Open Source Used In Cisco Meeting Server (formerly Acano Server) 3.4

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1.6 hd-parm 9.38

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"checkTag : validation tool for libzstd"

"command :
"$ ./checkTag tag"

"checkTag validates tags of following format : v[0-9].[0-9].[0-9]{any}

"The tag is then compared to zstd version number.

"They are compatible if first 3 digits are identical.

"Anything beyond that is free, and doesn’t impact validation.

"Example : tag v1.8.1.2 is compatible with version 1.8.1

"When tag and version are not compatible, program exits with error code 1.

"When they are compatible, it exists with a code 0.

"checkTag is intended to be used in automated testing environment.

*/

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Alan Cox <alan@lxorg.uku.org.uk>
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Chris Kleitsch
Hardware I2C

Gerd Knorr <kraxel@cs.tu-berlin.de>
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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.

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If distribution of object code is made by offering access to copy
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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.

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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.

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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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for CyberLogin for Linux which allows logging onto EON
(in case you are wondering where CyberLogin is, EON changed its login procedure and CyberLogin is no longer used.)

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for merging the nxt2002 and nxt2004 modules into a
single nxt200x frontend driver.

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src/gzip/infblock.c
src/gzip/infblock.h
src/gzip/infblock.h
src/gzip/infblock.h
src/gzip/infblock.h
src/gzip/inflate.c
src/gzip/inftrees.c
src/gzip/inftrees.h
src/gzip/inftrees.h
src/gzip/inftrees.h
src/gzip/inftrees.h
#
src/tools/apinames.c
src/tools/ftrandom/ftrandom.c
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1.27 hd-parm 9.38

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Mark Lord (mlord@pobox.com)

1.28 goprotobuf 2.4.1

1.28.1 Available under license :

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1.29 linux-kernel 4.4.245

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[This is the first released version of the library GPL. It is numbered 2 because it goes with version 2 of the ordinary GPL.]

Preamble

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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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/* 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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for their continuing work on the DVB driver

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for his contributions to the dvb-net driver

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for CyberLogin for Linux which allows logging onto EON
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for the nxt2004 frontend driver

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for merging the nxt2002 and nxt2004 modules into a
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1.31 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 "";
}

1.32 lombok 1.18.12

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1.33 python 3.7.3

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

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

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Mersenne Twister
--------------

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


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

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

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

The `socket` module uses the functions, `getaddrinfo`, and
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Asynchronous socket services
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Modified by Jack Jansen, CWI, July 1995:
- Use binascii module to do the actual line-by-line conversion
  between ascii and binary. This results in a 1000-fold speedup. The C
version is still 5 times faster, though.
- Arguments more compliant with Python standard

XML Remote Procedure Calls

The :mod:`xmlrpc.client` module contains the following notice::

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Select kqueue
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---------
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Original location:
https://github.com/majek/csiphash/

Solution inspired by code from:
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strtod and dtoa
--------------

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

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-------

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1.34 libevent 2.0.22

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# TEXT TYPES

text/x-speech
text/css
text/csv

# IMAGE TYPES

# X-Windows bitmap (b/w)
image/x-xbitmap
# X-Windows pixelmap (8-bit color)
image/x-xpixmap
# Portable Network Graphics
image/png
# Scalable Vector Graphics
image/svg+xml
# Image Exchange Format (RFC 1314)
image/ief
# RGB
image/rgb
# Group III Fax (RFC 1494)
image/g3fax
# X Windowdump format
image/x-xwindowdump
# Macintosh PICT format
image/x-pict
# PPM (UNIX PPM package)
image/x-portable-pixamppm
# PGM (UNIX PPM package)
image/x-portable-grayamppgm
# PBM (UNIX PPM package)
image/x-portable-bitamppbm
# PNM (UNIX PPM package)
image/x-portable-anymamppnm
# Microsoft Windows bitmap
image/x-ms-bmpbmp
# CMU raster
image/x-cmu-rasteras
# Kodak Photo-CD
image/x-photo-cdpd
# Computer Graphics Metafile
image/cgm
gm
# CALS Type 1 or 2
image/x-cals
mil cal
# Fractal Image Format (Iterated Systems)
image/fiffif
# QuickSilver active image (Micrografx)
image/x-mgx-dsfdsf
# CMX vector image (Corel)
image/x-cmxcmx
# Wavelet-compressed (Summus)
image/waveletwi
# AutoCad Drawing (SoftSource)
image/vnd.dwg
dwg
# AutoCad DXF file (SoftSource)
image/vnd.dxf
dxf
# Simple Vector Format (SoftSource)
image/vnd.svf

# AUDIO/VOICE/MUSIC RELATED TYPES

# ""basic""audio - 8-bit u-law PCM"
audio/basicau snd
# Macintosh audio format (AIpple)
audio/x-aiffaif aiff aifc
# Microsoft audio
audio/x-wavwav
# MPEG audio
audio/x-mpegmpa abs mpega
# MPEG-2 audio
audio/x-mpeg-2mp2a mpa2
# compressed speech (Echo Speech Corp.)
audio/echospeeches
# Toolvox speech audio (Voxware)
audio/voxwarevox
# RapidTransit compressed audio (Fast Man)
application/fastmanlcc
# Realaudio (Progressive Networks)
application/x-pn-realaudio ram
# MIDI music data
x-music/x-midimmid
# Koan music data (SSeyo)
application/vnd.koanskp
# Speech synthesis data (MVP Solutions)
text/x-speechtalk
# VIDEO TYPES

# MPEG video
video/mpeg mpg mpe
# MPEG-2 video
video/mpeg-2mpv2 mp2v
# Macintosh Quicktime
video/quicktimeqt mov
# Microsoft video
video/x-msvideoavi
# SGI Movie format
video/x-sgi-moviemovie
# VDOlive streaming video (VDOnet)
video/vdovdo
# Vivo streaming video (Vivo software)
video/vnd.vivotv

# SPECIAL HTTP/WEB APPLICATION TYPES

# Proxy autoconfiguration (Netscape browsers)
application/x-ns-proxy-autoconfigpac
# Netscape Cooltalk chat data (Netscape)
x-conference/x-cooltalkice

# TEXT-RELATED

# PostScript
application/postscriptai eps ps
# Microsoft Rich Text Format
application/rtf
# Adobe Acrobat PDF
application/pdf
# Maker Interchange Format (FrameMaker)
application/vnd.mifmif
# Troff document
application/x-troff tr roff
# Troff document with MAN macros
application/x-troff-manman
# Troff document with ME macros
application/x-troff-memem
# Troff document with MS macros
application/x-troff-msms
# LaTeX document
application/x-latexlatex
# Tex/LaTeX document
application/x-texxetxex
# GNU TexInfo document
application/x-texinfo\textexinfotexi
# TeX dvi format
application/x-dvidvi
# MS word document
application/msword\text{DOC}
# Office Document Architecture
application/oda\text{oda}
# Envoy Document
application/envoyevy

# ARCHIVE/COMPRESSED ARCHIVES

# Gnu tar format
application/x-gtargtar
# 4.3BSD tar format
application/x-tartar
# POSIX tar format
application/x-ustarustar
# Old CPIO format
application/x-bcpio\text{bcpio}
# POSIX CPIO format
application/x-cpio\text{cpio}
# UNIX sh shell archive
application/x-shar\text{shar}
# DOS/PC - Pkzipped archive
application/zip\text{zip}
# Macintosh Binhexed archive
application/mac-binhex40\text{hqx}
# Macintosh Stuffit Archive
application/x-stuffitsit\text{sea}
# Fractal Image Format
application/fractalsfif
# "Binary UUencoded"
application/octet-stream\text{uu}
# PC executable
application/octet-stream\text{exe}
# "WAIS "sources"
application/x-wais-sourceswsr\text{src}
# NCSA HDF data format
application/hdf\text{hdf}

# DOWNLOADABLE PROGRAM/SCRIPTS

# Javascript program
text/javascript\text{js}lsmocha
# UNIX bourne shell program
application/x-sh\text{sh}
# UNIX c-shell program
application/x-csh
# Perl program
application/x-perl
# Tcl (Tool Control Language) program
application/x-tcl

# ANIMATION/MULTIMEDIA

# FutureSplash vector animation (FutureWave)
application/futuresplash
# mBED multimedia data (mBED)
application/mbedlet
# PowerMedia multimedia (RadMedia)
application/x-rad-powermedia

# PRESENTATION

# PowerPoint presentation (Microsoft)
application/mspowerpoint
# ASAP WordPower (Software Publishing Corp.)
application/x-asap
# Astound Web Player multimedia data (GoldDisk)
application/astound

# SPECIAL EMBEDDED OBJECT

# OLE script e.g. Visual Basic (Ncompass)
application/x-olescript
# OLE Object (Microsoft/NCompass)
application/x-oleobject
# OpenScape OLE/OCX objects (Business@Web)
x-form/x-openscape
# Visual Basic objects (Amara)
application/x-webbasic
# Specialized data entry forms (Alpha Software)
application/x-alpha-form
# client-server objects (Wayfarer Communications)
x-script/x-wfxclient

# GENERAL APPLICATIONS

# Undefined binary data (often executable progs)
application/octet-stream
# Pointcast news data (Pointcast)
application/x-pcn
# Excel spreadsheet (Microsoft)
application/vnd.ms-excel
# PowerPoint (Microsoft)
application/vnd.ms-powerpoint
# Microsoft Project (Microsoft)
application/vnd.ms-projectmpp
# SourceView document (Dataware Electronics)
application/vnd.svd
# Net Install - software install (20/20 Software)
application/x-net-installins
# Carbon Copy - remote control/access (Microcom)
application/ccvc
# Spreadsheets (Visual Components)
workbook/formulaonevts

# 2D/3D DATA/VIRTUAL REALITY TYPES

# VRML data file
x-world/x-vrmlwrl vrml
# WIRL - VRML data (VREAM)
x-world/x-vreamvrw
# Play3D 3d scene data (Play3D)
application/x-p3dp3d
# Viscape Interactive 3d world data (Superscape)
x-world/x-svrsvr
# WebActive 3d data (Plastic Thought)
x-world/x-wvrwvr
# QuickDraw3D scene data (Apple)
x-world/x-3dmf3dmf

# SCIENTIFIC/MATH/CAD TYPES

# Mathematica notebook
application/mathematicama
# Computational meshes for numerical simulations
x-model/x-meshmsh
# Vis5D 5-dimensional data
application/vis5dv5d
# IGES models -- CAD/CAM (CGM) data
application/igesigs
# Autocad WHIP vector drawings
drawing/x-dwf/dwf

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* /opt/cola/permits/1136838417_1613931142.36/0/spring-context-support-5-2-8-release-sources-jar/org/springframework/mail/MailPreparationException.java

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* /opt/cola/permits/1136838417_1613931142.36/0/spring-context-support-5-2-8-release-sources-jar/org/springframework/cache/transaction/AbstractTransactionSupportingCacheManager.java
* /opt/cola/permits/1136838417_1613931142.36/0/spring-context-support-5-2-8-release-sources-jar/org/springframework/scheduling/commonj/DelegatingWork.java
* /opt/cola/permits/1136838417_1613931142.36/0/spring-context-support-5-2-8-release-sources-jar/org/springframework/scheduling/commonj/DelegatingTimerListener.java
* /opt/cola/permits/1136838417_1613931142.36/0/spring-context-support-5-2-8-release-sources-jar/org/springframework/scheduling/quartz/DelegatingJob.java
* /opt/cola/permits/1136838417_1613931142.36/0/spring-context-support-5-2-8-release-sources-
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*/
*/
jar/org/springframework/cache/ehcache/EhCacheFactoryBean.java
* /opt/cola/permits/1136838417_1613931142.36/0/spring-context-support-5-2-8-release-sources-jar/org/springframework/scheduling/quartz/SimpleTriggerFactoryBean.java
* /opt/cola/permits/1136838417_1613931142.36/0/spring-context-support-5-2-8-release-sources-jar/org/springframework/cache/jcache/interceptor/CachePutOperation.java
* /opt/cola/permits/1136838417_1613931142.36/0/spring-context-support-5-2-8-release-sources-jar/org/springframework/scheduling/quartz/LocalTaskExecutorThreadPool.java
* /opt/cola/permits/1136838417_1613931142.36/0/spring-context-support-5-2-8-release-sources-jar/org/springframework/cache/jcache/interceptor/JCacheOperationSourcePointcut.java
* /opt/cola/permits/1136838417_1613931142.36/0/spring-context-support-5-2-8-release-sources-jar/org/springframework/mail/javamail/JavaMailSenderImpl.java
* /opt/cola/permits/1136838417_1613931142.36/0/spring-context-support-5-2-8-release-sources-jar/org/springframework/cache/jcache/interceptor/JCacheOperationSourceAdvisor.java
* /opt/cola/permits/1136838417_1613931142.36/0/spring-context-support-5-2-8-release-sources-jar/org/springframework/cache/jcache/interceptor/DefaultCacheInvocationContext.java
* /opt/cola/permits/1136838417_1613931142.36/0/spring-context-support-5-2-8-release-sources-jar/org/springframework/mail/SimpleMailMessage.java
* /opt/cola/permits/1136838417_1613931142.36/0/spring-context-support-5-2-8-release-sources-jar/org/springframework/ui/freemarker/SpringTemplateLoader.java

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jar/org/springframework/cache/jcache/interceptor/KeyGeneratorAdapter.java
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jar/org/springframework/scheduling/quartz/MethodInvokingJobDetailFactoryBean.java
* /opt/cola/permits/1136838417_1613931142.36/0/spring-context-support-5-2-8-release-sources-
jar/org/springframework/cache/jcache/interceptor/CacheRemoveOperation.java
* /opt/cola/permits/1136838417_1613931142.36/0/spring-context-support-5-2-8-release-sources-
jar/org/springframework/cache/jcache/interceptor/CacheRemoveAllInterceptor.java
* /opt/cola/permits/1136838417_1613931142.36/0/spring-context-support-5-2-8-release-sources-
jar/org/springframework/cache/transaction/TransactionAwareCacheDecorator.java
* /opt/cola/permits/1136838417_1613931142.36/0/spring-context-support-5-2-8-release-sources-
jar/org/springframework/cache/jcache/interceptor/JCacheOperation.java
* /opt/cola/permits/1136838417_1613931142.36/0/spring-context-support-5-2-8-release-sources-
jar/org/springframework/scheduling/quartz/LocalDataSourceJobStore.java
* /opt/cola/permits/1136838417_1613931142.36/0/spring-context-support-5-2-8-release-sources-
jar/org/springframework/scheduling/quartz/ResourceLoaderClassLoadHelper.java

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  jar/org/springframework/cache/jcache/interceptor/CacheRemoveAllOperation.java
* /opt/cola/permits/1136838417_1613931142.36/0/spring-context-support-5-2-8-release-sources-
  jar/org/springframework/cache/ehcache/EhCacheManagerUtils.java
* /opt/cola/permits/1136838417_1613931142.36/0/spring-context-support-5-2-8-release-sources-
  jar/org/springframework/mail/javamail/JavaMailSender.java
* /opt/cola/permits/1136838417_1613931142.36/0/spring-context-support-5-2-8-release-sources-
  jar/org/springframework/mail/MailSender.java
* /opt/cola/permits/1136838417_1613931142.36/0/spring-context-support-5-2-8-release-sources-
  jar/org/springframework/mail/javamail/InternetAddressEditor.java
* /opt/cola/permits/1136838417_1613931142.36/0/spring-context-support-5-2-8-release-sources-
  jar/org/springframework/scheduling/quartz/QuartzJobBean.java
* /opt/cola/permits/1136838417_1613931142.36/0/spring-context-support-5-2-8-release-sources-
  jar/org/springframework/ui/freemarker/FreeMarkerTemplateUtils.java

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1.43 jakarta-validation-api 2.0.2

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 */

Found in path(s):
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/Validator.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/metadata/CascadableDescriptor.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/ConstraintTarget.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraints/FutureOrPresent.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraints/Null.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/ConstraintValidatorContext.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/metadata/ExecutableDescriptor.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/groups/Default.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/MessageInterpolator.java
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* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/metadata/package-info.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/valueextraction/Unwrapping.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/valueextraction/ValueExtractor.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraintvalidation/ValidationTarget.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/package-info.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/UnexpectedTypeException.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/metadata/BeanDescriptor.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraints/Digits.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/bootstrap/ProviderSpecificBootstrap.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/valueextraction/UnwrapByDefault.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraints/NegativeOrZero.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/ConstraintViolation.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/ConstraintDefinitionException.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/metadata/ValidateUnwrappedValue.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraintvalidation/SupportedValidationTarget.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/groups/package-info.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/spi/ValidationProvider.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/ElementKind.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/metadata/GroupConversionDescriptor.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/valueextraction/ExtractedValue.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/bootstrap/GenericBootstrap.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/metadata/MethodDescriptor.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/valueextraction/ValueExtractorDeclarationException.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/metadata/ConstructorDescriptor.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraintvalidation/package-info.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraints/AssertTrue.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/Path.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/executable/package-info.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/valueextraction/package-info.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraints/PositiveOrZero.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/valueextraction/ValueExtractorDefinitionException.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/BootstrapConfiguration.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraints/Min.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraints/Max.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraints/ReportAsSingleViolation.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraints/NotBlank.java

