"n").name} returns
a name for the current function,
if a
reasonable name can be found,
and the expression @T{debug.getinfo(print)}
returns a table with all available information
about the @Lid{print} function.

}

@LibEntry{debug.getlocal ([thread,] f, local)|

This function returns the name and the value of the local variable
with index @id{local} of the function at level @id{f} of the stack.
This function accesses not only explicit local variables,
but also parameters and temporary values.

The first parameter or local variable has @N{index 1}, and so on,
following the order that they are declared in the code,
counting only the variables that are active
in the current scope of the function.
Compile-time constants may not appear in this listing,

if they were optimized away by the compiler.
Negative indices refer to vararg arguments;
@num{-1} is the first vararg argument.
The function returns @fail
if there is no variable with the given index,
and raises an error when called with a level out of range.
(You can call @Lid{debug.getinfo} to check
whether the level is valid.)

Variable names starting with @Char{(} (open parenthesis) @C{)}
represent variables with no known names
(internal variables such as loop control variables,
and variables from chunks saved without debug information).

The parameter @id{f} may also be a function.
In that case, @id{getlocal} returns only the name of function parameters.

}

@LibEntry{debug.getmetatable (value)|

Returns the metatable of the given @id{value}
or @nil if it does not have a metatable.

}

@LibEntry{debug.getregistry ()|

Returns the registry table @see{registry}.

}

@LibEntry{debug.getupvalue (f, up)|

This function returns the name and the value of the upvalue
with index @id{up} of the function @id{f}.
The function returns @fail
if there is no upvalue with the given index.

(For Lua functions,
upvalues are the external local variables that the function uses,
and that are consequently included in its closure.)

For @N{C functions}, this function uses the empty string @T{""}
as
a name for all upvalues.

Variable name @Char{?} (interrogation mark)

represents variables with no known names
(variables from chunks saved without debug information).

}

@LibEntry{debug.getuservalue (u, n)|

Returns the @id{n}-th user value associated
to the userdata @id{u} plus a boolean,
@false if the userdata does not have that value.

}

@LibEntry{debug.sethook ([thread,] hook, mask [, count])|

Sets the given function as the debug hook.
The string @id{mask} and the number @id{count} describe
when the hook will be called.
The string mask may have any combination of the following characters,
with the given meaning:
@description{
@item{@Char{c}| the hook is called every time Lua calls a function;}
@item{@Char{r}| the hook is called every time Lua returns from a function;}
@item{@Char{l}| the hook is called every time Lua enters a new line of code.}
}
Moreover,
with a @id{count} different from zero,
the hook is called also after every @id{count} instructions.

When called without arguments,
@Lid{debug.sethook}
turns off the hook.

When the hook is called, its first parameter is a string
describing the event that has triggered its call:
@T{"call"}, @T{"tail call"}, @T{"return"},
@T{"line"}, and @T{"count"}.
For line events,
the hook also gets the new line number as its second parameter.
Inside a hook,
you can call @id{getinfo} with @N{level 2} to get more information about
the running function.
(@N{Level 0} is the @id{getinfo} function,
and @N{level 1} is the hook function.)

}

@LibEntry{debug.setlocal ([thread,] level, local, value)|

This function assigns the value @id{value} to the local variable
with index @id{local} of the function at level @id{level} of the stack.
The function returns @fail if there is no local
variable with the given index,
and raises an error when called with a @id{level} out of range.
(You can call @id{getinfo} to check whether the level is valid.)
Otherwise, it returns the name of the local variable.

See @Lid{debug.getlocal} for more
information about
variable indices and names.

}

@LibEntry{debug.setmetatable (value, table)|

Sets the metatable for the given @id{value} to the given @id{table}
(which can be @nil).
Returns @id{value}.

}

@LibEntry{debug.setupvalue (f, up, value)|

This function assigns the value @id{value} to the upvalue
with index @id{up} of the function @id{f}.
The function returns @fail if there is no upvalue
with the given index.
Otherwise, it returns the name of the upvalue.

See @Lid{debug.getupvalue} for more information about upvalues.

}

@LibEntry{debug.setuservalue (udata, value, n)|

Sets the given @id{value} as
the @id{n}-th user value associated to the given @id{udata}.
@id{udata} must be a full userdata.

Returns @id{udata},
or @fail if the userdata does not have that value.

}

@LibEntry{debug.traceback ([thread,] [message [, level]])|

If @id{message} is present but is neither a string nor @nil,
this function returns @id{message} without further processing.
Otherwise,
it returns a
 string with a traceback of the call stack.
The optional @id{message} string is appended
at the beginning of the traceback.
An optional @id{level} number tells at which level
to start the traceback
(default is 1, the function calling @id{traceback}).

}

@LibEntry{debug.upvalueid (f, n)|

Returns a unique identifier (as a light userdata)
for the upvalue numbered @id{n}
from the given function.

These unique identifiers allow a program to check whether different
closures share upvalues.
Lua closures that share an upvalue
(that is, that access a same external local variable)
will return identical ids for those upvalue indices.

}

@LibEntry{debug.upvaluejoin (f1, n1, f2, n2)|

Make the @id{n1}-th upvalue of the Lua closure @id{f1}
refer to the @id{n2}-th upvalue of the Lua closure @id{f2}.

}

}

}

@C{---}
@sect1{lua-sa| @title{Lua Standalone}

Although Lua has been designed as an extension language,
to be embedded in
 a host @N{C program},
it is also frequently used as a standalone language.
An interpreter for Lua as a standalone language,
called simply @id{lua},

is provided with the standard distribution.
The @x{standalone interpreter} includes
all standard libraries.
Its usage is:
@verbatim{
lua [options] [script [args]]
}
The options are:
@description{
@item{@T{-e @rep{stat}}| execute string @rep{stat};}
@item{@T{-i}| enter interactive mode after running @rep{script};}
@item{@T{-l @rep{mod}}| @Q{require} @rep{mod} and assign the
result to global @rep{mod};}
@item{@T{-l @rep{g=mod}}| @Q{require} @rep{mod} and assign the
result to global @rep{g};}
@item{@T{-v}| print version information;}
@item{@T{-E}| ignore environment variables;}
@item{@T{-W}| turn warnings on;}
@item{@T{--}| stop handling options;}
@item{@T{-}| execute @id{stdin} as a file and stop handling options.}
}
(The form @T{-l @rep{g=mod}} was introduced in @N{release 5.4.4}.)