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* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2.0-2-sources-3.jar/java/validation/overridesAttribute.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2.0-2-sources-3.jar/java/validation/spi/bootstrapState.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2.0-2-sources-3.jar/java/validation/constraints/email.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2.0-2-sources-3.jar/java/validation/constraintdeclarationexception.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2.0-2-sources-3.jar/java/validation/metadata/propertyDescriptor.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2.0-2-sources-3.jar/java/validation/constraintvalidator.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2.0-2-sources-3.jar/java/validation/executable/executabletype.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2.0-2-sources-3.jar/java/validation/constraints/assertFalse.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2.0-2-sources-3.jar/java/validation/constraints/future.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2.0-2-sources-3.jar/java/validation/constraints/decimalmax.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2.0-2-sources-3.jar/java/validation/constraints/positive.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2.0-2-sources-3.jar/java/validation/constraints/notempty.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2.0-2-sources-3.jar/java/validation/spi/configurationState.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2.0-2-sources-3.jar/java/validation/payload.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2.0-2-sources-3.jar/java/validation/constraints/decimalmin.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2.0-2-sources-3.jar/java/validation/constraints/past.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2.0-2-sources-3.jar/maven/jakarta.validation/jakarta.validation-api/pom.xml
1.44 libbsd 0.10.0 1

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*

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include/bsd/sys/bitstring.h
include/bsd/sys/queue.h
include/bsd/sys/time.h
include/bsd/timeconv.h
include/bsd/vis.h
man/bitstring.3bsd
man/errc.3bsd
man/explicit_bzero.3bsd
man/fgetln.3bsd
man/fgetwln.3bsd
man/fpurge.3bsd
man/getbssiz.3bsd
man/heapsort.3bsd
man/nlist.3bsd
man/queue.3bsd
man/radixsort.3bsd
man/reallocarray.3bsd
man/reallocf.3bsd
man/setmode.3bsd
man/strmode.3bsd
man/strnstr.3bsd
man/strtof.3bsd
man/unvis.3bsd
man/vis.3bsd
man/wcslcpy.3bsd
src/getbssiz.c
src/heapsort.c
src/merge.c
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man/expand_number.3bsd  
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man/pidfile.3bsd  
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src/arc4random_uniform.c
src/arc4random_unix.h
src/arc4random_win.h
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src/getentropy_aix.c
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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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Theodore Ts'o
23-June-2007

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* /opt/cola/permits/1135888174_1613626055.99/0/spring-aop-5-2-8-release-sources-1-jar/org/springframework/aop/aspectj/annotation/SingletonMetadataAwareAspectInstanceFactory.java
* /opt/cola/permits/1135888174_1613626055.99/0/spring-aop-5-2-8-release-sources-1-jar/org/aopalliance/aop/Advice.java
* /opt/cola/permits/1135888174_1613626055.99/0/spring-aop-5-2-8-release-sources-1-jar/org/aopalliance/intercept/Joinpoint.java
* /opt/cola/permits/1135888174_1613626055.99/0/spring-aop-5-2-8-release-sources-1-jar/org/springframework/aop/framework/ProxyFactory.java
* /opt/cola/permits/1135888174_1613626055.99/0/spring-aop-5-2-8-release-sources-1-jar/org/springframework/aop/aspectj/AspectJAfterReturningAdvice.java
* /opt/cola/permits/1135888174_1613626055.99/0/spring-aop-5-2-8-release-sources-1-jar/org/springframework/aop/config/AspectJAutoProxyBeanDefinitionParser.java
* /opt/cola/permits/1135888174_1613626055.99/0/spring-aop-5-2-8-release-sources-1-jar/org/springframework/aop/aspectj/annotation/MetadataAwareAspectInstanceFactory.java
* /opt/cola/permits/1135888174_1613626055.99/0/spring-aop-5-2-8-release-sources-1-jar/org/aopalliance/intercept/ConstructorInterceptor.java
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* /opt/cola/permits/1135888174_1613626055.99/0/spring-aop-5-2-8-release-sources-1-
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* /opt/cola/permits/1135888174_1613626055.99/0/spring-aop-5-2-8-release-sources-1-jar/org/springframework/aop/framework/autoproxy/BeanNameAutoProxyCreator.java
* /opt/cola/permits/1135888174_1613626055.99/0/spring-aop-5-2-8-release-sources-1-jar/org/springframework/aop/framework/autoproxy/InfrastructureAdvisorAutoProxyCreator.java

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* /opt/cola/permits/1135888174_1613626055.99/0/spring-aop-5-2-8-release-sources-1-
jar/org/springframework/aop/config/SpringConfiguredBeanDefinitionParser.java
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* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources.jar/org/dom4j/tree/DefaultText.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources.jar/org/dom4j/tree/DefaultNamespace.java
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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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That's all there is to it!

1.54 go-runtime 1.15.1

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1.60 asm 5.0.4

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*/
/**
 * Creates a new JSRInliner. <i>Subclasses must not use this</i> constructor. Instead, they must use the
 * @link #JSRInlinerAdapter(int, MethodVisitor, int, String, String, String, String[]) version.
 *
 * @param mv the <code>MethodVisitor</code> to send the resulting inlined
 * method code to (use <code>null</code> for none).
 *
 * @param access the method's access flags (see <link> OpCodes </link>). This
 * parameter also indicates if the method is synthetic and/or
 * deprecated.
 *
 * @param name the method's name.
 *
 * @param desc the method's descriptor (see <link> Type </link>).
 *
 * @param signature the method's signature. May be <tt>null</tt>
 *
 * @param exceptions the internal names of the method's exception classes (see
 * <link> Type#getName() </link>). May be <tt>null</tt>
 *
 * @throws IllegalStateException If a subclass calls this constructor.
 */

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*/
/** *
* Creates a new [@link GeneratorAdapter]. <i>Subclasses must not use this *
* constructor</i>. Instead, they must use the *
* [@link #GeneratorAdapter(int, MethodVisitor, int, String, String)] *
* version.
* *
* @param mv *
* the method visitor to which this adapter delegates calls.
* @param access *
* the method's access flags (see [@link Opcodes]).
* @param name *
* the method's name.
* @param desc *
* the method's descriptor (see [@link Type Type]).
* @throws IllegalStateException *
* If a subclass calls this constructor.
*/

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/**
 * Constructs a new [@link Textifier]. <i>Subclasses must not use this
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 *
 * @throws IllegalStateException
 *             If a subclass calls this constructor.
 */

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/**
 * Constructs a new [@link ClassNode]. <i>Subclasses must not use this
 * constructor</i>. Instead, they must use the [@link #ClassNode(int)]
 * version.
 * @throws IllegalStateException
 *             If a subclass calls this constructor.
 */

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*/
/**
 * Constructs a new {@link LocalVariableAnnotationNode}. <i>Subclasses must
 * not use this constructor</i>. Instead, they must use the
 * {@link #LocalVariableAnnotationNode(int, TypePath, LabelNode[], LabelNode[], int[], String)}
 * version.
 *
 * @param typeRef
 * a reference to the annotated type. See {@link TypeReference}.
 * @param typePath
 * the path to the annotated type argument, wildcard bound, array
 * element type, or static inner type within 'typeRef'. May be
 * <tt>null</tt> if the annotation targets 'typeRef' as a whole.
 * @param start
 * the first instructions corresponding to the continuous ranges
 * that make the scope of this local variable (inclusive).
 * @param end
 * the last instructions corresponding to the continuous ranges
 * that make the scope of this local variable (exclusive). This
 * array must have the same size as the 'start' array.
 * @param index
 * the local variable's index in each range. This array must have
 * the same size as the 'start' array.
 * @param desc
 * the class descriptor of the annotation class.
 */

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* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6.jar/org/objectweb/asm/tree/analysis/Interpreter.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6.jar/org/objectweb/asm/tree/分析/BasicVerifier.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6.jar/org/objectweb/asm/tree/FieldInsnNode.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6.jar/org/objectweb/asm/tree/VarInsnNode.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6.jar/org/objectweb/asm/tree/InsnNode.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6.jar/org/objectweb/asm/signature/SignatureReader.java
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/*
/**
 * Creates a new {@link AnalyzerAdapter}. <i>Subclasses must not use this
 * constructor</i>. Instead, they must use the
 * { @link #AnalyzerAdapter(int, String, int, String, String, MethodVisitor)}
 * version.
 *
 * @param owner
 * the owner's class name.
 * @param access
 * the method's access flags (see { @link Opcodes}).
 * @param name
 * the method's name.
 * @param desc
 * the method's descriptor (see { @link Type Type}).
 * @param mv
 * the method visitor to which this adapter delegates calls. May
 * be <tt>null</tt>.
 * @throws IllegalStateException
 * If a subclass calls this constructor.
 */

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* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/optimizer/shrink-resize.properties
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1.61 boost 1.71.0-6ubuntu6

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* /opt/ws_local/PERMITS_SQL/1075084041_1596044813.39/0/netty-transport-native-epoll-4-1-51-final-sources-jar/io/netty/channel/epoll/EpollDomainSocketChannelConfig.java
* /opt/ws_local/PERMITS_SQL/1075084041_1596044813.39/0/netty-transport-native-epoll-4-1-51-final-sources-jar/io/netty/channel/epoll/EpollChannelConfig.java
* /opt/ws_local/PERMITS_SQL/1075084041_1596044813.39/0/netty-transport-native-epoll-4-1-51-final-sources-jar/io/netty/channel/epoll/EpollEventArray.java
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* /opt/ws_local/PERMITS_SQL/1075084041_1596044813.39/0/netty-transport-native-epoll-4-1-51-final-sources-jar/io/netty/channel/epoll/AbstractEpollServerChannel.java
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* /opt/ws_local/PERMITS_SQL/1075084041_1596044813.39/0/netty-transport-native-epoll-4-1-51-final-sources-jar/io/netty/channel/epoll/EpollDomainSocketChannel.java

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 */
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* Allowing them being read would mean anyone with access to the channel could get them.
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 * Keys can only be set on, not read to prevent a potential leak, as they are confidential.
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* /opt/ws_local/PERMITS_SQL/1075084041_1596044813.39/0/netty-transport-native-epoll-4-1-51-final-sources-jar/io/netty/channel/epoll/EpollEventLoop.java
* /opt/ws_local/PERMITS_SQL/1075084041_1596044813.39/0/netty-transport-native-epoll-4-1-51-final-sources-jar/io/netty/channel/epoll/EpollChannelOption.java
* /opt/ws_local/PERMITS_SQL/1075084041_1596044813.39/0/netty-transport-native-epoll-4-1-51-final-sources-jar/io/netty/channel/epoll/AbstractEpollChannel.java
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* /opt/ws_local/PERMITS_SQL/1075084041_1596044813.39/0/netty-transport-native-epoll-4-1-51-final-sources-jar/io/netty/channel/epoll/EpollDatagramChannelConfig.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_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

1.63 util-linux 2.20

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* /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-
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* /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-
  jar/org/springframework/retry/backoff/ThreadWaitSleeper.java
* /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-
  jar/org/springframework/retry/annotation/Retryable.java
* /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-
  jar/org/springframework/retry/interceptor/Retryable.java
* /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-
  jar/org/springframework/classify/util/SimpleMethodInvoker.java
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* /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-
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* /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-
  jar/org/springframework/retry/policy/ExhaustedRetryException.java
* /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-
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* /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-
  jar/org/springframework/classify/PatternMatchingClassifier.java
* /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-
  jar/org/springframework/classify/annotation/Classifier.java
* /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-
  jar/org/springframework/classify/BackToBackPatternClassifier.java
* /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-
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* /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-
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* /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-
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* /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/context/RetryContextSupport.java
* /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/support/RetryTemplate.java
* /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/backoff/FixedBackOffPolicy.java
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* /opt/cola/permits/1135888116_1613626154.75/0/spring-context-5-2-8-release-sources-1-jar/org/springframework/scheduling/annotation/Schedules.java
* /opt/cola/permits/1135888116_1613626154.75/0/spring-context-5-2-8-release-sources-1-jar/org/springframework/context/config/PropertyOverrideBeanDefinitionParser.java
* /opt/cola/permits/1135888116_1613626154.75/0/spring-context-5-2-8-release-sources-1-jar/org/springframework/scripting/bsh/BshScriptFactory.java
* /opt/cola/permits/1135888116_1613626154.75/0/spring-context-5-2-8-release-sources-1-jar/org/springframework/scheduling/annotation/SchedulingConfiguration.java
* /opt/cola/permits/1135888116_1613626154.75/0/spring-context-5-2-8-release-sources-1-jar/org/springframework/cache/annotation/CacheEvict.java
* /opt/cola/permits/1135888116_1613626154.75/0/spring-context-5-2-8-release-sources-1-jar/org/springframework/jmx/export/annotation/ManagedNotifications.java
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* /opt/cola/permits/1135888116_1613626154.75/0/spring-context-5-2-8-release-sources-1-jar/org/springframework/cache/annotation/Caching.java
* /opt/cola/permits/1135888116_1613626154.75/0/spring-context-5-2-8-release-sources-1-jar/org/springframework/format/Parser.java
* /opt/cola/permits/1135888116_1613626154.75/0/spring-context-5-2-8-release-sources-1-jar/org/springframework/jmx/export/assembler/MetadataMBeanInfoAssembler.java

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* /opt/cola/permits/1135888116_1613626154.75/0/spring-context-5-2-8-release-sources-1- jar/org/springframework/context/annotation/Profile.java
* /opt/cola/permits/1135888116_1613626154.75/0/spring-context-5-2-8-release-sources-1- jar/org/springframework/context/event/EventExpressionRootObject.java
* /opt/cola/permits/1135888116_1613626154.75/0/spring-context-5-2-8-release-sources-1- jar/org/springframework/cache/config/CacheManagementConfigUtils.java
* /opt/cola/permits/1135888116_1613626154.75/0/spring-context-5-2-8-release-sources-1- jar/org/springframework/instrument/classloading/ResourceOverridingShadowingClassLoader.java
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/**
 * FactoryBean that obtains a WebSphere (javax.management.MBeanServer)
 * reference through WebSphere's proprietary AdminServiceFactory API,
 * available on WebSphere 5.1 and higher.
 *
 * Exposes the MBeanServer for bean references.
 *
 * This FactoryBean is a direct alternative to MBeanServerFactoryBean,
 * which uses standard JMX 1.2 API to access the platform's MBeanServer.
 */
* <p>See the javadocs for WebSphere's
* and
* @author Juergen Hoeller
* @author Rob Harrop
* @since 2.0.3
* @see javax.management.MBeanServer
* @see MBeanServerFactoryBean
*/

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* /opt/cola/permits/1135888116_1613626154.75/0/spring-context-5-2-8-release-sources-1.jar/org/springframework/validation/beanvalidation/SpringConstraintValidatorFactory.java
* /opt/cola/permits/1135888116_1613626154.75/0/spring-context-5-2-8-release-sources-1.jar/org/springframework/context/PayloadApplicationEvent.java
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* /opt/cola/permits/1135888116_1613626154.75/0/spring-context-5-2-8-release-sources-1-
  jar/org/springframework/scheduling/concurrent/ThreadPoolTaskExecutor.java
* /opt/cola/permits/1135888116_1613626154.75/0/spring-context-5-2-8-release-sources-1-
  jar/org/springframework/cache/concurrent/ConcurrentMapCacheManager.java
* /opt/cola/permits/1135888116_1613626154.75/0/spring-context-5-2-8-release-sources-1-
  jar/org/springframework/context/expression/StandardBeanExpressionResolver.java
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* /opt/cola/permits/1135888116_1613626154.75/0/spring-context-5-2-8-release-sources-1.jar/org/springframework/jmx/access/InvalidInvocationException.java
* /opt/cola/permits/1135888116_1613626154.75/0/spring-context-5-2-8-release-sources-1.jar/org/springframework/jmx/export/MBeanExporterListener.java
* /opt/cola/permits/1135888116_1613626154.75/0/spring-context-5-2-8-release-sources-1.jar/org/springframework/instrument/classloading/LoadTimeWeaver.java
* /opt/cola/permits/1135888116_1613626154.75/0/spring-context-5-2-8-release-sources-1.jar/org/springframework/context/config/ContextNamespaceHandler.java
* /opt/cola/permits/1135888116_1613626154.75/0/spring-context-5-2-8-release-sources-1.jar/org/springframework/context/config/SpringConfiguredBeanDefinitionParser.java
* /opt/cola/permits/1135888116_1613626154.75/0/spring-context-5-2-8-release-sources-1.jar/org/springframework/scheduling/TriggerContext.java
* /opt/cola/permits/1135888116_1613626154.75/0/spring-context-5-2-8-release-sources-1.jar/org/springframework/context/HierarchicalMessageSource.java
* /opt/cola/permits/1135888116_1613626154.75/0/spring-context-5-2-8-release-sources-1.jar/org/springframework/context/config/ContextNamespaceHandler.java
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Indicates that a component is only eligible for registration when all conditions match. A condition is any state that can be determined programmatically before the bean definition is due to be registered (see Condition for details).

The [Conditional] annotation may be used in any of the following ways:

- as a type-level annotation on any class directly or indirectly annotated with Configuration, including Configuration classes
- as a meta-annotation, for the purpose of composing custom stereotype annotations
- as a method-level annotation on any Bean method

If a Configuration class is marked with Conditional, all of the Bean methods, Import annotations, and ComponentScan annotations associated with that class will be subject to the conditions.

NOTE: Inheritance of Conditional annotations is not supported; any conditions from superclasses or from overridden methods will not be considered. In order to enforce these semantics, Conditional itself is not declared as Inherited; furthermore, any custom composed annotation that is meta-annotated with Conditional must not be declared as Inherited.

author Phillip Webb
author Sam Brannen
since 4.0
see Condition
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/**
 * Abstract the invocation of a cache operation.
 *
 * 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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John R. Hauser
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1.77 icu 66.1-2ubuntu2

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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 
SHAREDLIBFLAGS = -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,-Bs symbolic 

## 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 $@ $<
%.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,-Bsymb

# 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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Spring Boot CLI

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>>> JOpt Simple (net.sf.jopt-simple:jopt-simple)
>>> ASM 4.0 (org.ow2.asm:asm)

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 * @author Rossen Stoyanchev
 * @since 5.0
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Theodore Ts'o
23-June-2007

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That's all there is to it!
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 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 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): $(OBJ)
(cd pic; ld -Bshareable -o $(BSD_LIB) $(LDFLAGS_SHLIB) $(OBJ))
$(MV) pic/$(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 Common Error Description library. It is currently distributed together with the EXT2 file system utilities, which are otherwise packaged as "e2fsprogs".

This package was put together by Yann Dirson <dirson@debian.org>, from sources obtained from a mirror of:
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Gadi Oxman, August 1995

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* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/internal/bind/JsonTreeReader.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/internal/bind/ArrayTypeAdapter.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/internal/bind/ObjectTypeAdapter.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/internal/bind/MapTypeAdapterFactory.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/TypeAdapter.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/internal/bind/JsonReaderInternalAccess.java
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* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/internal/bind/TypeAdapterFactory.java
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  jar/com/google/gson/JsonSyntaxException.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/internal/Streams.java
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1.101 pam 1.1.5

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1.103 pluggy 0.13.1

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1.104 lua 5.2.3

1.105 rrule 2.6.8

1.105.1 Available under license:

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./rrule.js and ./test/tests.js is based on python-dateutil. LICENCE:
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python-dateutil - Extensions to the standard Python datetime module.

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1.106 go-runtime 1.13.4
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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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 */

Found in path(s):
* /opt/ws_local/PERMITS_SQL/1072948623_1595240780.88/0/netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/RoundRobinInetAddressResolver.java

1.108 openjdk-jre 11.0.11u9
1.108.1 Available under license :

## The Unicode Standard, Unicode Character Database, Version 10.0.0

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```
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### xwd utility
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include/GL/wglxext.h :

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Protocol Buffers for Go with Gadgets

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jseward@bzip.org
bzip2/libbzip2 version 1.0.4 of 20 December 2006
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########################################################################
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## version 0.1
##
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Found in path(s):

* /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
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5.jar/javassist/compiler/SymbolTable.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5.jar/javassist/bytecode/BadBytecode.java
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* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/tools/web/Webserver.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/NestMembersAttribute.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/convert/TransformBefore.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/tools/rmi/Proxy.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/analysis/SubroutineScanner.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/InstructionPrinter.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/tools/rmi/ObjectImporter.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/stackmap/TypedBlock.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/tools/reflect/Expr.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/tools/reflect/CannotCreateException.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/tools/reflect/KeywordTable.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/tools/reflect/ClassMetaobject.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/tools/rmi/ObjectImporter.java
jar/javassist/util/proxy/DefinePackageHelper.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/tools/reflect/Metaobject.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/convert/TransformAfter.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/Descriptor.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/compiler/JvstTypeChecker.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/AnnotationDefaultAttribute.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/compiler/ast/Variable.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/scopedpool/ScopedClassPoolFactory.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/LoaderClassPath.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/ParameterAnnotationsAttribute.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/expr/Instanceof.java
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* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/convert/TransformAccessArrayField.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/ExceptionsAttribute.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/compiler/ast/Keyword.java
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jar/javassist/CannotCompileException.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/util/proxy/RuntimeSupport.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/bytecode/AttributeInfo.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/bytecode/FieldInfo.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/tools/rmi/ObjectNotFoundException.java

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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
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/bytecode/annotation/StringMemberValue.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/bytecode/annotation/Annotation.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/bytecode/annotation/AnnotationMemberValueVisitor.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/bytecode/annotation/ClassMemberValue.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/bytecode/annotation/DoubleMemberValue.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/bytecode/annotation/FloatMemberValue.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/bytecode/annotation/EnumMemberValue.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/bytecode/annotation/CharMemberValue.java
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1.138 urllib3 1.26.5

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# Contributions to the urllib3 project

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  * 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

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  * Optional SNI-support for Python 2 via PyOpenSSL.
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  * Various bugfixes and test improvements.
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  * Correct six.moves conflict
  * Fixed pickle support of some exceptions
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  * 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
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  * Added HTTPS (CONNECT) proxy support
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  * Added abstraction for granular control of request fields
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  * 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

* James Meickle <https://permadeath.com/>
  * Improve handling of Retry-After header

* Chris Jerdonek <chris.jerdonek@gmail.com>
  * Remove a spurious TypeError from the exception chain inside
HTTPConnectionPool._make_request(), also for BaseExceptions.

* Jorge Lopez Silva <https://github.com/jalopezsilva>
* Added support for forwarding requests through HTTPS proxies.

* Benno Rice <benno@jeamland.net>
* Allow cadata parameter to be passed to underlying `SSLContext.load_verify_locations()`.

* Keiichi Kobayashi <abok.1k@gmail.com>
* Rename VerifiedHTTPSConnection to HTTPSConnection

* Himanshu Garg <garg_himanshu@outlook.com>
* DOC & LICENSE Update

* Hod Bin Noon <bin.noon.hod@gmail.com>
* Test improvements

* Chris Olufson <tycarac@gmail.com>
* Fix for connection not being released on HTTP redirect and response not preloaded

* [Bastiaan Bakker] <https://github.com/bastiaanb>
* Support for logging session keys via environment variable `SSLKEYLOGFILE` (Python 3.8+)

* [Ezzeri Esa] <https://github.com/savarin>
* Ports and extends on types from typeshed

* [Your name or handle] <[email or website]>
  * [Brief summary of your changes]

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**1.140 jansi-osx 1.8**

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<signature of Ty Coon>, 1 April 1989
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- modules/audio_coding/codecs/g722/main/source/g722_enc_dec.h
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modules/audio_processing/aec/aec_rfft.c
system_wrappers/source/condition_variable_event_win.cc
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system_wrappers/source/spreadsortlib/spreadsort.hpp

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-------------------------------------------------------------------------------------

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common_audio/signal_processing/spl_sqrt_floor_arm.S

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 *
 * From: Wilco Dijkstra <Wilco.Dijkstra@ntlworld.com>
 * Date: Fri, Jun 24, 2011 at 3:20 AM
 * Subject: Re: sqrt routine
 * To: Kevin Ma <kma@google.com>
 * Hi Kevin,
 * Thanks for asking. Those routines are public domain (originally posted to
 * comp.sys.arm a long time ago), so you can use them freely for any purpose.
 * Cheers,
 * Wilco
 *
 * ----- Original Message -----
 * From: "Kevin Ma" <kma@google.com>
 * To: <Wilco.Dijkstra@ntlworld.com>
 * Sent: Thursday, June 23, 2011 11:44 PM
 * Subject: Fwd: sqrt routine
 * Hi Wilco,
 * I saw your sqrt routine from several web sites, including
 * http://www.finesse.demon.co.uk/steven/sqrt.html.
 * Just wonder if there's any copyright information with your Successive
 * approximation routines, or if I can freely use it for any purpose.
 * Thanks.
 * Kevin
 */
-------------------------------------------------------------------------------------

Files:
modules/audio_coding/codecs/g711/main/source/g711.c
modules/audio_coding/codecs/g711/main/source/g711.h

License:
/*
* SpanDSP - a series of DSP components for telephony

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

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

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* ones who might try to proprietize my work and use it to my
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*/

-------------------------------------------------------------------------------
Files:
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modules/audio_coding/codecs/g722/main/source/g722_encode.c

License:
/*
* SpanDSP - a series of DSP components for telephony
* 
* g722_decode.c - The ITU G.722 codec, decode part.
* 
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* 
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* even the slimy ones who might try to proprietize my work and use it
* to my detriment.
* 
* 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
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modules/audio_device/mac/portaudio/pa_ringbuffer.c
modules/audio_device/mac/portaudio/pa_ringbuffer.h

License:
/*
 * $Id: pa_memorybarrier.h 1240 2007-07-17 13:05:07Z bjornroche $
 * Portable Audio I/O Library
 * Memory barrier utilities
 *
 * Author: Bjorn Roche, XO Audio, LLC
 *
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 */

/*
 * $Id: pa_ringbuffer.c 1421 2009-11-18 16:09:05Z bjornroche $
 * Portable Audio I/O Library
 * Ring Buffer utility.
 *
 * Author: Phil Burk, http://www.softsynth.com
 * modified for SMP safety on Mac OS X by Bjorn Roche
 * modified for SMP safety on Linux by Leland Lucius
 * also, allowed for const where possible
 * modified for multiple-byte-sized data elements by Sven Fischer
 *
 * Note that this is safe only for a single-thread reader and a
 * single-thread writer.
 *
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Source:

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* /opt/cola/permits/1135888122_1613626080.95/0/spring-orm-5-2-8-release-sources-jar/org/springframework/orm/hibernate5/HibernateCallback.java
* /opt/cola/permits/1135888122_1613626080.95/0/spring-orm-5-2-8-release-sources-jar/org/springframework/orm/hibernate5/SessionHolder.java
* /opt/cola/permits/1135888122_1613626080.95/0/spring-orm-5-2-8-release-sources-jar/org/springframework/orm/hibernate5/SpringFlushSynchronization.java
* /opt/cola/permits/1135888122_1613626080.95/0/spring-orm-5-2-8-release-sources-jar/org/springframework/orm/jpa/EntityManagerHolder.java
* /opt/cola/permits/1135888122_1613626080.95/0/spring-orm-5-2-8-release-sources-jar/org/springframework/orm/jpa/vendor/EclipseLinkJpaDialect.java
* /opt/cola/permits/1135888122_1613626080.95/0/spring-orm-5-2-8-release-sources-jar/org/springframework/orm/jpa/persistenceunit/PersistenceUnitReader.java
* /opt/cola/permits/1135888122_1613626080.95/0/spring-orm-5-2-8-release-sources-jar/org/springframework/orm/jpa/vendor/Database.java
* /opt/cola/permits/1135888122_1613626080.95/0/spring-orm-5-2-8-release-sources-jar/org/springframework/orm/jpa/EntityManagerFactoryAccessor.java
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Found in path(s):
* /opt/cola/permits/1135888122_1613626080.95/0/spring-orm-5-2-8-release-sources-
  jar/org/springframework/orm/jpa/LocalEntityManagerFactoryBean.java
* /opt/cola/permits/1135888122_1613626080.95/0/spring-orm-5-2-8-release-sources-
  jar/org/springframework/orm/jpa/OpenSessionInViewInterceptor.java
* /opt/cola/permits/1135888122_1613626080.95/0/spring-orm-5-2-8-release-sources-
  jar/org/springframework/orm/hibernate5/HibernateOptimisticLockingFailureException.java
* /opt/cola/permits/1135888122_1613626080.95/0/spring-orm-5-2-8-release-sources-
  jar/org/springframework/orm/hibernate5/HibernateTemplate.java
* /opt/cola/permits/1135888122_1613626080.95/0/spring-orm-5-2-8-release-sources-
  jar/org/springframework/orm/hibernate5/ObjectOptimisticLockingFailureException.java
* /opt/cola/permits/1135888122_1613626080.95/0/spring-orm-5-2-8-release-sources-
  jar/org/springframework/orm/hibernate5/ObjectRetrievalFailureException.java
* /opt/cola/permits/1135888122_1613626080.95/0/spring-orm-5-2-8-release-sources-
  jar/org/springframework/orm/hibernate5/spring-orm-5-2-8-release-sources-
  jar/org/springframework/orm/jpa/LocalContainerEntityManagerFactoryBean.java
* /opt/cola/permits/1135888122_1613626080.95/0/spring-orm-5-2-8-release-sources-
  jar/org/springframework/orm/jpaodynamicsunit/DefaultPersistenceUnitManager.java
* /opt/cola/permits/1135888122_1613626080.95/0/spring-orm-5-2-8-release-sources-
  jar/org/springframework/orm/jpa/AbstractJpaVendorAdapter.java
* /opt/cola/permits/1135888122_1613626080.95/0/spring-orm-5-2-8-release-sources-
  jar/org/springframework/orm/hibernate5/support/HibernateDaoSupport.java
* /opt/cola/permits/1135888122_1613626080.95/0/spring-orm-5-2-8-release-sources-
  jar/org/springframework/orm/jpa/vendor/EclipseLinkJpaVendorAdapter.java
* /opt/cola/permits/1135888122_1613626080.95/0/spring-orm-5-2-8-release-sources-
  jar/org/springframework/orm/jpa/vendor/AbstractJpaVendorAdapter.java

---

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 */

Found in path(s):
* /opt/cola/permits/1135888122_1613626080.95/0/spring-orm-5-2-8-release-sources-
jar/org/springframework/jpa/persistenceunit/SmartPersistenceUnitInfo.java
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 */

/**
 * Create a transactional EntityManager proxy for the given EntityManagerFactory.
 * @param emf the EntityManagerFactory to obtain EntityManagers from as needed
 * @param properties the properties to be passed into the
 * $ { @code createEntityManager } call (may be $ { @code null }$)}

Open Source Used In Cisco Meeting Server (formerly Acano Server) 3.4 1671
* @param entityManagerInterfaces the interfaces to be implemented by the
* EntityManager. Allows the addition or specification of proprietary interfaces.
* @return a shareable transactional EntityManager proxy
*/

Found in path(s):
* /opt/cola/permits/1135888122_1613626080.95/0/spring-orm-5-2-8-release-sources-
  jar/org/springframework/orm/jpa/SharedEntityManagerCreator.java

---

1.157 open-vm-tools 9.4.0

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Version 2.1, February 1999

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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/configuration/package-info.java
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources.jar/org/flywaydb/core/api/android/ContextHolder.java
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources.jar/org/flywaydb/core/internal/database/oracle/OracleResults.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources.jar/org/flywaydb/core/internal/database/mysql/MySQLParser.java
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources.jar/org/flywaydb/core/internal/database/cockroachdb/package-info.java
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1.161 ehcache-impl 3.8.1

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1.162 commons-fileupload 62

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* /opt/cola/permits/1135888101_1613626209.41/0/spring-beans-5-2-8-release-sources-1-jar/org/springframework/beans/factory/xml/UtilNamespaceHandler.java
* /opt/cola/permits/1135888101_1613626209.41/0/spring-beans-5-2-8-release-sources-1-jar/org/springframework/beans/factory/xml/NamespaceHandlerResolver.java

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Found in path(s):
* /opt/cola/permits/1135888101_1613626209.41/0/spring-beans-5-2-8-release-sources-1-jar/org/springframework/beans/support/ResourceEditorRegistrar.java
* /opt/cola/permits/1135888101_1613626209.41/0/spring-beans-5-2-8-release-sources-1-jar/org/springframework/beans/support/InputStreamEditor.java
* /opt/cola/permits/1135888101_1613626209.41/0/spring-beans-5-2-8-release-sources-1-jar/org/springframework/beans/support/BeanDefinitionCustomizer.java
* /opt/cola/permits/1135888101_1613626209.41/0/spring-beans-5-2-8-release-sources-1-jar/org/springframework/beans/support/ImplicitlyAppearedSingletonException.java
* /opt/cola/permits/1135888101_1613626209.41/0/spring-beans-5-2-8-release-sources-1-jar/org/springframework/beans/support/NotReadablePropertyException.java
* /opt/cola/permits/1135888101_1613626209.41/0/spring-beans-5-2-8-release-sources-1-jar/org/springframework/beans/support/Annotation/AnnotatedBeanDefinition.java
1.166 lua 5.1.5

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1.167 oniguruma 6.9.4-1

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1.168 docker 1.9.1

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1.174 fdisk 1.1.0

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*/
/**
* Kotlin compliant `WebTestClient.BodySpec` for expectations on the response body decoded
* to a single Object, see [KT-5464](https://youtrack.jetbrains.com/issue/KT-5464) for
* more details.
* @since 5.0.6
*/

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Protocol Buffers for Go with Gadgets

Go support for Protocol Buffers - Google's data interchange format

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https://github.com/golang/protobuf