After handling its options, @id{lua} runs the given @emph{script}.
When
called without arguments,
@id{lua} behaves as @T{lua -v -i}
when the standard input (@id{stdin}) is a terminal,
and as @T{lua -} otherwise.

When called without the option @T{-E},
the interpreter checks for an environment variable @defid{LUA_INIT_5_4}
(or @defid{LUA_INIT} if the versioned name is not defined)
before running any argument.
If the variable content has the format @T{@At@rep{filename}},
then @id{lua} executes the file.
Otherwise, @id{lua} executes the string itself.

When called with the option @T{-E},
Lua does not consult any environment variables.
In particular,
the values of @Lid{package.path} and @Lid{package.cpath}
are set with the default paths defined in @id{luaconf.h}.

The options @T{-e}, @T{-l}, and @T{-W} are handled in
the order they appear.
For instance, an invocation like
@verbatim{

$ lua -e 'a=1' -llib1 script.lua
}
will first set @id{a} to 1, then require the library @id{lib1},
and finally run the file @id{script.lua} with no arguments.
(Here
 @T{$} is the shell prompt. Your prompt may be different.)

Before running any code,
@id{lua} collects all command-line arguments
in a global table called @id{arg}.
The script name goes to index 0,
the first argument after the script name goes to index 1,
and so on.
Any arguments before the script name
(that is, the interpreter name plus its options)
go to negative indices.
For instance, in the call
@verbatim{
$ lua -la b.lua t1 t2
}
the table is like this:
@verbatim{
arg = { [-2] = "lua", [-1] = "-la",
      [0] = "b.lua",
      [1] = "t1", [2] = "t2" }
}
If there is no script in the call,
the interpreter name goes to index 0,
followed by the other arguments.
For instance, the call
@verbatim{
$ lua -e "print(arg[1])"
}
will print @St{-e}.
If there is a script,
the script is called with arguments
@T{arg[1]}, @Cdots, @T{arg[#arg]}.
Like all chunks in Lua,
the script is compiled as a variadic function.

In interactive mode,
Lua repeatedly prompts and waits for a line.
After reading
 a line,
Lua first try to interpret the line as an expression.
If it succeeds, it prints its value.
Otherwise, it interprets the line as a statement.
If you write an incomplete statement,

the interpreter waits for its completion
by issuing a different prompt.

If the global variable @defid{_PROMPT} contains a string,
then its value is used as the prompt.
Similarly, if the global variable @defid{_PROMPT2} contains a string,
its value is used as the secondary prompt
(issued during incomplete statements).

In case of unprotected errors in the script,
the interpreter reports the error to the standard error stream.
If the error object is not a string but
has a metamethod @idx{__tostring},
the interpreter calls this metamethod to produce the final message.
Otherwise, the interpreter converts the error object to a string
and adds a stack traceback to it.
When warnings are on,
they are simply printed in the standard error output.

When finishing normally,
the interpreter closes its main Lua state
@seeF{lua_close}.
The
 script can avoid this step by
calling @Lid{os.exit} to terminate.

To allow the use of Lua as a
script interpreter in Unix systems,
Lua skips the first line of a file chunk if it starts with @T{#}.
Therefore, Lua scripts can be made into executable programs
by using @T{chmod +x} and @N{the @T{#!}} form,
as in
@verbatim{
#!/usr/local/bin/lua
}
Of course,
the location of the Lua interpreter may be different in your machine.
If @id{lua} is in your @id{PATH},
then
@verbatim{
#!/usr/bin/env lua
}
is a more portable solution.

}

@sect1{incompat| @title{Incompatibilities with the Previous Version}

@simplesect{

Here we list the incompatibilities that you may find when moving a program
from @N{Lua 5.3} to @N{Lua 5.4}.

You can avoid some incompatibilities by compiling Lua with
appropriate options (see file @id{luaconf.h}).
However,
all these compatibility options will be removed in the future.
More often than not,
compatibility issues arise when these compatibility
options
are removed.
So, whenever you have the chance,
you should try to test your code with a version of Lua compiled
with all compatibility options turned off.
That will ease transitions to newer versions of Lua.

Lua versions can always change the C API in ways that
do not imply source-code changes in a program,
such as the numeric values for constants
or the implementation of functions as macros.
Therefore,
you should never assume that binaries are compatible between
different Lua versions.
Always recompile clients of the Lua API when
using a new version.

Similarly, Lua versions can always change the internal representation
of precompiled chunks;
precompiled chunks are not compatible between different Lua versions.

The standard paths in the official distribution may
change between versions.

}

@sect2{@title{Incompatibilities in the Language}
@itemize{

@item{
The coercion of strings to numbers in
arithmetic and bitwise operations
has been removed from the core language.
The string
library does a similar job
for arithmetic (but not for bitwise) operations

using the string metamethods.
However, unlike in previous versions,
the new implementation preserves the implicit type of the numeral
in the string.
For instance, the result of @T{"1" + "2"} now is an integer,
not a float.
}

@item{
Literal decimal integer constants that overflow are read as floats,
instead of wrapping around.
You can use hexadecimal notation for such constants if you
want the old behavior
(reading them as integers with wrap around).
}

@item{
The use of the @idx{__lt} metamethod to emulate @idx{__le}
has been removed.
When needed, this metamethod must be explicitly defined.
}

@item{
The semantics of the numerical @Rw{for} loop
over integers changed in some details.
In particular, the control variable never wraps around.
}

@item{
A label for a @Rw{goto} cannot be declared where a label with the same
name is visible, even if this other label is declared in an enclosing
block.
}

@item{
When
 finalizing an object,
Lua does not ignore @idx{__gc} metamethods that are not functions.
Any value will be called, if present.
(Non-callable values will generate a warning,
like any other error when calling a finalizer.)
}

}

}

@sect2{@title{Incompatibilities in the Libraries}

@itemize{

@item{
The function @Lid{print} does not call @Lid{tostring}
to format its arguments;
instead, it has this functionality hardwired.
You should use @idx{__tostring} to modify how values are printed.
}