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package engine

import (   "bytes"   "encoding/json"   "strings"   "testing"   "time"

github.com/docker/cli/cli/command/formatter"
  github.com/docker/cli/internal/licenseutils"
  github.com/docker/licensing/model"
  gotest.tools/assert"
   is "gotest.tools/assert/cmp"
)

func TestSubscriptionContextWrite(t *testing.T) {
  cases := []struct {
    context  formatter.Context
    expected string
  }{
    // Errors
    {
      formatter.Context{Format: "{{InvalidFunction}}"},
      "Template parsing error: template: :1: function "InvalidFunction" not defined",
    },
  }
Open Source Used In Cisco Meeting Server (formerly Acano Server) 3.4 1992

```
formatter.Context{Format: "{{nil}}"},
`Template parsing error: template: :1:2: executing "" at <nil>: nil is not a command`
`,
},

// Table format
{
formatter.Context{Format: NewSubscriptionsFormat("table", false)},
`NUM                  OWNER               PRODUCT ID          EXPIRES                         PRICING COMPONENTS
1                   owner1              productid1          2020-01-01 10:00:00 +0000 UTC   compstring
2                   owner2              productid2          2020-01-01 10:00:00 +0000 UTC   compstring
`,
},

formatter.Context{Format: NewSubscriptionsFormat("table", true)},
`1: License Name: name1 Quantity: 10 nodes Expiration date: 2020-01-01
2: License Name: name2 Quantity: 20 nodes Expiration date: 2020-01-01
`,
},

formatter.Context{Format: NewSubscriptionsFormat("table {{.Owner}}", false)},
`OWNER
owner1
owner2
`,
},

formatter.Context{Format: NewSubscriptionsFormat("table {{.Owner}}", true)},
`OWNER
owner1
owner2
`,

// Raw Format
{
`license: id1
name: name1
owner: owner1
components: compstring

license: id2
name: name2
owner: owner2
components: compstring
`,
}
```
expiration, _ := time.Parse(time.RFC822, "01 Jan 20 10:00 UTC")

for _, testcase := range cases {
    subscriptions := []licenseutils.LicenseDisplay{
    {
        Num: 1,
        Owner: "owner1",
        Subscription: model.Subscription{
            ID: "id1",
            Name: "name1",
            ProductID: "productid1",
            Expires: &expiration,
            PricingComponents: model.PricingComponents{
                &model.SubscriptionPricingComponent{
                    Name: "nodes",
                    Value: 10,
                },
            },
            ComponentsString: "compstring",
        },
    },
    {
        Num: 2,
        Owner: "owner2",
        Subscription: model.Subscription{
            ID: "id2",
            Name: "name2",
            ProductID: "productid2",
            Expires: &expiration,
            PricingComponents: model.PricingComponents{
                &model.SubscriptionPricingComponent{
                    Name: "nodes",
                    Value: 20,
                },
            },
        },
    },
}
func TestSubscriptionContextWriteJSON(t *testing.T) {
    expiration, _ := time.Parse(time.RFC822, "01 Jan 20 10:00 UTC")
    subscriptions := []licenseutils.LicenseDisplay{
        {
            Num:   1,
            Owner: "owner1",
            Subscription: model.Subscription{
                ID:        "id1",
                Name:      "name1",
                ProductID: "productid1",
                Expires:   &expiration,
                PricingComponents: model.PricingComponents{
                    &model.SubscriptionPricingComponent{
                        Name:  "nodes",
                        Value: 10,
                    },
                },
                ComponentsString: "compstring",
            },
        },
        {
            Num:   2,
            Owner: "owner2",
            Subscription: model.Subscription{
                ID:        "id2",
                Name:      "name2",
                ProductID: "productid2",
                Expires:   &expiration,
                PricingComponents: model.PricingComponents{
                    &model.SubscriptionPricingComponent{
                        Name:  "nodes",
                        Value: 20,
                    },
                },
                ComponentsString: "compstring",
            },
        },
    }
    out := &bytes.Buffer{}
    testcase.context.Output = out
    err := SubscriptionsWrite(testcase.context, subscriptions)
    if err != nil {
        assert.Error(t, err, testcase.expected)
    } else {
        assert.Check(t, is.Equal(testcase.expected, out.String()))
    }
}
ComponentsString: "compstring",

expectedJSONs := []map[string]interface{}{
{
 "Owner":            "owner1",
 "ComponentsString": "compstring",
 "Expires":          "2020-01-01T10:00:00Z",
 "DockerID":         "",
 "Eusa":             nil,
 "ID":               "id1",
 "Start":            nil,
 "Name":             "name1",
 "Num":              float64(1),
 "PricingComponents": []interface{}{
 map[string]interface{}{
 "name":  "nodes",
 "value": float64(10),
 },
 },
 "ProductID":         "productid1",
 "ProductRatePlan":   "",
 "ProductRatePlanID": "",
 "State":             "",
 "Summary":           "License Name: name1\tQuantity: 10 nodes\tExpiration date: 2020-01-01",
 },
{
 "Owner":            "owner2",
 "ComponentsString": "compstring",
 "Expires":          "2020-01-01T10:00:00Z",
 "DockerID":         "",
 "Eusa":             nil,
 "ID":               "id2",
 "Start":            nil,
 "Name":             "name2",
 "Num":              float64(2),
 "PricingComponents": []interface{}{
 map[string]interface{}{
 "name":  "nodes",
 "value": float64(20),
 },
 },
 "ProductID":         "productid2",
 "ProductRatePlan":   "",
 "ProductRatePlanID": "",
}
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package licensing

import (    "context"    "crypto/hmac"    "crypto/sha256"    "encoding/base64"    "encoding/json"    "fmt"    "time"

    "github.com/docker/libtrust"
    "github.com/docker/licensing/lib/errors"
    "github.com/docker/licensing/lib/go-clientlib"
    "github.com/docker/licensing/model"
)

}

// Check verifies that the license identified by the given key id is valid. Note that it does not // interrogate the contents of the license. func (c *client) check(ctx context.Context, license model.IssuedLicense) (*model.CheckResponse, error) {    keyID := license.KeyID    privateKey := license.PrivateKey

    authorization, err := c.getAuthorization(ctx, license)    if err != nil {        return nil, err    }
// TODO: Mason - replace this parseJWS with a non libtrust lib
signature, err := libtrust.ParseJWS(authorization)
if err != nil {
    return nil, errors.Wrapf(err, errors.Fields{
        "key_id": keyID,
    }, "license parse JWS failed")
}

keys, err := signature.Verify()
if err != nil {
    return nil, errors.Wrapf(err, errors.Fields{
        "key_id": keyID,
    }, "license signature verification failed")
}

keyCnt := len(keys)
if keyCnt != 1 {
    err = fmt.Errorf("unexpected number of signing keys (%d)", keyCnt)
    return nil, errors.WithStack(err).With(errors.Fields{
        "key_id": keyID,
    })
}

key := keys[0]

if !c.recognizedSigningKey(key) {
    return nil, errors.New("unrecognized signing key")
}

payload, err := signature.Payload()
if err != nil {
    return nil, errors.Wrapf(err, errors.Fields{
        "key_id": keyID,
    }, "malformed signature payload")
}

checkRes := new(model.CheckResponse)
err = json.Unmarshal(payload, &checkRes)
if err != nil {
    return nil, errors.Wrapf(err, errors.Fields{
        "key_id": keyID,
    }, "license payload unmarshal failed")
}

msg := checkRes.Expiration.Format(time.RFC3339)
if err := checkToken(msg, checkRes.Token, privateKey); err != nil {
    return nil, errors.Wrap(err, errors.Fields{
        "key_id": keyID,
    })
}

return checkRes, nil

// recognizedSigningKey returns true if the given key is signed with a recognized signing key, false otherwise
func (c *client) recognizedSigningKey(key libtrust.PublicKey) bool {
    for _, publicKey := range c.publicKeys {
        if key.KeyID() == publicKey.KeyID() {
            return true
        }
    }
    return false
}

// getAuthorization returns the decoded license authorization
func (c *client) getAuthorization(ctx context.Context, license model.IssuedLicense) ([]byte, error) {
    decoded, err := base64.StdEncoding.DecodeString(license.Authorization)
    if err != nil {
        return nil, errors.Wrapf(err, errors.Fields{
            "key_id": license.KeyID,
        }, "decoding license authorization failed")
    }
    return decoded, nil
}

// All of the functions in this file assume that they are receiving a properly
// formatted private key.

// checkToken performs a MAC algorithm (where token is generated by hashing the
// message with the privateKey via GenerateToken) with the purpose of authenticating
// the validity of both the message and the private key of the person who generated
// the token.
func checkToken(message, token, privateKey string) error {
    tokenBytes, err := base64.URLEncoding.DecodeString(token)
    if err != nil {
        return errors.Wrapf(err, errors.Fields{"token": token})
    }

    generatedToken, err := generateToken(message, privateKey)
    if err != nil {
        return errors.Wrapf(err, errors.Fields{"token": generatedToken})
    }
}

// generateToken generates a token for the given message and privateKey.
func generateToken(message, privateKey string) string {
    // Implementation details...
}
generatedBytes, err := base64.URLEncoding.DecodeString(generatedToken)
if err != nil {
    return errors.Wrap(err, errors.Fields{"token": token})
}

if !hmac.Equal(tokenBytes, generatedBytes) {
    return errors.Forbidden(errors.Fields{"token": token}, "invalid token")
}

return nil

// generateToken generates a hash of the message with the privateKey via the
// sha256 algorithm.
func generateToken(message, privateKey string) (string, error) {
    key, err := base64.URLEncoding.DecodeString(privateKey)
    if err != nil {
        return "", errors.Wrap(err, errors.Fields{"msg": message})
    }

    h := hmac.New(sha256.New, key)
    h.Write([]byte(message))
    return base64.URLEncoding.EncodeToString(h.Sum(nil)), nil
}

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```go
package model

import "time"

// A CheckResponse is the internal content of the PublicCheckResponse signed json blob.
type CheckResponse struct {
    Expiration  time.Time `json:"expiration"
    Token       string    `json:"token"
    MaxEngines  int       `json:"maxEngines"
    ScanningEnabled bool    `json:"scanningEnabled"
    Type        string    `json:"licenseType"
    Tier        string    `json:"tier"
}

// IssuedLicense represents an issued license
type IssuedLicense struct {
    KeyID         string `json:"key_id"
    PrivateKey    string `json:"private_key"
    Authorization string `json:"authorization"
}

// Valid returns true if the License is syntactically valid, false otherwise
func (l *IssuedLicense) Valid() (bool, string) {
    if l.KeyID == "" {
        return false, "empty key_id"
    }

    if l.PrivateKey == "" {
        return false, "empty private_key"
    }

    if l.Authorization == "" {
        return false, "empty authorization"
    }
}
```
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package engine

import (
    "time"
    "github.com/docker/cli/cli/command/formatter"
    "github.com/docker/cli/internal/licenseutils"
    "github.com/docker/licensing/model"
)

const (
    defaultSubscriptionsTableFormat = "table
        {{.Num}}	{{.Owner}}	{{.ProductID}}	{{.Expires}}	{{.ComponentsString}}"
    defaultSubscriptionsQuietFormat = "{{.Num}}:{{.Summary}}"
)

numHeader               = "NUM"
ownerHeader             = "OWNER"
licenseNameHeader       = "NAME"
idHeader                = "ID"
dockerIDHeader          = "DOCKER ID"
productIDHeader         = "PRODUCT ID"
productRatePlanHeader   = "PRODUCT RATE PLAN"
productRatePlanIDHeader = "PRODUCT RATE PLAN ID"
startHeader             = "START"
expiresHeader           = "EXPIRES"
stateHeader             = "STATE"
eusaHeader              = "EUSA"
pricingComponentsHeader = "PRICING COMPONENTS"
)

// NewSubscriptionsFormat returns a Format for rendering using a license Context
func NewSubscriptionsFormat(source string, quiet bool) formatter.Format {
    switch source {
    case formatter.TableFormatKey:
        if quiet {
            return defaultSubscriptionsQuietFormat
        }
        return defaultSubscriptionsTableFormat
    case formatter.RawFormatKey:
        if quiet {
            return `license: {{.ID}}`
        }
    }
return `license: {{.ID}}
name: {{.Name}}
owner: {{.Owner}}
components: {{.ComponentsString}}
`
func (c *licenseContext) Owner() string {
    return c.l.Owner
}

func (c *licenseContext) ComponentsString() string {
    return c.l.ComponentsString
}

func (c *licenseContext) Summary() string {
    return c.l.String()
}

func (c *licenseContext) Name() string {
    return c.l.Name
}

func (c *licenseContext) ID() string {
    return c.l.ID
}

func (c *licenseContext) DockerID() string {
    return c.l.DockerID
}

func (c *licenseContext) ProductID() string {
    return c.l.ProductID
}

func (c *licenseContext) ProductRatePlan() string {
    return c.l.ProductRatePlan
}

func (c *licenseContext) ProductRatePlanID() string {
    return c.l.ProductRatePlanID
}

func (c *licenseContext) Start() *time.Time {
    return c.l.Start
}

func (c *licenseContext) Expires() *time.Time {
    return c.l.Expires
}

func (c *licenseContext) State() string {
    return c.l.State
}
func (c *licenseContext) Eusa() *model.EusaState {
    return c.l.Eusa
}

func (c *licenseContext) PricingComponents() []model.SubscriptionPricingComponent {
    // Dereference the pricing component pointers in the pricing components
    // so it can be rendered properly with the template formatter

    var ret []model.SubscriptionPricingComponent
    for _, spc := range c.l.PricingComponents {
        if spc == nil {
            continue
        }
        ret = append(ret, *spc)
    }
    return ret
}

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1.192 ffmpeg 4.3.1

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- libpostproc
- optional x86 optimization in the files
  - `libavcodec/x86/flac_dsp_gpl.asm`
  - `libavcodec/x86/idct_mmx.c`
  - `libavfilter/x86/vf_removegrain.asm`
- the following building and testing tools
  - `compat/solaris/make_sunver.pl`
  - `doc/t2h.pm`
  - `doc/texi2pod.pl`
  - `libswresample/tests/swresample.c`
  - `tests/checkasm/*`
  - `tests/tiny_ssim.c`
- the following filters in libavfilter:
  - `signature_lookup.c`
  - `vf_blackframe.c`
  - `vf_boxblur.c`
  - `vf_colormatrix.c`
  - `vf_cover_rect.c`
  - `vf_cropdetect.c`
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There are a handful of files under other licensing terms, namely:

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

## External libraries

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

### Compatible libraries

The following libraries are under GPL version 2:
- avisynth
- frei0r
- libcdio
- libdavs2
- librubberband
- libvidstab
- libx264
- libx265
- libxavs
- libxavs2
- libxvid

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

The following libraries are under LGPL version 3:
- gmp
- libaribb24
- liblensfun

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

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

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

### Incompatible libraries

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

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Protocol Buffers for Go with Gadgets

Go support for Protocol Buffers - Google's data interchange format

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https://github.com/golang/protobuf

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package engine

import (
    "bytes"
    "encoding/json"
    "strings"
    "testing"
    "time"

    "github.com/docker/cli/cli/command/formatter"
    "github.com/docker/cli/internal/licenseutils"
    "github.com/docker/licensing/model"
    "gotest.tools/assert"
    is "gotest.tools/assert/cmp"
)

func TestSubscriptionContextWrite(t *testing.T) {
    cases := []struct {
        context formatter.Context
        expected string
    }{
        // Errors
        {
            formatter.Context{Format: "{{InvalidFunction}}"},
            `Template parsing error: template: :1: function "InvalidFunction" not defined
             `,
            },
            {
                formatter.Context{Format: "{{nil}}"},
                `Template parsing error: template: :1:2: executing "" at <nil>: nil is not a command
             `,
            },
        // Table format
    }
```json
{
  formatter.Context{Format: NewSubscriptionsFormat("table", false)},
  NUM          OWNER      PRODUCT ID          EXPIRES                         PRICING COMPONENTS
  1            owner1    productid1          2020-01-01 10:00:00 +0000 UTC   compstring
  2            owner2    productid2          2020-01-01 10:00:00 +0000 UTC   compstring
  
  formatter.Context{Format: NewSubscriptionsFormat("table", true)},
  `1: License Name: name1 Quantity: 10 nodes Expiration date: 2020-01-01
  2: License Name: name2 Quantity: 20 nodes Expiration date: 2020-01-01
  
  formatter.Context{Format: NewSubscriptionsFormat("table {{.Owner}}", false)},
  `OWNER
  owner1
  owner2
  
  formatter.Context{Format: NewSubscriptionsFormat("table {{.Owner}}", true)},
  `OWNER
  owner1
  owner2
  
  // Raw Format
  
  `license: id1
  name: name1
  owner: owner1
  components: compstring
  
  license: id2
  name: name2
  owner: owner2
  components: compstring
  
  formatter.Context{Format: NewSubscriptionsFormat("raw", true)},
  `license: id1
  license: id2
  `,
  