@item{
The pseudo-random number generator used by the function @Lid{math.random}
now starts with a somewhat random seed.
Moreover, it uses a different algorithm.
}

@item{
By default, the decoding functions in the @Lid{utf8} library
do not accept surrogates as valid code points.
An extra parameter in these functions makes them more permissive.
}

@item{
The options @St{setpause} and @St{setstepmul}
of the function @Lid{collectgarbage} are deprecated.
You should use the new option @St{incremental} to set
them.
}

@item{
The function @Lid{io.lines} now returns four values,
instead of just one.
That can be a problem when it is used as the sole
argument to another function that has optional parameters,
such as in @T{load(io.lines(filename, "L"))}.
To fix that issue,
you can wrap the call into parentheses,
to adjust its number of results to one.
}

}

}

@sect2{@title{Incompatibilities in the API}

@itemize{

@item{

Full userdata now has an arbitrary number of associated user values.
Therefore, the functions @id{lua_newuserdata},
@id{lua_setuservalue}, and @id{lua_getuservalue} were
replaced by @Lid{lua_newuserdatauv},
@Lid{lua_setiuservalue}, and @Lid{lua_getiuservalue},
which have an extra argument.

For compatibility, the old names still work as macros assuming
one single user value.
Note, however, that userdata with zero user values
are more efficient memory-wise.
}

@item{
The function @Lid{lua_resume} has an extra parameter.
This out parameter returns the number of values on
the top
 of the stack that were yielded or returned by the coroutine.
(In previous versions,
those values were the entire stack.)
}

@item{
The function @Lid{lua_version} returns the version number,
instead of an address of the version number.
The Lua core should work correctly with libraries using their
own static copies of the same core,
so there is no need to check whether they are using the same
address space.
}

@item{
The constant @id{LUA_ERRGCMM} was removed.
Errors in finalizers are never propagated;
instead, they generate a warning.
}

@item{
The options @idx{LUA_GCSETPAUSE} and @idx{LUA_GCSETSTEPMUL}
of the function @Lid{lua_gc} are deprecated.
You should use the new option @id{LUA_GCINC} to set them.
}

}

}

}

```
@C{[================================================================}

@sect1{BNF| @title{The Complete Syntax of Lua}

Here is the complete syntax of Lua in extended BNF.
As usual in extended BNF,
@bnfNter{{A}} means 0 or more @bnfNter{A}s,
and @bnfNter{[A]} means an optional
 @bnfNter{A}.
(For operator precedences, see @See{prec};
for a description of the terminals
@bnfNter{Name}, @bnfNter{Numeral},
and @bnfNter{LiteralString}, see @See{lexical}.)
@index{grammar}

@Produc{

@producname{chunk}@producbody{block}

@producname{block}@producbody{@bnfrep{stat} @bnfopt{retstat}}

@producname{stat}@producbody{
 @bnfter{;}
@OrNL varlist @bnfter{=} explist
@OrNL functioncall
@OrNL label
@OrNL   @Rw{break}
@OrNL   @Rw{goto} Name
@OrNL @Rw{do} block @Rw{end}
@OrNL @Rw{while} exp @Rw{do} block @Rw{end}
@OrNL @Rw{repeat} block @Rw{until} exp
@OrNL @Rw{if} exp @Rw{then} block
 @bnfrep{@Rw{elseif} exp @Rw{then} block}
 @bnfopt{@Rw{else} block} @Rw{end}
@OrNL @Rw{for} @bnfNter{Name} @bnfter{=} exp @bnfter{,} exp @bnfopt{@bnfter{,} exp}
 @Rw{do} block @Rw{end}
@OrNL   @Rw{for} namelist @Rw{in} explist @Rw{do} block @Rw{end}
@OrNL @Rw{function} funcname funcbody
@OrNL @Rw{local} @Rw{function} @bnfNter{Name} funcbody
@OrNL @Rw{local} attnamelist @bnfopt{@bnfter{=} explist}
}

@producname{attnamelist}@producbody{
  @bnfNter{Name} attrib @bnfrep{@bnfter{,} @bnfNter{Name} attrib}}

@producname{attrib}@producbody{@bnfopt{@bnfter{<} @bnfNter{Name} @bnfter{>}}}
```

```
@producname{retstat}@producbody{@Rw{return}
                    @bnfopt{explist} @bnfopt{@bnfter{;}}}

@producname{label}@producbody{@bnfter{::} Name @bnfter{::}}

@producname{funcname}@producbody{@bnfNter{Name} @bnfrep{@bnfter{.} @bnfNter{Name}}
                  @bnfopt{@bnfter{:} @bnfNter{Name}}}

@producname{varlist}@producbody{var @bnfrep{@bnfter{,} var}}

@producname{var}@producbody{
 @bnfNter{Name}
@Or prefixexp @bnfter{[} exp @bnfter{]}
@Or prefixexp @bnfter{.} @bnfNter{Name}
}

@producname{namelist}@producbody{@bnfNter{Name} @bnfrep{@bnfter{,} @bnfNter{Name}}}


@producname{explist}@producbody{exp @bnfrep{@bnfter{,} exp}}

@producname{exp}@producbody{
 @Rw{nil}
@Or @Rw{false}
@Or @Rw{true}
@Or @bnfNter{Numeral}
@Or @bnfNter{LiteralString}
@Or @bnfter{...}
@Or functiondef
@OrNL prefixexp
@Or tableconstructor
@Or exp
 binop exp
@Or unop exp
}

@producname{prefixexp}@producbody{var @Or functioncall @Or @bnfter{(} exp @bnfter{)}}

@producname{functioncall}@producbody{
 prefixexp args
@Or prefixexp @bnfter{:} @bnfNter{Name} args
}

@producname{args}@producbody{
 @bnfter{(} @bnfopt{explist} @bnfter{)}
@Or tableconstructor
@Or @bnfNter{LiteralString}
```

```
}

@producname{functiondef}@producbody{@Rw{function} funcbody}

@producname{funcbody}@producbody{@bnfter{(} @bnfopt{parlist} @bnfter{)} block @Rw{end}}

@producname{parlist}@producbody{namelist @bnfopt{@bnfter{,} @bnfter{...}}
 @Or @bnfter{...}}

@producname{tableconstructor}@producbody{@bnfter{@Open} @bnfopt{fieldlist} @bnfter{@Close}}

@producname{fieldlist}@producbody{field @bnfrep{fieldsep field} @bnfopt{fieldsep}}

@producname{field}@producbody{@bnfter{[} exp @bnfter{]} @bnfter{=} exp @Or @bnfNter{Name}
@bnfter{=} exp @Or exp}

@producname{fieldsep}@producbody{@bnfter{,} @Or @bnfter{;}}

@producname{binop}@producbody{
  @bnfter{+} @Or @bnfter{-} @Or @bnfter{*} @Or @bnfter{/} @Or @bnfter{//}
   @Or @bnfter{^} @Or @bnfter{%}
      @OrNL
 @bnfter{&} @Or @bnfter{~} @Or @bnfter{|} @Or @bnfter{>>} @Or @bnfter{<<}
   @Or @bnfter{..}
      @OrNL
 @bnfter{<} @Or @bnfter{<=} @Or @bnfter{>} @Or @bnfter{>=}
   @Or @bnfter{==} @Or @bnfter{~=}
      @OrNL
 @Rw{and} @Or @Rw{or}}

@producname{unop}@producbody{@bnfter{-} @Or @Rw{not} @Or @bnfter{#} @Or
 @bnfter{~}}

}

}

@C{]==================================================================}

}
@C{)]----------------------------------------------------------------------}
```

Found in path(s):
* /opt/cola/permits/1771012052_1692696990.443187/0/lua-lua-v5-4-6-0-g6443185-tar-gz/lua-lua-6443185/manual/manual.of
No license file was found, but licenses were detected in source scan.

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header = string.gsub(header, "All rights reserved",

Found in path(s):
* /opt/cola/permits/1771012052_1692696990.443187/0/lua-lua-v5-4-6-0-g6443185-tar-gz/lua-lua-6443185/manual/2html
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```
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*********************************************************************************
]]
```

Found in path(s):
* /opt/cola/permits/1771012052_1692696990.443187/0/lua-lua-v5-4-6-0-g6443185-tar-gz/lua-lua-6443185/testes/all.lua

1.293 libpkit 0.23.2

1.293.1 Available under license :

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1.294 rtmpdump a107cef9b392616dff54fabfd37f985ee2190a6f

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the
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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

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b) Use a suitable shared library mechanism for linking with the Library. A suitable mechanism is one that (1) uses at run time a copy of the library already present on the user's computer system, rather than copying library functions into the executable, and (2) will operate properly with a modified version of the library, if the user installs one, as long as the modified version is interface-compatible with the version that the work was made with.

c) 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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/* nicstar.c v0.22 Jawaid Bazyar (bazyar@hypermall.com)
* nicstar.c, M. Welsh (matt.welsh@cl.cam.ac.uk)
*
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* 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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1.300 spring-context 5.2.24.RELEASE

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*/
/**
* Indicates that a component is only eligible for registration when all
* {@linkplain #value specified conditions} match.
*
* <p>A <em>condition</em> 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:
* <ul>
* <li>as a type-level annotation on any class directly or indirectly annotated with
* {@code @Component}, including {@link Configuration @Configuration} classes</li>
* <li>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
*/
```

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* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/context/annotation/Conditional.java
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```

*/

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* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/ejb/config/LocalStatelessSessionBeanDefinitionParser.java
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* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/context/annotation/Condition.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
*/
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* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/format/datetime/joda/LocalDateParser.java
* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/format/datetime/joda/LocalDateTimeParser.java
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 /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/validation/beanvalidation/OptionalValidatorFactoryBean.java
* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/format/datetime/joda/MillisecondInstantPrinter.java
* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/format/datetime/joda/ReadablePartialPrinter.java
* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/context/i18n/LocaleContext.java
* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/format/datetime/joda/DateTimeParser.java
* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/format/datetime/joda/LocalTimeParser.java
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 /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/context/annotation/Description.java
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* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/context/annotation/FilterType.java
* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/context/i18n/TimeZoneAwareLocaleContext.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
*/

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* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-
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* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/remoting/support/RemoteInvocationFactory.java
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 /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/jmx/export/SpringModelMBean.java
* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/remoting/support/RemoteInvocationExecutor.java
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 /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/cache/support/CompositeCacheManager.java
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* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/context/annotation/AnnotatedBeanDefinitionReader.java
* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/context/annotation/ParserStrategyUtils.java
*
/opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/context/event/EventListener.java
* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/format/datetime/standard/InstantFormatter.java
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* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/scheduling/annotation/Scheduled.java
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jar/org/springframework/context/annotation/Import.java
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*
/opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/jndi/support/SimpleJndiBeanFactory.java
* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/context/annotation/ConfigurationClass.java
* /opt/cola/permits/1812856512_1696412316.2311742/0/spring-context-5-2-24-release-sources-1-jar/org/springframework/context/event/ApplicationListenerMethodAdapter.java

1.301 libpng 1.6.37

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pnm2png / png2pnm --- conversion from PBM/PGM/PPM-file to PNG-file

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1.302 net-snmp 5.9

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```
#!/usr/bin/env bash
# MIT licenses will each have a unique MD5 sum since they contain a unique copyright.
# This script will read the license file into memory, strip out the copyright, and then
# generate an MD5 that is not unique and can be matched against a known MIT MD5 sum.
set -e

calculate_md5_sum() {
 local FILE="$1"

 # Read the contents of the file into a variable
 local raw_license_text=$(<"$FILE")

 # Convert to lowercase
 local lowercase_license_text="${raw_license_text,,}"

 # Remove anything before the beginning of the license
 local stripped_license_text=$(awk '/permission is hereby granted,/{p=1} p' <<< "$lowercase_license_text")

 # Replace line breaks (Windows or Linux) with a single space
 local replaced_linebreaks=$(tr '\r\n' ' ' <<< "$stripped_license_text")