}
```
// Custom Format
{
    formatter.Context{Format: NewSubscriptionsFormat("{{.Owner}}", false),
        'owner1
        owner2
        },
}

expiration, _ := time.Parse(time.RFC822, "01 Jan 20 10:00 UTC")

for _, testcase := range cases {
    subscriptions := []licenseutils.LicenseDisplay{

        { Num: 1,
        Owner: "owner1",
        Subscription: model.Subscription{
            ID: "id1",
            Name: "name1",
            ProductID: "productid1",
            Expires: &expiration,
            PricingComponents: model.PricingComponents{
                &model.SubscriptionPricingComponent{
                    Name: "nodes",
                    Value: 10,
                },
                },
                ComponentsString: "compstring",
            },
        },

        { Num: 2,
        Owner: "owner2",
        Subscription: model.Subscription{
            ID: "id2",
            Name: "name2",
            ProductID: "productid2",
            Expires: &expiration,
            PricingComponents: model.PricingComponents{
                &model.SubscriptionPricingComponent{
                    Name: "nodes",
                    Value: 20,
                },
                },
                ComponentsString: "compstring",
            },
        }
    }
}
out := &bytes.Buffer{}
testcase.context.Output = out
err := SubscriptionsWrite(testcase.context, subscriptions)
if err != nil {
    assert.Error(t, err, testcase.expected)
} else {
    assert.Check(t, is.Equal(testcase.expected, out.String()))
}

func TestSubscriptionContextWriteJSON(t *testing.T) {
    expiration, _ := time.Parse(time.RFC822, "01 Jan 20 10:00 UTC")
    subscriptions := []licenseutils.LicenseDisplay{
        {
            Num:   1,
            Owner: "owner1",
            Subscription: model.Subscription{
                ID:        "id1",
                Name:      "name1",
                ProductID: "productid1",
                Expires:   &expiration,
                PricingComponents: model.PricingComponents{
                    &model.SubscriptionPricingComponent{
                        Name:  "nodes",
                        Value: 10,
                    },
                },
                ComponentsString: "compstring",
            },
            Num: 2,
            Owner: "owner2",
            Subscription: model.Subscription{
                ID:        "id2",
                Name:      "name2",
                ProductID: "productid2",
                Expires:   &expiration,
                PricingComponents: model.PricingComponents{
                    &model.SubscriptionPricingComponent{
                        Name:  "nodes",
                        Value: 20,
                    },
                },
                ComponentsString: "compstring",
            },
        },
    }
}
expectedJSONs := []map[string]interface{} {
    {
        "Owner": "owner1",
        "ComponentsString": "compstring",
        "Expires": "2020-01-01T10:00:00Z",
        "DockerID": "",
        "Eusa": nil,
        "ID": "id1",
        "Start": nil,
        "Name": "name1",
        "Num": float64(1),
        "PricingComponents": []interface{} {
            map[string]interface{} {
                "name": "nodes",
                "value": float64(10),
            },
        },
        "ProductID": "productid1",
        "ProductRatePlan": "",
        "ProductRatePlanID": "",
        "State": "",
        "Summary": "License Name: name1
        Quantity: 10 nodes
        Expiration date: 2020-01-01",
    },
    {
        "Owner": "owner2",
        "ComponentsString": "compstring",
        "Expires": "2020-01-01T10:00:00Z",
        "DockerID": "",
        "Eusa": nil,
        "ID": "id2",
        "Start": nil,
        "Name": "name2",
        "Num": float64(2),
        "PricingComponents": []interface{} {
            map[string]interface{} {
                "name": "nodes",
                "value": float64(20),
            },
        },
        "ProductID": "productid2",
        "ProductRatePlan": "",
        "ProductRatePlanID": "",
        "State": "",
        "Summary": "License Name: name2
        Quantity: 20 nodes
        Expiration date: 2020-01-01",
    }
}
func TestSubscriptionContextWriteJSONField(t *testing.T) {
subscriptions := []licenseutils.LicenseDisplay{
    {Num: 1, Owner: "owner1"},
    {Num: 2, Owner: "owner2"},
}
out := &bytes.Buffer{
if err != nil {
    t.Fatal(err)
}
for i, line := range strings.Split(strings.TrimSpace(out.String()), "\n") {
    var s string
    if err := json.Unmarshal([]byte(line), &s); err != nil {
        t.Fatal(err)
    }
    assert.Check(t, is.Equal(subscriptions[i].Owner, s))
}
}

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import (
    "context"
    "crypto/hmac"
    "crypto/sha256"
    "encoding/base64"
    "encoding/json"
    "fmt"
    "time"
    "github.com/docker/libtrust"
    "github.com/docker/licensing/lib/errors"
    "github.com/docker/licensing/lib/go-clientlib"
    "github.com/docker/licensing/model"
)

func (c *client) getLicenseFile(ctx context.Context, subID string) (*model.IssuedLicense, error) {
    url := c.baseURI
    url.Path += fmt.Sprintf("/api/billing/v4/subscriptions/%s/license-file", subID)
    license := new(model.IssuedLicense)
    if _, _, err := c.doReq(ctx, "GET", &url, clientlib.RecvJSON(license)); err != nil {
        return nil, err
    }
    return license, nil
}

// Check verifies that the license identified by the given key id is valid. Note that it does not // interrogate the contents of the license.
func (c *client) check(ctx context.Context, license model.IssuedLicense) (*model.CheckResponse, error) {
    keyID := license.KeyID
    privateKey := license.PrivateKey
    authorization, err := c.getAuthorization(ctx, license)
    if err != nil {
        return nil, err
    }
    signature, err := libtrust.ParseJWS(authorization)
    if err != nil {
        return nil, errors.Wrapf(err, errors.Fields{
            "field": "signature",
            "message": "failed to parse JWS authorization"})
    }
    // TODO: Mason - replace this parseJWS with a non libtrust lib
    signature, err := libtrust.ParseJWS(authorization)
    if err != nil {
        return nil, errors.Wrapf(err, errors.Fields{
            "field": "signature",
            "message": "failed to parse JWS authorization"})
    }
    return
keys, err := signature.Verify()
if err != nil {
    return nil, errors.Wrap(err, errors.Fields{
        "key_id": keyID,
    }, "license signature verification failed")
}

keyCnt := len(keys)
if keyCnt != 1 {
    err = fmt.Errorf("unexpected number of signing keys (%d)", keyCnt)
    return nil, errors.WithStack(err).With(errors.Fields{
        "key_id": keyID,
    })
}

key := keys[0]

if !c.recognizedSigningKey(key) {
    return nil, errors.New("unrecognized signing key")
}

payload, err := signature.Payload()
if err != nil {
    return nil, errors.Wrap(err, errors.Fields{
        "key_id": keyID,
    }, "malformed signature payload")
}

checkRes := new(model.CheckResponse)
err = json.Unmarshal(payload, &checkRes)
if err != nil {
    return nil, errors.Wrap(err, errors.Fields{
        "key_id": keyID,
    }, "license payload unmarshal failed")
}

msg := checkRes.Expiration.Format(time.RFC3339)
if err := checkToken(msg, checkRes.Token, privateKey); err != nil {
    return nil, errors.Wrap(err, errors.Fields{
        "key_id": keyID,
    })
}
return checkRes, nil

// recognizedSigningKey returns true if the given key is signed with a recognized signing key, false otherwise
func (c *client) recognizedSigningKey(key libtrust.PublicKey) bool {
    for _, publicKey := range c.publicKeys {
        if key.KeyID() == publicKey.KeyID() {
            return true
        }
    }
    return false
}

// getAuthorization returns the decoded license authorization
func (c *client) getAuthorization(ctx context.Context, license model.IssuedLicense) ([]byte, error) {
    decoded, err := base64.StdEncoding.DecodeString(license.Authorization)
    if err != nil {
        return nil, errors.Wrapf(err, errors.Fields{
            "key_id": license.KeyID,
        }, "decoding license authorization failed")
    }
    return decoded, nil
}

// All of the functions in this file assume that they are receiving a properly
// formatted private key.

// checkToken performs a MAC algorithm (where token is generated by hashing the
// message with the privateKey via GenerateToken) with the purpose of authenticating
// the validity of both the message and the private key of the person who generated
// the token.
func checkToken(message, token, privateKey string) error {
    tokenBytes, err := base64.URLEncoding.DecodeString(token)
    if err != nil {
        return errors.Wrap(err, errors.Fields{
            "token": token
        })
    }
    generatedToken, err := generateToken(message, privateKey)
    if err != nil {
        return errors.Wrap(err, errors.Fields{
            "token": token
        })
    }
    generatedBytes, err := base64.URLEncoding.DecodeString(generatedToken)
    if err != nil {
        return errors.Wrap(err, errors.Fields{
            "token": token
        })
    }
    if !hmac.Equal(tokenBytes, generatedBytes) {

return errors.Forbidden(errors.Fields{"token": token}, "invalid token")
}

return nil
}

// generateToken generates a hash of the message with the privateKey via the
// sha256 algorithm.
func generateToken(message, privateKey string) (string, error) {
    key, err := base64.URLEncoding.DecodeString(privateKey)
    if err != nil {
        return "", errors.Wrap(err, errors.Fields{"msg": message})
    }
    h := hmac.New(sha256.New, key)
    h.Write([]byte(message))
    return base64.URLEncoding.EncodeToString(h.Sum(nil)), nil
}

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procfs provides functions to retrieve system, kernel and process metrics from the pseudo-filesystem proc.

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package model

import "time"

// A CheckResponse is the internal content of the PublicCheckResponse signed
// json blob.
type CheckResponse struct {
    Expiration  time.Time `json:"expiration"`
    Token       string    `json:"token"`
    MaxEngines  int       `json:"maxEngines"`
    ScanningEnabled bool    `json:"scanningEnabled"`
    Type        string    `json:"licenseType"`
    Tier        string    `json:"tier"`
}

// IssuedLicense represents an issued license
type IssuedLicense struct {
    KeyID      string `json:"key_id"`
    PrivateKey string `json:"private_key"`
    Authorization string `json:"authorization"`
}

// Valid returns true if the License is syntactically valid, false otherwise
func (l *IssuedLicense) Valid() (bool, string) {
    if l.KeyID == "" {
        return false, "empty key_id"
    }

    if l.PrivateKey == "" {
        return false, "empty private_key"
    }

    if l.Authorization == "" {
        return false, "empty authorization"
    }

    return true, ""
}

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package engine

import (  
    "time"
    
    "github.com/docker/cli/cli/command/formatter"
    "github.com/docker/cli/internal/licenseutils"
    "github.com/docker/licensing/model"
)

const (  
    defaultSubscriptionsTableFormat = "table
    {{.Num}}	{{.Owner}}	{{.ProductID}}	{{.Expires}}	{{.ComponentsString}}"
    defaultSubscriptionsQuietFormat = "{{.Num}}:{{.Summary}}"
)

    numHeader               = "NUM"
    ownerHeader             = "OWNER"
    licenseNameHeader       = "NAME"
    idHeader                = "ID"
    dockerIDHeader          = "DOCKER ID"
    productIDHeader         = "PRODUCT ID"
    productRatePlanHeader   = "PRODUCT RATE PLAN"
    productRatePlanIDHeader = "PRODUCT RATE PLAN ID"
    startHeader             = "START"
    expiresHeader           = "EXPIRES"
    stateHeader             = "STATE"
    eusaHeader              = "EUSA"
    pricingComponentsHeader = "PRICING COMPONENTS"
)

// NewSubscriptionsFormat returns a Format for rendering using a license Context
func NewSubscriptionsFormat(source string, quiet bool) formatter.Format {  
    switch source {  
    case formatter.TableFormatKey:  
        if quiet {  
            return defaultSubscriptionsQuietFormat  
        }  
        return defaultSubscriptionsTableFormat  
    case formatter.RawFormatKey:  
        if quiet {  
            return `license: {{.ID}}`
        }  
        return `license: {{.ID}}
name: {{.Name}}
owner: {{.Owner}}
components: {{.ComponentsString}}`  
    }  
    return formatter.Format(source)
}

// SubscriptionsWrite writes the context
func SubscriptionsWrite(ctx formatter.Context, subs []licenseutils.LicenseDisplay) error {
    render := func(format func(subContext formatter.SubContext) error) error {
        for _, sub := range subs {
            licenseCtx := &licenseContext{trunc: ctx.Trunc, l: sub}
            if err := format(licenseCtx); err != nil {
                return err
            }
            return nil
        }
        licenseCtx := licenseContext{}
        licenseCtx.Header = map[string]string{
            "Num":               numHeader,
            "Owner":             ownerHeader,
            "Name":              licenseNameHeader,
            "ID":                idHeader,
            "DockerID":          dockerIDHeader,
            "ProductID":         productIDHeader,
            "ProductRatePlan":   productRatePlanHeader,
            "ProductRatePlanID": productRatePlanIDHeader,
            "Start":             startHeader,
            "Expires":           expiresHeader,
            "State":             stateHeader,
            "Eusa":              eusaHeader,
            "ComponentsString":  pricingComponentsHeader,
        }
        return ctx.Write(&licenseCtx, render)
    }
    return nil
}

type licenseContext struct {
    formatter.HeaderContext
    trunc bool
    l     licenseutils.LicenseDisplay
}

func (c *licenseContext) MarshalJSON() ([]byte, error) {
    return formatter.MarshalJSON(c)
}

func (c *licenseContext) Num() int {
    return c.l.Num
}

func (c *licenseContext) Owner() string {
    return c.l.Owner
}

func (c *licenseContext) ComponentsString() string {

func (c *licenseContext) Summary() string {
    return c.l.ComponentsString
}

func (c *licenseContext) Name() string {
    return c.l.Name
}

func (c *licenseContext) ID() string {
    return c.l.ID
}

func (c *licenseContext) DockerID() string {
    return c.l.DockerID
}

func (c *licenseContext) ProductID() string {
    return c.l.ProductID
}

func (c *licenseContext) ProductRatePlan() string {
    return c.l.ProductRatePlan
}

func (c *licenseContext) ProductRatePlanID() string {
    return c.l.ProductRatePlanID
}

func (c *licenseContext) Start() *time.Time {
    return c.l.Start
}

func (c *licenseContext) Expires() *time.Time {
    return c.l.Expires
}

func (c *licenseContext) State() string {
    return c.l.State
}

func (c *licenseContext) Eusa() *model.EusaState {
    return c.l.Eusa
}

func (c *licenseContext) PricingComponents() []model.SubscriptionPricingComponent {
// Dereference the pricing component pointers in the pricing components
// so it can be rendered properly with the template formatter

var ret []model.SubscriptionPricingComponent
for _, spc := range c.l.PricingComponents {
    if spc == nil {
        continue
    }
    ret = append(ret, *spc)
}
return ret

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1.196 jackson-module-parameter-names

2.11.2

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1.200 zlib 1.2.11.dfsg-2ubuntu1

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

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The data format used by the zlib library is described by RFCs (Request for Comments) 1950 to 1952 in the files http://tools.ietf.org/html/rfc1950 (zlib format), rfc1951 (deflate format) and rfc1952 (gzip format).

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1.201 open-ldap 2.4.58

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1.202 cache-api 1.1.1

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1.206 zlib 1.2.11

1.206.1 Available under license :
/* zlib.h -- interface of the 'zlib' general purpose compression library
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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>
 *
 * 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>
 *
 * 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.
 * </p>
 *
 * <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
 * }
 * </pre>
 *
public class DataServerHandler extends SimpleChannelInboundHandler<Message> {
    private boolean loggedIn;

    @Override
    public void channelRead0(ChannelHandlerContext ctx, Message message) {
        if (message instanceof LoginMessage) {
            authenticate((LoginMessage) message);
            loggedIn = true;
        } else if (message instanceof GetDataMessage) {
            if (loggedIn) {
                ctx.writeAndFlush(fetchSecret((GetDataMessage) message));
            } else {
                fail();
            }
        }
    }
}

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:

// Create a new handler instance per channel.
// See ChannelInitializer#initChannel(Channel).
public class DataServerInitializer extends ChannelInitializer<Channel> {
    @Override
    public void initChannel(Channel channel) {
        channel.pipeline().addLast("handler", new DataServerHandler());
    }
}

<h4>Using AttributeKeys</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 AttributeKeys which is provided by
ChannelHandlerContext:

public interface Message {
    // your methods here
}


public class DataServerHandler extends SimpleChannelInboundHandler<Message> {
    private final AttributeKey<Boolean> auth = AttributeKey.valueOf("auth");

    @Override
    public void channelRead(ChannelHandlerContext ctx, Message message) {
        Attribute<Boolean> attr = ctx.attr(auth);
        if (message instanceof LoginMessage) {
            authenticate((LoginMessage) o);
            attr.set(true);
        } else if (message instanceof GetDataMessage) {
            if (Boolean.TRUE.equals(attr.get())) {
                ctx.writeAndFlush(fetchSecret((GetDataMessage) o));
            } else {
                fail();
            }
        }
    }

    public void channelRead(ChannelHandlerContext ctx, Message message) {
        Attribute<Boolean> attr = ctx.attr(auth);
        if (message instanceof LoginMessage) {
            authenticate((LoginMessage) o);
            attr.set(true);
        } else if (message instanceof GetDataMessage) {
            if (Boolean.TRUE.equals(attr.get())) {
                ctx.writeAndFlush(fetchSecret((GetDataMessage) o));
            } else {
                fail();
            }
        }
    }

    public class DataServerInitializer extends ChannelInitializer<Channel> {
        private static final DataServerHandler SHARED = new DataServerHandler();

        @Override
        public void initChannel(Channel channel) {
            channel.pipeline().addLast("handler", SHARED);
        }
    }

    The @Sharable annotation

    In the example above which used an AttributeKey, you might have noticed the @Sharable annotation.
    If a ChannelHandler is annotated with the @Sharable annotation, it means you can create an instance of the handler just once and add it to one or more ChannelPipelines multiple times without a race condition.
    If this annotation is not specified, you have to create a new handler.
instance every time you add it to a pipeline because it has unshared state such as member variables.

This annotation is provided for documentation purpose, just like the JCIP annotations.

Additional resources worth reading

Please refer to the `ChannelHandler`, and `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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1.212 jctools-core 3.0.0

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```xml
<project xmlns="http://maven.apache.org/POM/4.0.0" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="http://maven.apache.org/POM/4.0.0 http://maven.apache.org/maven-v4_0_0.xsd">
  <modelVersion>4.0.0</modelVersion>

  <groupId>org.jctools</groupId>
  <artifactId>jctools-core</artifactId>
  <version>3.0.0</version>
  <name>Java Concurrency Tools Core Library</name>
  <description>Java Concurrency Tools Core Library</description>
  <packaging>bundle</packaging>

  <dependencies>
    <dependency>
      <groupId>org.hamcrest</groupId>
      <artifactId>hamcrest-all</artifactId>
      <version>${hamcrest.version}</version>
      <scope>test</scope>
    </dependency>

    <dependency>
      <groupId>junit</groupId>
      <artifactId>junit</artifactId>
    </dependency>
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```
<version>${junit.version}</version>
<scope>test</scope>
</dependency>

<dependency>
<groupId>com.google.guava</groupId>
<artifactId>guava-testlib</artifactId>
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<scope>test</scope>
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<plugin>
<groupId>org.apache.maven.plugins</groupId>
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<includes>
<include>*.java</include>
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</configuration>
</plugin>

<plugin>
<groupId>org.apache.felix</groupId>
<artifactId>maven-bundle-plugin</artifactId>
<version>4.2.1</version>
<extensions>true</extensions>
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<instructions>
<Import-Package>sun.misc;resolution:=optional</Import-Package>
</instructions>
</configuration>
</plugin>

<plugin>
<groupId>org.apache.maven.plugins</groupId>
<artifactId>maven-source-plugin</artifactId>
<version>3.2.0</version>
<executions>
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<id>attach-sources</id>
<phase>verify</phase>
<goals>
<goal>jar-no-fork</goal>
</goals>
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</plugin>
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</build>
<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>

<properties>
<project.build.sourceEncoding>UTF-8</project.build.sourceEncoding>
<java.version>1.6</java.version>
<java.test.version>1.8</java.test.version>

<maven.compiler.source>${java.version}</maven.compiler.source>
<maven.compiler.target>${java.version}</maven.compiler.target>
<maven.compiler.testSource>${java.test.version}</maven.compiler.testSource>
<maven.compiler.testTarget>${java.test.version}</maven.compiler.testTarget>

<hamcrest.version>1.3</hamcrest.version>
<junit.version>4.12</junit.version>
<guava-testlib.version>21.0</guava-testlib.version>
</properties>

</project>

Found in path(s):
* /opt/cola/permits/1177956791_1625584358.42/0/jctools-core-3-0-0-5-jar/META-INF/maven/org.jctools/jctools-core/pom.xml

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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;version="3.0.0",org.jctools.queues.spec;version="3.0.0",org.jctools.queues.spec;version="3.0.0",org.jctools.queues.atomic;version="3.0.0",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

1.213 jansi 1.8
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#

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

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jloup@gzip.org          madler@alumni.caltech.edu

The data format used by the zlib library is described by RFCs (Request for Comments) 1950 to 1952 in the files http://tools.ietf.org/html/rfc1950 (zlib format), rfc1951 (deflate format) and rfc1952 (gzip format).

*/
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* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
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1.231 cryptsetup 1.7.2

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1.232 uclibc 0.9.33.2

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let me know how it works with your libc
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On Wed, 1 Mar 2006 20:15:02 +0100 (CET) Peter S. Mazinger wrote:
Hello Glenn!

I would want to add testregex.c and the related *.dat files to the uClibc testsuite. uClibc is licensed under LGPL v2.1. I haven't found any licensing related info on testregex.

Is it allowed to use the code there, or should I accomodate the testsuite to download the needed files from the original site each time it is ran?

Thanks, Peter

--
Peter S. Mazinger <ps dot m at gmx dot net>    ID: 0xA5F059F2
Key fingerprint = 92A4 31E1 56BC 3D5A 2D08 BB6E C389 975E A5F0 59F2
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1.233 apr-util 1.6.1
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*/opt/cola/permits/1135888131_1613626079.1/0/spring-tx-5-2-8-release-sources-1-jar/org/springframework/jca/ccci/core/CciOperations.java
*/opt/cola/permits/1135888131_1613626079.1/0/spring-tx-5-2-8-release-sources-1-jar/org/springframework/transaction/event/TransactionPhase.java
*/opt/cola/permits/1135888131_1613626079.1/0/spring-tx-5-2-8-release-sources-1-jar/org/springframework/transaction/annotation/TransactionAnnotationParser.java
*/opt/cola/permits/1135888131_1613626079.1/0/spring-tx-5-2-8-release-sources-1-jar/org/springframework/transaction/reactive/GenericReactiveTransaction.java
*/opt/cola/permits/1135888131_1613626079.1/0/spring-tx-5-2-8-release-sources-1-jar/org/springframework/transaction/annotation/AnnotationTransactionAttributeSource.java
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* /opt/cola/permits/1135888131_1613626079.1/0/spring-tx-5-2-8-release-sources-1.jar/org/springframework/transaction/TransactionStatus.java
* /opt/cola/permits/1135888131_1613626079.1/0/spring-tx-5-2-8-release-sources-1.jar/org/springframework/transaction/StaticTransactionDefinition.java
* /opt/cola/permits/1135888131_1613626079.1/0/spring-tx-5-2-8-release-sources-1.jar/org/springframework/transaction/reactive/TransactionSynchronization.java
* /opt/cola/permits/1135888131_1613626079.1/0/spring-tx-5-2-8-release-sources-1.jar/org/springframework/transaction/event/ApplicationListenerMethodTransactionalAdapter.java
* /opt/cola/permits/1135888131_1613626079.1/0/spring-tx-5-2-8-release-sources-1.jar/org/springframework/transaction/reactive/TransactionCallback.java
* /opt/cola/permits/1135888131_1613626079.1/0/spring-tx-5-2-8-release-sources-1.jar/org/springframework/transaction/reactive/TransactionContextHolder.java
* /opt/cola/permits/1135888131_1613626079.1/0/spring-tx-5-2-8-release-sources-1.jar/org/springframework/transaction/interceptor/CompositeTransactionAttributeSource.java
* /opt/cola/permits/1135888131_1613626079.1/0/spring-tx-5-2-8-release-sources-1.jar/org/springframework/transaction/support/WithoutTransactionOperations.java
* /opt/cola/permits/1135888131_1613626079.1/0/spring-tx-5-2-8-release-sources-1.jar/org/springframework/transaction/support/DefaultTransactionStatus.java
* /opt/cola/permits/1135888131_1613626079.1/0/spring-tx-5-2-8-release-sources-1.jar/org/springframework/transaction/reactive/ReactiveResourceSynchronization.java
* /opt/cola/permits/1135888131_1613626079.1/0/spring-tx-5-2-8-release-sources-1.jar/org/springframework/transaction/reactive/TransactionContextManager.java
* /opt/cola/permits/1135888131_1613626079.1/0/spring-tx-5-2-8-release-sources-1.jar/org/springframework/transaction/support/AbstractTransactionStatus.java
* /opt/cola/permits/1135888131_1613626079.1/0/spring-tx-5-2-8-release-sources-1.jar/org/springframework/transaction/reactive/TransactionSynchronizationManager.java
* /opt/cola/permits/1135888131_1613626079.1/0/spring-tx-5-2-8-release-sources-1.jar/org/springframework/transaction/reactive/ReactiveTransaction.java
* /opt/cola/permits/1135888131_1613626079.1/0/spring-tx-5-2-8-release-sources-1.jar/org/springframework/transaction/interceptor/TransactionProxyFactoryBean.java