 # Replace multiple spaces with a single space
 local normalized_license_text=$(tr -s ' ' <<< "$replaced_linebreaks")

 # Strip away any non-printable, non-whitespace characters
 local clean_unprintable_license_text=$(tr
 -cd '[:print:][:space:]' <<< "$normalized_license_text")

 # Remove punctuation and special characters
 local clean_license_text=$(echo "$clean_unprintable_license_text" | sed 's/[^a-zA-Z ]//g')

 # Calculate the MD5 sum of the cleaned license text
 local MD5SUM=$(echo -n "$clean_license_text" | md5sum | awk '{print $1}')

 # Output the MD5 sum
 echo "$MD5SUM"
```

```
}

# Check if the FILE argument is provided
if [ -z "$1" ]; then
 echo "Please provide a FILE as an argument."
 exit 1
fi

# Invoke the function with the provided FILE argument
calculate_md5_sum "$1"
WEV @@ WEV[B  "1
x   ?"U@,5  @mISmIN<GimCN7g1u|E
43mI,5WEV @@ WEV   @mImImIAmImImI0mImImI*mImI
A0mImImI...
lost+found...

;9GimCN7g

!"#$%&'()*+,-
./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~

!"#$%&'()*+,-
./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~

!"#$%&'()*+,-
./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~

!"#$%&'()*+,-
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*/
package org.hibernate.graph.internal.parse;
}

/**
* Antlr grammar describing the Hibernate EntityGraph Language.
*/
class GeneratedGraphParser extends Parser;

options {
   // call the vocabulary (H)ibernate (E)ntity(G)raph (L)anguage
 exportVocab=HEGL;

   k = 2;

// buildAST = true;
 buildAST = false;
}


{
 // ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
 // semantic actions/callouts

 protected void startAttribute(Token attributeName) {
 }

 protected void startQualifiedAttribute(Token attributeName, Token qualifier) {
 }
```

```
 protected void finishAttribute() {
 }

 protected void startSubGraph(Token subType) {
 }

 protected void finishSubGraph()
 {
 }
}


graph
 : attributeNode (COMMA attributeNode)*
 ;

attributeNode
 : attributePath (subGraph)? { finishAttribute(); }
 ;

attributePath
 : path:NAME (DOT qualifier:NAME)? {
  if ( qualifier == null ) {
   startAttribute( path );
  }
  else {
   startQualifiedAttribute( path, qualifier );
  }
 }
 ;

subGraph
 : LPAREN (subtype:NAME COLON)? { startSubGraph( subtype ); } attributeNode (COMMA attributeNode )*
RPAREN {
  finishSubGraph();
 }
 ;



// **** LEXER ************************************************************************

/**
* Lexer for the Hibernate EntityGraph Language grammar
*/
class GraphLexer extends Lexer;

options {
```

```
  // call the vocabulary (H)ibernate (E)ntity(G)raph (L)anguage
 exportVocab=HEGL;

  k = 2;

  // Allow any char but \uffff (16 bit -1, ANTLR's EOF character)
  charVocabulary = '\u0000'..'\ufffe';

 caseSensitive = false;
 testLiterals = false;
}

COLON: ':';

COMMA: ',';

DOT: '.';

LPAREN: '(';

RPAREN: ')';

WHITESPACE
 :   (   ' '
  |
   '\t'
  |   '\r' '\n' { newline(); }
  |   '\n'      { newline(); }
  |   '\r'      { newline(); }
  )
  {$setType(Token.SKIP);} //ignore this token
 ;


/**
* In this grammar, basically any string since we (atm) have no keywords
*/
NAME
 : NAME_START ( NAME_CONTINUATION )*
 ;

protected
NAME_START
  :    '_'
  |    '$'
  |    'a'..'z'
  // HHH-558 : Allow unicode chars in identifiers
  //|    '\u0080'..'\ufffe'
```

```
  ;

protected
NAME_CONTINUATION
  :   NAME_START
  |   '0'..'9'
  ;
```

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*/
//  "proprietary" methods is better (this class is "proprietary" too).
```

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*/
/**
  * Subclass used to simply instantiation of singular attributes representing an entity's
  * version.
  */
```

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* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/metamodel/model/domain/internal/SingularAttributeImpl.java
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*/
/**
```

* JTA platform implementation intended for use with WebSphere Application Server (WAS).
* <p/>
* WAS, unlike every other app server on the planet, does not allow direct access to the JTS TransactionManager.
* Instead, for common transaction-related tasks users must utilize a proprietary API known as
ExtendedJTATransaction.
* <p/>
* Even more unfortunate, the exact TransactionManagerLookup to use inside of WAS is highly dependent upon
* WAS version
* the WAS container in which Hibernate will be utilized
*
* <p/>
* This class is reported to work on WAS version 6 in any of the standard J2EE/Java EE component containers.
*
* @author Gavin
 King
* @author Jesper Udby
* @author Steve Ebersole
*/

Found in path(s):
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-
jar/org/hibernate/engine/transaction/jta/platform/internal/WebSphereExtendedJtaPlatform.java
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*/

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jar/org/hibernate/sql/ForUpdateFragment.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-
jar/org/hibernate/loader/plan/build/spi/ExpandingQuerySpace.java
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jar/org/hibernate/tool/schema/internal/exec/ScriptTargetOutputToWriter.java
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jar/org/hibernate/ejb/HibernateEntityManager.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-
jar/org/hibernate/hql/spi/id/cte/CteValuesListBuilder.java
*
 /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-
jar/org/hibernate/query/criteria/internal/expression/ListIndexExpression.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-
jar/org/hibernate/cfg/PropertyInferredData.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-

jar/org/hibernate/result/Output.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/boot/package-info.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/persister/collection/QueryableCollection.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/engine/jdbc/connections/internal/BasicConnectionCreator.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/engine/transaction/spi/IsolationDelegate.java
*
/opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/param/ExplicitParameterSpecification.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/stat/internal/StatsNamedContainer.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/hql/spi/id/global/IdTableInfoImpl.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/resource/transaction/backend/jta/internal/synchronization/SynchronizationCallbackCoordinator.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/boot/jaxb/internal/stax/HbmEventReader.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/boot/model/source/spi/HibernateTypeSource.java
*
/opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/event/internal/EntityCopyAllowedLoggedObserver.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/engine/jdbc/internal/package-info.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/mapping/PrimitiveArray.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/engine/jdbc/env/spi/LobCreatorBuilder.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/loader/plan/spi/CompositeQuerySpace.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/hql/internal/classic/QueryTranslatorImpl.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/tuple/IdentifierProperty.java
*
/opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/dialect/Oracle12cDialect.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/type/descriptor/java/BooleanTypeDescriptor.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/annotations/Target.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/annotations/OptimisticLocking.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-

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* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/action/internal/EntityActionVetoException.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/loader/entity/CollectionElementLoader.java
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* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/mapping/ForeignKey.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/persister/walking/internal/EntityIdentifierDefinitionHelper.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/boot/model/naming/PhysicalNamingStrategyStandardImpl.java
*
/opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/query/spi/ScrollableResultsImplementor.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/resource/transaction/LocalSynchronizationException.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/tool/schema/extract/spi/PrimaryKeyInformation.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/boot/jaxb/internal/MappingBinder.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/bytecode/spi/BytecodeProvider.java

* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/query/internal/NativeQueryImpl.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/engine/spi/CompositeTracker.java
*
/opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/property/access/internal/PropertyAccessStrategyEmbeddedImpl.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/secure/internal/JaccSecurityListener.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/type/ByteType.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/tool/schema/spi/TargetDescriptor.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/UnknownEntityTypeException.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/engine/jdbc/dialect/spi/DialectFactory.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/event/spi/PreCollectionRemoveEventListener.java
*
/opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/boot/model/source/spi/DiscriminatorSource.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/tool/schema/internal/exec/JdbcConnectionAccessConnectionProviderImpl.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/annotations/NamedNativeQueries.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/collection/internal/PersistentSortedSet.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/annotations/FilterDef.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/boot/model/source/spi/PluralAttributeElementSourceManyToAny.java
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/opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/dialect/DB2390V8Dialect.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/boot/archive/internal/JarFileBasedArchiveDescriptor.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/boot/spi/BootstrapContext.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/hql/internal/ast/tree/SessionFactoryAwareNode.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/boot/model/source/spi/AnyKeySource.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/persister/walking/spi/AssociationVisitationStrategy.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/type/descriptor/sql/JdbcTypeJavaClassMappings.java
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/opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/tuple/CreationTimestampGeneration.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/hql/spi/id/inline/AbstractInlineIdsBulkIdHandler.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/hql/spi/id/inline/InlineIdsIdsInClauseDeleteHandlerImpl.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/persister/walking/spi/CompositionDefinition.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/engine/jdbc/batch/internal/package-info.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/type/descriptor/java/LocalDateJavaDescriptor.java
*
/opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/engine/internal/MutableEntityEntryFactory.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/annotations/DynamicInsert.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/query/criteria/internal/CriteriaDeleteImpl.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/internal/CoordinatingEntityNameResolver.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/tool/hbm2ddl/FileExporter.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/loader/plan/build/spi/ExpandingCompositeQuerySpace.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/engine/jdbc/WrappedNClob.java
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/opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/loader/custom/CollectionReturn.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/dialect/MySQLMyISAMDialect.java
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/id/IdentifierGeneratorHelper.java
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* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/jpa/orm_2_2.xsd
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/jpa/persistence_2_2.xsd

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```
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*/
/**
  * Used to pass along the CDI BeanManager, if any, to be used.
  *
  * According to JPA, strictly, the BeanManager should be passed in
  * at boot-time and be ready for use at that time.  However not all
  * environments can do this (WildFly e.g.).  To accommodate such
  * environments, Hibernate provides 2 options:
  *
  *     * a proprietary CDI extension SPI (that we have proposed to
  *      the CDI spec group as a standard option) that can be used
  *      to provide delayed BeanManager access.  To use this solution,
  *      the reference passed as the BeanManager during bootstrap
  *      should be typed as {@link ExtendedBeanManager}
  *     * delayed access to the BeanManager
 reference.  Here, Hibernate
  *      will not access the reference passed as the BeanManager during
  *      bootstrap until it is first needed.  Note however that this has
  *      the effect of delaying any deployment problems until after
  *      bootstrapping.
  *
  * This setting is used to configure Hibernate ORM's access to
  * the BeanManager (either directly or via {@link ExtendedBeanManager}).
  */
```

Found in path(s):
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/cfg/AvailableSettings.java
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```
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*/
/*
* Written by Doug Lea with assistance from members of JCP JSR-166
* Expert Group and released to the public domain, as explained at
* http://creativecommons.org/licenses/publicdomain
*
```

```
* Modified for https://jira.jboss.org/jira/browse/ISPN-299
* Includes ideas described in http://portal.acm.org/citation.cfm?id=1547428
*
*/
/**
* A hash table supporting full concurrency of retrievals and
* adjustable expected concurrency for updates. This class obeys the
* same functional specification as {@link java.util.Hashtable}, and
* includes versions of methods corresponding to each method of
* <tt>Hashtable</tt>. However, even though all operations are
* thread-safe, retrieval
 operations do <em>not</em> entail locking,
* and there is <em>not</em> any support for locking the entire table
* in a way that prevents all access.  This class is fully
* interoperable with <tt>Hashtable</tt> in programs that rely on its
* thread safety but not on its synchronization details.
* <p/>
* <p> Retrieval operations (including <tt>get</tt>) generally do not
* block, so may overlap with update operations (including
* <tt>put</tt> and <tt>remove</tt>). Retrievals reflect the results
* of the most recently <em>completed</em> update operations holding
* upon their onset.  For aggregate operations such as <tt>putAll</tt>
* and <tt>clear</tt>, concurrent retrievals may reflect insertion or
* removal of only some entries.  Similarly, Iterators and
* Enumerations return elements reflecting the state of the hash table
* at some point at or since the creation of the iterator/enumeration.
* They do <em>not</em> throw {@link java.util.ConcurrentModificationException}.
*
 However, iterators are designed to be used by only one thread at a time.
* <p/>
* <p> The allowed concurrency among update operations is guided by
* the optional <tt>concurrencyLevel</tt> constructor argument
* (default <tt>16</tt>), which is used as a hint for internal sizing.  The
* table is internally partitioned to try to permit the indicated
* number of concurrent updates without contention. Because placement
* in hash tables is essentially random, the actual concurrency will
* vary.  Ideally, you should choose a value to accommodate as many
* threads as will ever concurrently modify the table. Using a
* significantly higher value than you need can waste space and time,
* and a significantly lower value can lead to thread contention. But
* overestimates and underestimates within an order of magnitude do
* not usually have much noticeable impact. A value of one is
* appropriate when it is known that only one thread will modify and
* all others will only read. Also, resizing
 this or any other kind of
* hash table is a relatively slow operation, so, when possible, it is
* a good idea to provide estimates of expected table sizes in
* constructors.
```

```
* <p/>
* <p>This class and its views and iterators implement all of the
* <em>optional</em> methods of the {@link Map} and {@link Iterator}
* interfaces.
* <p/>
* <p>This class is copied from Infinispan, and was originally written
* by Doug Lea with assistance from members of JCP JSR-166 Expert Group and
* released to the public domain, as explained at
* http://creativecommons.org/licenses/publicdomain</p>
* <p/>
* <p/>
* <p> Like {@link java.util.Hashtable} but unlike {@link HashMap}, this class
* does <em>not</em> allow <tt>null</tt> to be used as a key or value.
*
* @param <K> the type of keys maintained by this map
* @param <V> the type of mapped values
*
* @author Doug Lea
*/
```