* /opt/cola/permits/1135888131_1613626079.1/0/spring-tx-5-2-8-release-sources-1.jar/org/springframework/transaction/interceptor/TransactionAttributeEditor.java
* /opt/cola/permits/1135888131_1613626079.1/0/spring-tx-5-2-8-release-sources-1.jar/org/springframework/transaction/config/JtaTransactionManagerFactoryBean.java
* /opt/cola/permits/1135888131_1613626079.1/0/spring-tx-5-2-8-release-sources-1.jar/org/springframework/transaction/support/TransactionOperations.java
* /opt/cola/permits/1135888131_1613626079.1/0/spring-tx-5-2-8-release-sources-1.jar/org/springframework/transaction/annotation/Propagation.java
* /opt/cola/permits/1135888131_1613626079.1/0/spring-tx-5-2-8-release-sources-1.jar/org/springframework/transaction/reactive/TransactionOperatorImpl.java
* /opt/cola/permits/1135888131_1613626079.1/0/spring-tx-5-2-8-release-sources-1.jar/org/springframework/transaction/interceptor/TransactionAttribute.java
* /opt/cola/permits/1135888131_1613626079.1/0/spring-tx-5-2-8-release-sources-1.jar/org/springframework/transaction/annotation/SpringTransactionAnnotationParser.java
* /opt/cola/permits/1135888131_1613626079.1/0/spring-tx-5-2-8-release-sources-1.jar/org/springframework/transaction/annotation/Ejb3TransactionAnnotationParser.java
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* /opt/cola/permits/1135888131_1613626079.1/0/spring-tx-5-2-8-release-sources-1-jar/org/springframework/jca/cci/object/MappingRecordOperation.java
* /opt/cola/permits/1135888131_1613626079.1/0/spring-tx-5-2-8-release-sources-1-jar/org/springframework/jca/context/SpringContextResourceAdapter.java
* /opt/cola/permits/1135888131_1613626079.1/0/spring-tx-5-2-8-release-sources-1-jar/org/springframework/jca/cci/CannotCreateRecordException.java
* /opt/cola/permits/1135888131_1613626079.1/0/spring-tx-5-2-8-release-sources-1-jar/org/springframework/jca/context/BootstrapContextAware.java
* /opt/cola/permits/1135888131_1613626079.1/0/spring-tx-5-2-8-release-sources-1-jar/org/springframework/jca/endpoint/GenericMessageEndpointFactory.java
* /opt/cola/permits/1135888131_1613626079.1/0/spring-tx-5-2-8-release-sources-1-jar/org/springframework/jca/cci/connection/CciLocalTransactionManager.java
* /opt/cola/permits/1135888131_1613626079.1/0/spring-tx-5-2-8-release-sources-1-jar/org/springframework/jca/cci/object/SimpleRecordOperation.java
1.238 commons-lang3 3.10

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1.240 libcap 2.22

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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.

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.

Although the Lesser General Public License is less protective of the users' freedom, it does ensure that the user of a program that is linked with the Library has the freedom and the wherewithal to run that program using a modified version of the Library.

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, whereas the latter must be combined with the library in order to run.

^L

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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
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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
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entire whole, and thus to each and every part regardless of who wrote
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This option is useful when you wish to copy part of the code of
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4. You may copy and distribute the Library (or a portion or
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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.

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.)

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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 Library" must include any data and utility programs needed for reproducing the executable from it. However, as a special exception, the materials to be 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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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.)

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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.

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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
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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 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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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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Protocol Buffers for Go with Gadgets

Go support for Protocol Buffers - Google's data interchange format

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procfs provides functions to retrieve system, kernel and process metrics from the pseudo-filesystem proc.

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1.249 kubernetes-api 1.8.11
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Protocol Buffers for Go with Gadgets

Go support for Protocol Buffers - Google's data interchange format

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Bundle-Description: swagger-integration
Automatic-Module-Name: io.swagger.v3.oas.integration
Bundle-License: "Apache License 2.0",\link="http://www.apache.org/licen
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
1.254 luxon 1.25.1

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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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Protocol Buffers for Go with Gadgets

Go support for Protocol Buffers - Google's data interchange format

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1.267 jackson-dataformat-yaml 2.11.2
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# 1.268 ldns 1.7.1

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```
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## DO NOT EDIT - This file generated from ./build-aux/ltmain.in
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# libtool (GNU libtool) 2.4.6
# Provide generalized library-building support services.
# Written by Gordon Matzigkeit <gord@gnu.ai.mit.edu>, 1996

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/* */
/* FILE:sha2.c */
/* AUTHOR:Aaron D. Gifford - http://www.aarongifford.com/ */
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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: sha2.c,v 1.1 2001/11/08 00:01:51 adg Exp adg $
*/

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* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources.jar/org/springframework/security/web/savedrequest/Enumerator.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources.jar/org/springframework/security/web/util/UrlUtils.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources.jar/org/springframework/security/web/access/DefaultWebInvocationPrivilegeEvaluator.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources.jar/org/springframework/security/web/savedrequest/FastHttpDateFormat.java
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* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources.jar/org/springframework/security/web/session/HttpSessionEventPublisher.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources.jar/org/springframework/security/web/PortMapperImpl.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources.jar/org/springframework/security/web/authentication/www/DigestAuthenticationEntryPoint.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources.jar/org/springframework/security/web/PortResolver.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources.jar/org/springframework/security/web/authentication/RememberMeServices.java
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* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/servletapi/SecurityContextHolderAwareRequestFilter.java
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* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/access/channel/InsecureChannelProcessor.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/firewall/StrictHttpFirewall.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/logout/LogoutFilter.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/rememberme/RememberMeAuthenticationFilter.java

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* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/firewall/StrictHttpFirewall.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/logout/LogoutFilter.java
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* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
  jar/org/springframework/security/web/util/matcher/ELRequestMatcher.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
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jar/org/springframework/security/web/server/authentication/WebFilterChainServerAuthenticationSuccessHandler.ja
va
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.450/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/server/authentication/RedirectServerAuthenticationSuccessHandler.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.450/spring-security-web-5-3-4-release-sources-
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.450/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/server/util/matcher/OrServerWebExchangeMatcher.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.450/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/server/results/ServerRedirectStrategy.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.450/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/server/savedrequest/NoOpServerRequestCache.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.450/spring-security-web-5-3-4-release-sources-
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* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/jackson2/DefaultSavedRequestMixin.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/session/SessionInformationExpiredStrategy.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/jackson2/CookieDeserializer.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/jackson2/WebAuthenticationDetailsMixin.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/jackson2/SavedCookieMixin.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/jackson2/WebServletJackson2Module.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/jackson2/CookieMixin.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/jackson2/PreAuthenticatedAuthenticationTokenMixin.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/jackson2/WebJackson2Module.java

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* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/transport/HttpsRedirectWebFilter.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/AbstractAuthenticationTargetUrlRequestHandler.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/session/ConcurrentSessionFilter.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/AuthenticationFilter.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/authentication/ReactivePreAuthenticatedAuthenticationManager.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/access/intercept/RequestKey.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/header/writers/ReferrerPolicyHeaderWriter.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
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* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/jackson2/DefaultCsrfServerTokenMixin.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/jackson2/PreAuthenticatedAuthenticationTokenDeserializer.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/jackson2/WebServerJackson2Module.java

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jar/org/springframework/security/web/server/authentication/AuthenticationWebFilter.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
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* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/session/InvalidSessionAccessDeniedHandler.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/csrf/HttpSessionCsrfTokenRepository.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/csrf/CsrfAuthenticationStrategy.java
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* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/http/SecurityHeaders.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/authentication/logout/HttpStatusReturningServerLogoutSuccessHandler.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/authentication/ServerAuthenticationConverter.java
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* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/reactive/result/method/annotation/AuthenticationPrincipalArgumentResolver.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/ServerHttpBasicAuthenticationConverter.java
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* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/ForwardAuthenticationFailureHandler.java
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* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/header/XXssProtectionServerHttpHeadersWriter.java
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* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/Preauth/AbstractPreAuthenticatedProcessingFilter.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/authentication/preauth/AbstractPreAuthenticatedProcessingFilter.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/authentication/logout/DelegatingServerLogoutHandler.java

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  jar/org/slf4j/bridge/SLF4JBridgeHandler.java

1.273 openssl 1.1.1f-1ubuntu2.3

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* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/body-pix.min.js
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/body-pix.esm.js

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* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/body_pix_test.d.ts
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/body_pix_test.js
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/single_person/argmax2d_test.js
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/body_pix_test.js
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/single_person/argmax2d_test.d.ts

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 *=============================================================================
 */

import * as tf from '@tensorflow/tfjs-core';

/**
 * Takes the sigmoid of the part heatmap output and generates a 2d one-hot tensor
 * with ones where the part's score has the maximum value.
 */
partHeatmapScores
*/

function toFlattenedOneHotPartMap(partHeatmapScores: tf.Tensor3D): tf.Tensor2D {
    const numParts = partHeatmapScores.shape[2];
    const partMapLocations = tf.argmax(partHeatmapScores, 2);
    const partMapFlattened = tf.reshape(partMapLocations, [-1]);
    return tf.oneHot(partMapFlattened, numParts);  
}

    return tf.math.reduce_sum(tf.math.multiply(image, mask));
}

/**
 * Takes the sigmoid of the segmentation output, and generates a segmentation
 * mask with a 1 or 0 at each pixel where there is a person or not a person. The segmentation threshold determines
 * the threshold of a score for a pixel for it to be considered part of a person. * @param segmentScores A 3d-tensor of the sigmoid of the segmentation output
 * @param segmentationThreshold The minimum that segmentation values must have to be considered part of the person. Affects the generation of the segmentation mask and the clipping of the colored part image.
 */

export function toMaskTensor(segmentScores: tf.Tensor3D, threshold: number): tf.Tensor2D {
    return tf.tidy(() => { 
        return tf.cast(tf.math.greater_equal(segmentScores, tf.scalar(threshold)), 'int32');
    });
}

/**
 * Takes the sigmoid of the part map output, and returns a 2d tensor of an image with the corresponding value at each pixel corresponding to the part with the highest value. These part ids are clipped by the segmentation mask. Wherever the a pixel is clipped by the segmentation mask, its value will set to -1, indicating that there is no part in that pixel. * @param segmentScores A 3d-tensor of the sigmoid of the segmentation output. * @param partHeatmapScores A 3d-tensor of thesigmoid of the part heatmap output. The third dimension corresponds to the part. * @returns A 2d tensor of an image with the corresponding value at each pixel corresponding to the part with the highest value. These part ids are clipped * by the segmentation mask. It will have values of -1 for pixels that aren't * outside of the body and do not have a corresponding part. */

    const [partMapHeight, partMapWidth, numParts] = partHeatmapScores.shape;
    const flattenedMap = toFlattenedOneHotPartMap(partHeatmapScores);
    const partNumbers = tf.expandDims(tf.range(0, numParts, 1, 'int32'), 1);
    const partMapFlattened = cast(tf.matmul(flattenedMap, partNumbers as tf.Tensor2D), 'int32');
    const partMapShiftedUpForClipping = tf.add(partMapFlattened, tf.scalar(1, 'int32'));
    const partMapShiftedUpClipped = tf.math.reduce_sum(tf.math.multiply(partMapShiftedUpForClipping, segmentationMask));
    return tf.tidy(() => { 
        return tf.math.reduce_max(partMapShiftedUpClipped);
    });
}

export function decodeOnlyPartSegmentation(partHeatmapScores: tf.Tensor3D): tf.Tensor2D {
    const [partMapHeight, partMapWidth, numParts] = partHeatmapScores.shape;
    const flattenedMap = toFlattenedOneHotPartMap(partHeatmapScores);
    const partNumbers = tf.expandDims(tf.range(0, numParts, 1, 'int32'), 1);
    const partMapFlattened = cast(tf.matmul(flattenedMap, partNumbers as tf.Tensor2D), 'int32');
    const partMapShiftedUpForClipping = tf.add(partMapFlattened, tf.scalar(1, 'int32'));
    const partMapShiftedUpClipped = tf.math.reduce_sum(tf.math.multiply(partMapShiftedUpForClipping, segmentationMask));
    return tf.tidy(() => { 
        return tf.math.reduce_max(partMapShiftedUpClipped);
    });
}

import * as tfconv from '@tensorflow/tfjs-converter';
import * as tf from '@tensorflow/tfjs-core';
import {BodyPixOutputStride} from './types';

/**
 * BodyPix supports using various convolution neural network models
 * (e.g. ResNet and MobileNetV1) as its underlying base model. * The following BaseModel interface defines a unified interface for creating such BodyPix base models. Currently both MobileNet (in ./mobilenet.ts) and ResNet (in ./resnet.ts) implements the BaseMode
 */

}
const inputShape = this.model.inputs[0].shape as [number, number, number, number];

  tf.util.assert(inputShape[1] === -1) && (inputShape[2] === -1), () => `Input shape [${inputShape[1]}, ${inputShape[2]}] must both be equal to or -1`);

  abstract preprocessInput(input: tf.Tensor3D): tf.Tensor3D;

  /**
   * Predicts intermediate Tensor representations.
   * @param input The input RGB image of the base model.
   * @return A dictionary of base model's intermediate predictions.
   * The returned dictionary should contains the following elements:
   * - heatmapScores: A Tensor3D that represents the keypoint heatmap scores.
   * - offsets: A Tensor3D that represents the offsets.
   * - displacementFwd: A Tensor3D that represents the forward displacement.
   * - displacementBwd: A Tensor3D that represents the backward displacement.
   * - segmentation: A Tensor3D that represents the segmentation of all people.
   * - longOffsets: A Tensor3D that represents the long offsets used for instance grouping.
   * - partHeatmaps: A Tensor3D that represents the body part segmentation.
   */
  predict(input: tf.Tensor3D): {
    heatmapScores: tf.Tensor3D,
    offsets: tf.Tensor3D,
    displacementFwd: tf.Tensor3D,
    displacementBwd: tf.Tensor3D,
    segmentation: tf.Tensor3D,
    partHeatmaps: tf.Tensor3D,
    longOffsets: tf.Tensor3D,
    partOffsets: tf.Tensor3D
  } {
    return tf.tidy(() => {
      const asFloat = this.preprocessInput(tf.cast(input, 'float32'));
      const asBatch = tf.expandDims(asFloat, 0);
      const results = this.model.predict(asBatch) as tf.Tensor4D[];
      const results3d: tf.Tensor3D[] = results.map(y => tf.squeeze(y, [0]));
      const namedResults = this.nameOutputResults(results3d);
      return {
        heatmapScores: tf.sigmoid(namedResults.heatmap),
        offsets: namedResults.offsets,
        displacementFwd: namedResults.displacementFwd,
        displacementBwd: namedResults.displacementBwd,
        segmentation: namedResults.segmentation,
        partHeatmaps: namedResults.partHeatmaps,
        longOffsets: namedResults.longOffsets,
        partOffsets: namedResults.partOffsets
      };
    });
  }

  // Because MobileNet and ResNet predict() methods output a different order for these values, we have a method that needs to be implemented to order them.
  abstract nameOutputResults(results: tf.Tensor3D[]): {
    heatmap:
    offsets:
    segmentation:
    partHeatmaps:
    longOffsets:
    partOffsets:
  };

  dispose() {
    this.model.dispose();
  }

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 */

import * as tf from '@tensorflow/tfjs-core';

export class MobileNet extends BaseModel {
  preprocessInput(input: tf.Tensor3D): tf.Tensor3D {
    // Normalize the pixels [0, 255] to be between [-1, 1].
    return tf.tidy(() => tf.sub(tf.div(input, 127.5), 1.0));
  }

  nameOutputResults(results: tf.Tensor3D[]) {
    const [heatmap, offsets, segmentation, partHeatmaps, longOffsets] = results;
    return {
      heatmap,
      offsets,
      segmentation,
      partHeatmaps,
      longOffsets,
      displacementFwd,
      displacementBwd,
      partOffsets
    };
  }
}
export type Tuple<T> = [T, T];
export type StringTuple = Tuple<string>;
export type NumberTuple = Tuple<number>;

export const PART_NAMES = ['nose', 'leftEye', 'rightEye', 'leftEar', 'rightEar', 'leftShoulder', 'rightShoulder', 'leftElbow', 'rightElbow', 'leftWrist', 'rightWrist', 'leftHip', 'rightHip', 'leftKnee', 'rightKnee', 'leftAnkle', 'rightAnkle'];

export const NUM_KEYPOINTS = PART_NAMES.length;

export interface NumberDict {
  [jointName: string]: number;
}

export const PART_IDS = PART_NAMES.reduce((result: NumberDict, jointName, i) => {
  result[jointName] = i;
  return result;
}, {});

export const CONNECTED_PART_NAMES: StringTuple[] = [
  ['leftHip', 'leftShoulder'],
  ['leftElbow', 'leftShoulder'],
  ['leftElbow', 'leftWrist'], ['leftHip', 'leftKnee'],
  ['rightHip', 'rightShoulder'],
  ['rightElbow', 'rightShoulder'],
  ['rightElbow', 'rightWrist'], ['rightHip', 'rightKnee'],
  ['rightKnee', 'rightAnkle'], ['leftShoulder', 'rightShoulder'], ['leftHip', 'rightHip'],
];

/*
 * Define the skeleton. This defines the parent->child relationships of our * tree. Arbitrarily this defines the nose as the root of the tree, however * since we will infer the displacement for both parent->child and * child->parent, we can define the tree root as any node. **/
export const POSE_CHAIN: StringTuple[] = [
  ['nose', 'leftEye'],
  ['leftEye', 'leftEar'],
  ['nose', 'rightEye'],
  ['rightEye', 'rightEar'],
  ['nose', 'leftShoulder'],
  ['leftShoulder', 'leftElbow'],
  ['leftElbow', 'leftWrist'],
  ['leftShoulder', 'leftHip'],
];

const CONNECTED_PART_INDICES = CONNECTED_PART_NAMES.map(([jointNameA, jointNameB]) => [
  PART_IDS[jointNameA],
  PART_IDS[jointNameB]
]);

export function getScale(
    [height, width]: [number, number],
    [inputResolutionY, inputResolutionX]: [number, number],
    padding: Padding): [number, number] {
  const {top: padT, bottom: padB, left: padL, right: padR} = padding;
  const scaleY = inputResolutionY / (padT + padB + height);
  const scaleX = inputResolutionX / (padL + padR + width);
  return [scaleX, scaleY];
}

export function getOffsetPoint(
    y: number, x: number, keypoint: number, offsets: TensorBuffer3D): Vector2D {
  return {
    y: offsets.get(y, x, keypoint),
    x: offsets.get(y, x, keypoint + NUM_KEYPOINTS)
  };
}

export function getImageCoords(
    part: Part, outputStride: number, offsets: TensorBuffer3D): Vector2D {
  const {heatmapY, heatmapX, id: keypoint} = part;
  const {y, x} = getOffsetPoint(heatmapY, heatmapX, keypoint, offsets);
  return {
    x: part.heatmapX * outputStride + x,
    y: part.heatmapY * outputStride + y
  };
}

export function fillArray<T>(element: T, size: number): T[] {
  const result: T[] = new Array(size);
  for (let i = 0; i < size; i++) {
    result[i] = element;
  }
  return result;
}

export function clamp(a: number, min: number, max: number): number {
  if (a < min) {
    return min;
  }
  if (a > max) {
    return max;
  }
  return a;
}

export function squaredDistance(
    y1: number, x1: number, y2: number, x2: number): number {
  const dy = y2 - y1;
  const dx = x2 - x1;
  return dy * dy + dx * dx;
}

export function addVectors(a: Vector2D, b: Vector2D): Vector2D {
  return {x: a.x + b.x, y: a.y + b.y};
}

export function clampVector(a: Vector2D, min: number, max: number): Vector2D {
  return {y: clamp(a.y, min, max), x: clamp(a.x, min, max)};
}

export function OpenSourceUsedInCiscoMeetingServer(onlyAcanoServer) 3.4 3150
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---

*/

import {NUM_KEYPOINTS} from '../keypoints';
import {Padding, Pose} from '../types';

import {getScale} from './util';

interface Pair {
  x: number;
  y: number;
}

function computeDistance(embedding: Pair[], pose: Pose, minPartScore = 0.3) {
  let distance = 0.0;
  let numKpt = 0;
  for (let p = 0; p < embedding.length; p++) {
    if (pose.keypoints[p].score > minPartScore) {
      numKpt += 1;
      distance += (embedding[p].x - pose.keypoints[p].position.x) ** 2 +
        (embedding[p].y - pose.keypoints[p].position.y) ** 2;
    }
  }
  return distance;
}

function convertToPositionInOutput(pose: Pose, keypointsIndex: number) {
  let position = {x: 0, y: 0};
  let x = Math.round(((pose.T + pose.y + 1.0) * scaleY - 1.0) / stride);
  let y = Math.round(((pose.L + pose.x + 1.0) * scaleX - 1.0) / stride);
  return {x, y};
}

function getEmbedding(location: Pair, keypointIndex: number) {
  const newPos = convertToPositionInOutput(location, keypointIndex);
  const nn = newPos.y * outputResolutionX + newPos.x;
  return {x: newPos.x, y: newPos.y};
}

function matchEmbeddingToInstance(location: Pair, longOffsets: Float32Array, poses: Pose[], numKptForMatching: number) {
  let kMin = -1;
  let kMinDist = Infinity;
  for (let k = 0; k < poses.length; k++) {
    const dist = computeDistance(embedding, poses[k]);
    if (dist < kMinDist) {
      kMin = k;
      kMinDist = dist;
    }
  }
  return kMin;
}

function getOutputResolution(inputResolution: number) {
  const outputResolution = Math.round(inputResolution / stride);
  return outputResolution;
}

export function decodeMultipleMasksCPU(segmentation: Uint8Array, longOffsets: Float32Array, poses: Pose[], numKptForMatching: number) {
  for (let i = 0; i < segmentation.length; i++) {
    if (segmentation[i] === 1) {
      const kMin = matchEmbeddingToInstance(location, keypointsIndex);
      if (kMin >= 0) {
        dataArrays[kMin][i] = 1;
      }
    }
  }
  return dataArrays;
}

export function decodeMultiplePartMasksCPU(segmentation: Uint8Array, longOffsets: Float32Array, poses: Pose[], numKptForMatching: number) {
  for (let i = 0; i < segmentation.length; i++) {
    if (segmentation[i] === 1) {
      const kMin = matchEmbeddingToInstance(location, keypointsIndex);
      if (kMin >= 0) {
        dataArrays[kMin][i] = 1;
      }
    }
  }
  return dataArrays;
}
```typescript
getOutputResolution([inHeight, inWidth], stride):\n  for (let i = 0; i < height; i += 1) \n    const n = i * width + j;\n    const prob = segmentation[n];\n    if (prob == 1) \n      const kMin = matchEmbeddingToInstance\n        ([x, 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  return dataArrays[n];\n```