Found in path(s):
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/internal/util/collections/BoundedConcurrentHashMap.java
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* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/jpa/persistence_2_1.xsd
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/bytecode/package.html
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/package.html
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/jpa/orm_2_0.xsd
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/loader/package.html
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 /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/loader/entity/package.html
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/exception/package.html
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/tuple/package.html
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/hql/package.html
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/sql/package.html
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/hql/internal/classic/package.html
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/jpa/persistence_1_0.xsd
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/pretty/package.html
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* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/hql/internal/antlr/package.html
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/jdbc/package.html
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* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/transform/package.html
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/opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/loader/collection/package.html
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/usertype/package.html
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/dialect/function/package.html
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/action/package.html
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/jpa/persistence_2_0.xsd
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/hibernate-configuration-4.0.xsd
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* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/loader/custom/package.html
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/criterion/package.html
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/hibernate-mapping-4.0.xsd
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/persister/collection/package.html
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/collection/package.html
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/jpa/orm_2_1.xsd

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* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/xsd/mapping/legacy-mapping-4.0.xsd
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/persister/entity/package.html
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/xsd/cfg/legacy-configuration-4.0.xsd
* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/cache/spi/access/package.html
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* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/event/package.html
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* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/org/hibernate/hibernate-mapping-3.0.dtd
No license file was found, but licenses were detected in source scan.

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#
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#
org.hibernate.jpa.HibernatePersistenceProvider

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* /opt/cola/permits/1820832905_1697181084.1285665/0/hibernate-core-5-4-20-final-sources-jar/META-INF/services/javax.persistence.spi.PersistenceProvider

1.309 safeclib 4.1.42

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1.311 pcre 8.42

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Written by: Philip Hazel
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1.312 libevent 2.1.12

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1.313 py 1.8.0

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Python was created in the early 1990s by Guido van Rossum at Stichting
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principal author, although it includes many contributions from others.

In 1995, Guido continued his work on Python at the Corporation for
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In May 2000, Guido and the Python core development team moved to
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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
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1.318 docker v19.03.5

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Protocol Buffers for Go with Gadgets

Go support for Protocol Buffers - Google's data interchange format

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1.321 libvmtools 12.2.5.43614

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Open-vm-tools v10.3.0

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$OpenLDAP: pkg/ldap/libraries/liblutil/base64.c,v 1.15 2006/01/03 22:12:11 kurt Exp $ /
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rijndael-alg-fst.c

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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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D3DES (V5.09) -

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Written with Symantec's THINK (Lightspeed) C by Richard Outerbridge.
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,
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lib/hcrypto/test_dh.c

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1.328 webrtc m89

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//*
//* Enhancements by Stanley Yamane:
//*   o reverse lookup table for the decode function
//*   o reserve string buffer space in advance
//*
//***

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```

# g711
```
/*
* 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>
*
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*/

```

# g722
```
/*
* 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>
*
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*
* Based in part on a single channel G.722 codec which is:
*
```
```

* Copyright (c) CMU 1993
* Computer Science, Speech Group
* Chengxiang Lu and Alex Hauptmann
*/

```

# libc++
```
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```
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```

# sigslot
```
// sigslot.h: Signal/Slot classes
//
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//
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```

# spl_sqrt_floor
```
/*
* Written by Wilco Dijkstra, 1996. The following email exchange establishes the
* license.
*
* 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
*/

```
```

usrsctp
```
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```

zlib
```
version 1.2.11, January 15th, 2017

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1.330 zlib 1.2.5

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/* zlib.h -- interface of the 'zlib' general purpose compression library
version 1.2.5, April 19th, 2010

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The data format used by the zlib library is described by RFCs (Request for
Comments) 1950 to 1952 in the files http://www.ietf.org/rfc/rfc1950.txt
(zlib format), rfc1951.txt (deflate format) and rfc1952.txt (gzip format).
*/

1.331 zlib 1.3.1

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1.332 jaxb-core 2.3.3

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1.334 expat 2.6.2

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1.335 fastapi 0.68.2

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1.337 activation-api 1.2.2

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1.338 nghttp2 1.40.0-1ubuntu0.3

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1.340 servlet-api 4.0.0

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1.341 pkix ssh 13.5

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/**
* NCSA HTTPd Server
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* 605 E. Springfield, Champaign, IL 61820
* httpd@ncsa.uiuc.edu
*
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*
*****************************************************************************
 *
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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>');
    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(' Comments are disabled for this page at the moment.<\/div>');
}
})(window, document);
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1.346 activation 1.2.2

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1.347 typing-extensions 4.12.2

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Python was created in the early 1990s by Guido van Rossum at Stichting Mathematisch Centrum (CWI, see https://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 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, 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
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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
2.1.2	2.1.1	2002	PSF	yes
2.1.3	2.1.2	2002	PSF	yes
2.2 and above	2.1.1	2001-now		
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Thanks to the many outside volunteers who have worked under Guido's
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1.348 kerberos 1.17-6ubuntu4.7

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lib/gss_mechs/mech_krb5/et/kdb5_err.c
lib/gss_mechs/mech_spnego/mech/gssapiP_spnego.h
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lib/krb5/kdb/kdb_convert.c
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lib/libgss/g_rel_name.c
lib/libgss/g_rel_oid_set.c
lib/libgss/g_seal.c
lib/libgss/g_sign.c
lib/libgss/g_store_cred.c
lib/libgss/g_unseal.c
lib/libgss/g_userok.c
lib/libgss/g_utils.c
lib/libgss/g_verify.c
lib/libgss/gssd_pname_to_uid.c
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lib/gssapi/generic/gssapi_err_generic.et
lib/gssapi/mechglue/g_accept_sec_context.c
lib/gssapi/mechglue/g_acquire_cred.c
lib/gssapi/mechglue/g_canon_name.c
lib/gssapi/mechglue/g_compare_name.c
lib/gssapi/mechglue/g_context_time.c
lib/gssapi/mechglue/g_delete_sec_context.c
lib/gssapi/mechglue/g_dsp_name.c
lib/gssapi/mechglue/g_dsp_status.c
lib/gssapi/mechglue/g_dup_name.c
lib/gssapi/mechglue/g_exp_sec_context.c
lib/gssapi/mechglue/g_export_name.c
lib/gssapi/mechglue/g_glue.c
lib/gssapi/mechglue/g_imp_name.c
lib/gssapi/mechglue/g_imp_sec_context.c
lib/gssapi/mechglue/g_init_sec_context.c
lib/gssapi/mechglue/g_initialize.c
lib/gssapi/mechglue/g_inquire_context.c
lib/gssapi/mechglue/g_inquire_cred.c
lib/gssapi/mechglue/g_inquire_names.c
lib/gssapi/mechglue/g_process_context.c
lib/gssapi/mechglue/g_rel_buffer.c
lib/gssapi/mechglue/g_rel_cred.c
lib/gssapi/mechglue/g_rel_name.c
lib/gssapi/mechglue/g_rel_oid_set.c
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lib/gssapi/mechglue/g_utils.c
lib/gssapi/mechglue/g_verify.c
lib/gssapi/mechglue/gssd_pname_to_uid.c
lib/gssapi/mechglue/mglueP.h
lib/gssapi/mechglue/oid_ops.c
lib/gssapi/spnego/gssapiP_spnego.h
lib/gssapi/spnego/spnego_mech.c

and the initial implementation of incremental propagation,
including
the following new or changed files:

include/iprop_hdr.h
kadmin/server/ipropd_svc.c
lib/kdb/iprop.x
lib/kdb/kdb_convert.c
lib/kdb/kdb_log.c
lib/kdb/kdb_log.h
lib/krb5/error_tables/kdb5_err.et
kprop/kpropd_rpc.c
kprop/kproplog.c

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1.364 pytest 4.6.3

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backport frop python3 Lib/test/support.py

1.366 spring-data-jpa 2.3.3.RELEASE

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1.367 databases 0.7.0

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1.373 sse-starlette 1.6.1

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1.374 loguru 0.7.0

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1.375 spring-retry 1.2.5.RELEASE

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* /opt/cola/permits/2310012312_1736263660.092692/0/spring-retry-1-2-5-release-sources-4-jar/org/springframework/retry/stats/DefaultRetryStatistics.java
*
 /opt/cola/permits/2310012312_1736263660.092692/0/spring-retry-1-2-5-release-sources-4-jar/org/springframework/retry/stats/DefaultRetryStatisticsFactory.java
* /opt/cola/permits/2310012312_1736263660.092692/0/spring-retry-1-2-5-release-sources-4-jar/org/springframework/retry/stats/ExponentialAverageRetryStatistics.java
* /opt/cola/permits/2310012312_1736263660.092692/0/spring-retry-1-2-5-release-sources-4-jar/org/springframework/retry/stats/DefaultStatisticsRepository.java
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* /opt/cola/permits/2310012312_1736263660.092692/0/spring-retry-1-2-5-release-sources-4-jar/org/springframework/retry/stats/MutableRetryStatistics.java

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* /opt/cola/permits/2310012312_1736263660.092692/0/spring-retry-1-2-5-release-sources-4-jar/org/springframework/retry/backoff/ExponentialRandomBackOffPolicy.java

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>>> freebsd-base64-4.8
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==========

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base64.c -- routines to encode/decode base64 data
$OpenLDAP: pkg/ldap/libraries/liblutil/base64.c,v 1.15 2006/01/03 22:12:11 kurt Exp $ /
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>>> unicode-5.0

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1.388 restclient-cpp 0.5.2

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1.389 nlohmann-json 3.11.2

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1.391 shins 2.6.0

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1.392 linux-kernel 5.10.220

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/* 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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1.394 host-automake 1.14.1

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- 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
- web-fragment_3_0.xsd

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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

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- javaee_8.xsd
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The original XML Schemas for Java EE Deployment Descriptors:
- javaee_5.xsd
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- 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
- 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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org.apache.tomcat.util.json.JSONParser.jj is
 a public domain javacc grammar
for JSON written by Robert Fischer.
https://github.com/RobertFischer/json-parser

For portions of the Tomcat JNI OpenSSL API and the OpenSSL JSSE integration
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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
- 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
- web-fragment_4_0.xsd

may be obtained from:
http://www.oracle.com/webfolder/technetwork/jsc/xml/ns/javaee/index.html

1.403 servlet-api 4.0.0

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* /opt/cola/permits/2423134725_1744416246.4316745/0/servlet-api-4-0-0-sources-8-jar/org/xipki/http/servlet/ServletURI.java
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* /opt/cola/permits/2423134725_1744416246.4316745/0/servlet-api-4-0-0-sources-8-jar/org/xipki/http/servlet/HttpServlet.java
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* /opt/cola/permits/2423134725_1744416246.4316745/0/servlet-api-4-0-0-sources-8-jar/org/xipki/http/servlet/SslReverseProxyMode.java

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