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 *
 *=============================================================================
 */

import * as tf from '@tensorflow/tfjs-core';
import * as tf_webgl from '@tensorflow/tfjs-backend-webgl';

import {NUM_KEYPOINTS} from '../keypoints';
import {Padding, Pose} from '../types';
import {getScale} from './util';

export function decodeMultipleMasksWebGl(
    segmentation: tf.Tensor2D,
    longOffsets: tf.Tensor3D,
    posesAboveScore: Pose[], height: number, width: number, stride: number,
    [inHeight, inWidth]: [number, number], padding: Padding, refineSteps: number, minKptScore: number,
    maxNumPeople: number): tf.TensorInfo {
  // The height/width of the image/canvas itself.
  const [origHeight, origWidth] = segmentation.shape;
  // The height/width of the output of the model.
  const [outHeight, outWidth] = longOffsets.shape.slice(0, 2);
  // Make pose tensor of shape [MAX_NUM_PEOPLE, NUM_KEYPOINTS, 3] where each of the last 3 coordinates correspond to the score, h and w coordinate of that keypoint.
  const poseVals = new Float32Array(maxNumPeople * NUM_KEYPOINTS * 3).fill(0.0);
  for (let i = 0; i < posesAboveScore.length; i++) {
    const poseOffset = i * NUM_KEYPOINTS * 3;
    const pose = posesAboveScore[i];
    for (let kp = 0; kp < NUM_KEYPOINTS; kp++) {
      const keypoint = pose.keypoints[kp];
      const offset = poseOffset + kp * 3;
      poseVals[offset] = keypoint.score;
      poseVals[offset + 1] = keypoint.position.y;
      poseVals[offset + 2] = keypoint.position.x;
    }
  }
  const [scaleX, scaleY] = getScale([height, width], [inHeight, inWidth], padding);
  const posesTensor = tf.tensor(poseVals, [maxNumPeople, NUM_KEYPOINTS, 3]);
  const program: tf_webgl.GPGPUProgram = {
    variableNames: ['segmentation', 'longOffsets', 'poses'],
    outputShape: [origHeight, origWidth],
    userCode: `int convertToPositionInOutput(int pos, int pad, float scale, int stride) {
      return round(pos / scale - 1) / stride;
    }
    float dist(float x1, float y1, float x2, float y2) {
      return pow(x1 - x2, 2.0) + pow(y1 - y2, 2.0);
    }
    float sampleLongOffsets(float h, float w, int d, int k) {
      float dy = sampleLongOffsets(h, w, d, k);
      float dx = sampleLongOffsets(h, w, d, k);
      return mix(dy, dx);
    }
    float findNearestPose(int h, int w) {
      float prob = getSegmentation(h, w);
      if (prob < 1.0) {
        return -1;
      }
      float stridedH = convertToPositionInOutputFloat(h, [padT, padL], [scaleX, scaleY], stride);
      float stridedW = convertToPositionInOutputFloat(w, [padT, padL], [scaleX, scaleY], stride);
      float curDistSum = 0.0;
      for (int k = 0; k < NUM_KEYPOINTS; k++) {
        float dy = sampleLongOffsets(stridedH, strideW, 1, k);
        float dx = sampleLongOffsets(stridedH, strideW, 0, k);
        float y = float(h) + dy;
        float x = float(w) + dx;
        float curDist = dist(x, y, x + dx, y + dy);
        curDistSum += curDist;
      }
      return round(min(curDistSum, curDistSum + 0.000000001));
    }

    // Done(Tyler): convert from output space h/w to strided space.
    float strideH = convertToPositionInOutputFloat(h, [padT, padL], [scaleX, scaleY], stride);
    float strideW = convertToPositionInOutputFloat(w, [padT, padL], [scaleX, scaleY], stride);
    float minDist = 1.0;
    for (int i = 0; i < maxNumPeople; i++) {
      float curDistSum = 0.0;
      for (int k = 0; k < NUM_KEYPOINTS; k++) {
        float dy = sampleLongOffsets(stridedH, strideW, 1, k);
        float dx = sampleLongOffsets(stridedH, strideW, 0, k);
        float y = float(h) + dy;
        float x = float(w) + dx;
        float curDist = dist(x, y, x + dx, y + dy);
        curDistSum += curDist;
      }
      if (curDistSum < minDist) {
        minDist = curDistSum;
        int iMin = i;
      }
    }
    return iMin;
  }`,
  ...`
```
```
float($\lfloor$height - 1.0$\rfloor$));
int xRounded = round(min(x, float($\lfloor$width - 1.0$\rfloor$]));
float xStrided = convertToPositionInOutputFloat($\lfloor$yRounded, $\lfloor$padT$\rfloor$, $\lfloor$scaleY$\rfloor$, $\lfloor$stride$\rfloor$);
float xStrided = convertToPositionInOutputFloat($\lfloor$xRounded, $\lfloor$padL$\rfloor$, $\lfloor$scaleX$\rfloor$, $\lfloor$stride$\rfloor$);
float dy = sampleLongOffsets(yStrided, xStrided, 0, k);
y = y + dy;
x = x + dx;
```

```
open source used in cisco meeting server (formerly acano server) 3.4

```javascript
pose.score >= minPoseScore);\n
let partSegmentationsByPersonData: Int32Array[];\n\nif (isWebglBackend()) {
  const partSegmentations = tf.tidy(() => {
    const masksTensorInfo = decodeMultipleMasksWebGl(\n      segmentation, longOffsets, posesAboveScore, height, width, stride, \n      [inHeight, inWidth], padding, \n      refineSteps, minKeypointScore, \n      maxNumPeople);\n    const masksTensor = tf.engine().makeTensorFromDataId(\n      masksTensorInfo.dataId, masksTensorInfo.shape, \n      masksTensorInfo.dtype) as tf.Tensor2D;\n    return posesAboveScore.map(\n      (_, k) => \n      toPersonKPartSegmentation(masksTensor, partSegmentation, k));\n  });\n
  partSegmentationsByPersonData = (await Promise.all(partSegmentations.map(x => x.data()))) as \n    Int32Array[];\n\n  partSegmentations.forEach(x => x.dispose());
} else {
  const segmentationsData = await segmentation.data() as Uint8Array;\n  const longOffsetsData = await longOffsets.data() as Float32Array;\n  const partSegmentationData = await partSegmentation.data() as Uint8Array;\n  const seg = decodeMultiplePartMasksCPU(\n    segmentationData, longOffsetsData, partSegmentationData, \n    posesAboveScore, height, width, stride, \n    [inHeight, inWidth], padding, \n    refineSteps);\n
  return partSegmentationsByPersonData.map(\n    (data, k) => {
      return {pose: posesAboveScore[k], data, height, \n        width});\n    });
}
```

```
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 */
```

```javascript
function half(k) {
  return Math.floor(k / 2);
}

export class MaxHeap<T> {
  private priorityQueue: T[];\n  private numberOfElements: number;\n  private getElementValue: (element: T) => number;

  constructor(maxSize: number, getElementValue: (element: T) => number) {
    this.priorityQueue = new Array(maxSize);
    this.numberOfElements = -1;
    this.getElementValue = getElementValue;
  }

  public enqueue(x: T): void {
    this.priorityQueue[++this.numberOfElements] = x;
    this.swim(this.numberOfElements);
  }

  public dequeue(): T {
    const max = this.priorityQueue[0];
    this.exchange(0, this.numberOfElements--);
    this.sink(0);
    this.priorityQueue[this.numberOfElements + 1] = null;
    return max;
  }

  public empty(): boolean {
    return this.numberOfElements == -1;
  }

  public size(): number {
    return this.numberOfElements + 1;
  }

  public all(): T[] {
    return this.priorityQueue.slice(0, this.numberOfElements + 1);
  }

  public max(): T {
    return this.priorityQueue[0];
  }

  private swim(k: number): void {
    while (k > 0 && this.less(half(k), k)) {
      this.exchange(k, half(k));
      k = half(k);
    }
  }

  private sink(k: number): void {
    while (2 * k <= this.numberOfElements) {
      let j = 2 * k;
      if (j < this.numberOfElements) {
        j++;
      }
      if (!this.less(k, j)) {
        break;
      }
      this.exchange(k, j);
    }
  }

  private getValueAt(i: number): number {
    return this.getValueAt(i);
  }

  private less(i: number, j: number): boolean {
    return this.getValueAt(i) < this.getValueAt(j);
  }

  private exchange(i: number, j: number): void {
    const t = this.setValueAt(i);
    this.setValueAt(j);
    this.setValueAt(t);
  }

  private this.setValueAt(i: number): number {
    return this.getValueAt(i);
  }

  private this.exchange(i: number, j: number): void {
    const t = this.setValueAt(i);
    this.setValueAt(j);
    this.setValueAt(t);
  }
```

```javascript
/**
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 *
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 */
```

---

Open Source Used In Cisco Meeting Server (formerly Acano Server) 3.4

---

Open Source Used In Cisco Meeting Server (formerly Acano Server) 3.4 3154
import {PartWithScore, TensorBuffer3D} from './types';
import {MaxHeap} from './max_heap';

function scoreIsMaximumInLocalWindow(
    keypointId: number, score: number, heatmapY: number, heatmapX: number, localMaximumRadius: number, scores: TensorBuffer3D): boolean {
  const [height, width] = scores.shape;
  let localMaximum = true;
  const yStart = Math.max(heatmapY - localMaximumRadius, 0);
  const xStart = Math.max(heatmapX - localMaximumRadius, 0);
  const yEnd = Math.min(heatmapY + localMaximumRadius + 1, height);
  const xEnd = Math.min(heatmapX + localMaximumRadius + 1, width);
  for (let yCurrent = yStart; yCurrent < yEnd; ++yCurrent) {
    const xCurrent = xStart;
    for (let xCurrent = xStart; xCurrent < xEnd; ++xCurrent) {
      if (scores.get(yCurrent, xCurrent, keypointId) > score) {
        localMaximum = false;
        break;
      }
    }
    if (!localMaximum) {
      break;
    }
  }
  return localMaximum;
}

export function buildPartWithScoreQueue(
    scoreThreshold: number, localMaximumRadius: number, scores: TensorBuffer3D): MaxHeap<PartWithScore> {
  const [height, width, numKeypoints] = scores.shape;
  const queue = new MaxHeap<PartWithScore>(
      height * width * numKeypoints, ({score}) => score);
  for (let heatmapY = 0; heatmapY < height; ++heatmapY) {
    for (let heatmapX = 0; heatmapX < width; ++heatmapX) {
      for (let keypointId = 0; keypointId < numKeypoints; ++keypointId) {
        const score = scores.get(heatmapY, heatmapX, keypointId);
        // Only consider parts with score greater or equal to threshold as root candidates.
        if (score < scoreThreshold) {
          continue;
        }
        // Only consider keypoints whose score is maximum in a local window.
        if (scoreIsMaximumInLocalWindow(
            keypointId, score, heatmapY, heatmapX, localMaximumRadius, scores)) {
          queue.enqueue({score, part: {heatmapY, heatmapX, id: keypointId}});
        }
      }
    }
  }
  return queue;
}

/**
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 *
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 * software distributed under the License is distributed on an "AS IS" BASIS,
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
 * See the License for the specific language governing permissions and limitations under the License.
 */
neighbor interpolation for the source->target displacements.

```javascript
const sourceKeypointIndices = getStridedIndexNearPoint(sourceKeypoint.position, outputStride, height, width);
const displacement = getDisplacement(edgeId, sourceKeypointIndices, displacements);
const displacedPoint = addVectors(sourceKeypoint.position, displacement);
let targetKeypoint = displacedPoint;
for (let offsetRefineStep = 0; i < numRefineSteps; i++) {
  const targetKeypointIndices = getStridedIndexNearPoint(targetKeypoint, outputStride, height, width);
  const targetKeypoint = addVectors(targetKeypoint, displacementsBwd);
  const targetKeyPointIndices = getStridedIndexNearPoint(targetKeypoint, outputStride, height, width);
  const score = scoresBuffer.get(targetKeyPointIndices.y, targetKeyPointIndices.x);
  return {position: targetKeypoint, part: PART_NAMES[targetKeyPointId], score};
}
```

```javascript
/**
 * Follows the displacement fields to decode the full pose of the object instance given the position of a part that acts as root.
 * @return An array of decoded keypoints and their scores for a single pose
 */
export function decodePose(root: PartWithScore, scores: TensorBuffer3D, offsets: number, displacementsFwd: TensorBuffer3D, displacementsBwd: TensorBuffer3D): Keypoint[] {
  const numParts = scores.shape[2];
  const numEdges = parentToChildEdges.length;
  // Start a new detection instance at the position of the root.
  const {part: rootPart, score: rootScore} = root;
  const rootPoint = getImageCoords(rootPart, outputStride, offsets);
  const instanceKeypoints[rootPart.id] = {score: rootScore, part: PART_NAMES[rootPart.id], position: rootPoint};
  // Decode the part positions upwards in the tree, following the backward displacements.
  for (let edge = numEdges - 1; edge >= 0; --edge) {
    const sourceKeypointId = parentToChildEdges[edge];
    const targetKeypointId = childToParentEdges[edge];
    if (instanceKeypoints[sourceKeypointId] && !instanceKeypoints[targetKeypointId]) {
      instanceKeypoints[targetKeypointId] = decodeToTargetKeypoint(edge, instanceKeypoints[sourceKeypointId], targetKeypointId, scores, offsets, outputStride, displacementsBwd);
    }
  }
  // Decode the part positions downwards in the tree, following the forward displacements.
  for (let edge = 0; edge < numEdges; ++edge) {
    const sourceKeypointId = childToParentEdges[edge];
    const targetKeypointId = parentToChildEdges[edge];
    if (instanceKeypoints[sourceKeypointId] && !instanceKeypoints[targetKeypointId]) {
      instanceKeypoints[targetKeypointId] = decodeToTargetKeypoint(edge, instanceKeypoints[sourceKeypointId], targetKeypointId, scores, offsets, outputStride, displacementsFwd);
      return instanceKeypoints;
    }
  }

  *!
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  *
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  *
  *=============================================================================
  */

  import {Keypoint, Pose, TensorBuffer3D} from '../types';
  import {buildPartWithScoreQueue} from './build_part_with_score_queue';
  import {decodePose} from './decode_pose';
  import {getImageCoords, squaredDistance} from './util';

  function withinNmsRadiusOfCorrespondingPoint(poses: Pose[], squaredNmsRadius: number, {x, y}: {x: number, y: number}, keypointId: number): boolean {
    return poses.some(({keypoints}) => {
      const correspondingKeypoint = keypoints[keypointId].position;
      return squaredDistance(x, y, correspondingKeypoint.y, correspondingKeypoint.x) <= squaredNmsRadius;
    });
  }

  function getInstanceScore(existingPoses: Pose[], squaredNmsRadius: number, instanceKeypoints: Keypoint[]): number {
    let notOverlappedKeypointScores = instanceKeypoints.reduce((result, {position, score}, keypointId) =>
      {position: targetKeypoint, part: PART_NAMES[targetKeypointId], score: score;}
    };
```
if (!withinNmsRadiusOfCorrespondingPoint(existingPoses, squaredNmsRadius, position, keypointId)) {
  result += score;
}
return result;

notOverlappedKeypointScores /= instanceKeypoints.length;
A point \((y, x)\) is considered as root part candidate if its score is \(\text{an} //\) maximum in a window \(\lceil y - y'\rceil \leq k\text{LocalMaximumRadius}, \lceil x - x'\rceil \leq \text{an} //\)

kLocalMaximumRadius.\nconst kLocalMaximumRadius = 1;\n/**\n * Detects multiple poses and finds their parts from part scores and\n * displacement vectors. It returns up to \(\text{maxDetections}\) `object instance` detections in\n * decreasing root score order. It works as follows: We first\n * create a priority queue with local part score maxima\n * above \(\text{score Threshold}\), considering all parts at the same time. Then we\n * iteratively pull the top element of\n * the queue (in decreasing score order) 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 of \(\text{nmsRadius}\) pixels from the\n * corresponding part of a previously detected\n * instance, which is a form of part-based non-maximum suppression\n * (NMS). If the root candidate passes the NMS check, we start a new object instance\n * detection, treating the\n * corresponding part as root and finding the\n * positions of the remaining parts by following the displacement\n * vectors along the tree-structured part graph. We assign to the newly detected\n * instance a score equal to the\n * sum of scores of its parts which have not\n * been claimed by a previous instance (i.e., those at least \(\text{nmsRadius}\)\n * pixels away from the corresponding part of all previously detected\n * instances), divided by the total number of\n * parts \(\text{numParts}\).\n
const kLocalMaximumRadius = 1;

/**\n * Detects multiple poses and finds their parts from part scores and\n * displacement vectors. It returns up to \(\text{maxDetections}\) `object instance` detections in\n * decreasing root score order. It works as follows: We first\n * create a priority queue with local part score maxima\n * above \(\text{score Threshold}\), considering all parts at the same time. Then we\n * iteratively pull the top element of\n * the queue (in decreasing score order) 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 of \(\text{nmsRadius}\) pixels from the\n * corresponding part of a previously detected\n * instance, which is a form of part-based non-maximum suppression\n * (NMS). If the root candidate passes the NMS check, we start a new object instance\n * detection, treating the\n * corresponding part as root and finding the\n * positions of the remaining parts by following the displacement\n * vectors along the tree-structured part graph. We assign to the newly detected\n * instance a score equal to the\n * sum of scores of its parts which have not\n * been claimed by a previous instance (i.e., those at least \(\text{nmsRadius}\)\n * pixels away from the corresponding part of all previously detected\n * instances), divided by the total number of\n * parts \(\text{numParts}\).\n
const kLocalMaximumRadius = 1;

/**\n * Detects multiple poses and finds their parts from part scores and\n * displacement vectors. It returns up to \(\text{maxDetections}\) `object instance` detections in\n * decreasing root score order. It works as follows: We first\n * create a priority queue with local part score maxima\n * above \(\text{score Threshold}\), considering all parts at the same time. Then we\n * iteratively pull the top element of\n * the queue (in decreasing score order) 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 of \(\text{nmsRadius}\) pixels from the\n * corresponding part of a previously detected\n * instance, which is a form of part-based non-maximum suppression\n * (NMS). If the root candidate passes the NMS check, we start a new object instance\n * detection, treating the\n * corresponding part as root and finding the\n * positions of the remaining parts by following the displacement\n * vectors along the tree-structured part graph. We assign to the newly detected\n * instance a score equal to the\n * sum of scores of its parts which have not\n * been claimed by a previous instance (i.e., those at least \(\text{nmsRadius}\)\n * pixels away from the corresponding part of all previously detected\n * instances), divided by the total number of\n * parts \(\text{numParts}\).\n
const kLocalMaximumRadius = 1;
import * as tf from '@tensorflow/tfjs-core';

import {BaseModel} from './base_model';

export class ResNet extends BaseModel {
  preprocessInput(input: tf.Tensor3D): tf.Tensor3D {
    return tf.add(input, imageNetMean);
  }

  nameOutputResults(results: tf.Tensor3D[]): {
    const [displacementBwd, displacementFwd, offset, partHeatmaps, segmentation, partOffsets] = results;
    return {
      offset, segmentation, partHeatmaps, longOffsets, heatmap, displacementFwd, displacementBwd, partOffsets, heatmap, displacementBwd, partOffsets, longOffsets, heatmap, displacementFwd, displacementBwd, partOffsets
    };
  }
}

// The BodyPix 2.0 ResNet50 models use the latest TensorFlow.js 1.0 model format.
// quantBytes=4 corresponding to the non-quantized full-precision SavedModel.
export function resNet50SavedModel(stride: number, quantBytes: number): string {
  const graphJson = `model-stride${stride}.json`;
  if (quantBytes === 4) {
    return RESNET50_BASE_URL + `float/` + graphJson;
  } else {
    return RESNET50_BASE_URL + `quant${quantBytes}/` + graphJson;
  }
}

// The BodyPix 2.0 MobileNetV1 models use the latest TensorFlow.js 1.0 model format.
export function mobileNetSavedModel(stride: number, multiplier: number, quantBytes: number): string {
  const toStr: {[key: number]: string} = {1.0: '100', 0.75: '075', 0.50: '050'};
  const graphJson = `model-stride${stride}.json`;
  if (quantBytes === 4) {
    return MOBILENET_BASE_URL + `float/${toStr[multiplier]}/` + graphJson;
  } else {
    return MOBILENET_BASE_URL + `quant${quantBytes}/${toStr[multiplier]}/` + graphJson;
  }
}

// The BodyPix 2.0 MobileNetV1 models use the latest TensorFlow.js 1.0 model format.
export function mobileNetSavedModel(stride: number, multiplier: number, quantBytes: number): string {
  const toStr: {[key: number]: string} = {1.0: '100', 0.75: '075', 0.50: '050'};
  const graphJson = `model-stride${stride}.json`;
  if (quantBytes === 4) {
    return MOBILENET_BASE_URL + `float/` + graphJson;
  } else {
    return MOBILENET_BASE_URL + `quant${quantBytes}/` + graphJson;
  }
}

// The BodyPix 2.0 MobileNetV1 models use the latest TensorFlow.js 1.0 model format.
export function mobileNetSavedModel(stride: number, multiplier: number, quantBytes: number): string {
  const toStr: {[key: number]: string} = {1.0: '100', 0.75: '075', 0.50: '050'};
  const graphJson = `model-stride${stride}.json`;
  if (quantBytes === 4) {
    return MOBILENET_BASE_URL + `float/` + graphJson;
  } else {
    return MOBILENET_BASE_URL + `quant${quantBytes}/` + graphJson;
  }
}
and width.
  // We can't test the .height and .width properties directly, // because they evaluate to 0 if unset.
  return [input.height, input.width];
} else {
  return [input.videoHeight, input.videoWidth];
}

export function getInputSize(input: BodyPixInput): [number, number] {
  return ((typeof (HTMLCanvasElement) !== 'undefined' && input instanceof HTMLCanvasElement) || (typeof (OffscreenCanvas) !== 'undefined' && input instanceof OffscreenCanvas) || (typeof (HTMLImageElement) !== 'undefined' && input instanceof HTMLImageElement)) ? return getSizeFromImageLikeElement(input); } else if (typeof (ImageData) !== 'undefined' && input instanceof ImageData) {
    return [input.height, input.width];
  } else if (typeof (HTMLVideoElement) !== 'undefined' && input instanceof HTMLVideoElement) {
    return getSizeFromVideoElement(input);
  } else if (input instanceof tf.Tensor) {
    return [input.shape[0], input.shape[1]];
} else {
    throw new Error(`error: Unknown input type: ${input}.`);
}

function getInputSize(input: BodyPixInput): [number, number] {
  if ((typeof (HTMLCanvasElement) !== 'undefined' && input instanceof HTMLCanvasElement) || (typeof (OffscreenCanvas) !== 'undefined' && input instanceof OffscreenCanvas) || (typeof (HTMLImageElement) !== 'undefined' && input instanceof HTMLImageElement)) {
    return getSizeFromImageLikeElement(input);
} else if (typeof (ImageData) !== 'undefined' && input instanceof ImageData) {
    return [input.height, input.width];
  } else if (typeof (HTMLVideoElement) !== 'undefined' && input instanceof HTMLVideoElement) {
    return getSizeFromVideoElement(input);
  } else if (input instanceof tf.Tensor) {
    return [input.shape[0], input.shape[1]];
} else {
    throw new Error(`error: Unknown input type: ${input}.`);
}

export function getInputSize(input: BodyPixInput): [number, number] {
  if ((typeof (HTMLCanvasElement) !== 'undefined' &&
       input instanceof HTMLCanvasElement) ||
      (typeof (OffscreenCanvas) !== 'undefined' &&
          input instanceof OffscreenCanvas) ||
      (typeof (HTMLImageElement) !== 'undefined' &&
          input instanceof HTMLImageElement)) {
    return getSizeFromImageLikeElement(input);
  } else if (typeof (ImageData) !== 'undefined' && input instanceof ImageData) {
    return [input.height, input.width];
  } else if (typeof (HTMLVideoElement) !== 'undefined' && input instanceof HTMLVideoElement) {
    return getSizeFromVideoElement(input);
  } else if (input instanceof tf.Tensor) {
    return [input.shape[0], input.shape[1]];
  } else {
    throw new Error(`error: Unknown input type: ${input}.`);
}

export function getInputSize(input: BodyPixInput): [number, number] {
  if ((typeof (HTMLCanvasElement) !== 'undefined' &&
       input instanceof HTMLCanvasElement) ||
      (typeof (OffscreenCanvas) !== 'undefined' &&
          input instanceof OffscreenCanvas) ||
      (typeof (HTMLImageElement) !== 'undefined' &&
          input instanceof HTMLImageElement)) {
    return getSizeFromImageLikeElement(input);
  } else if (typeof (ImageData) !== 'undefined' && input instanceof ImageData) {
    return [input.height, input.width];
  } else if (typeof (HTMLVideoElement) !== 'undefined' && input instanceof HTMLVideoElement) {
    return getSizeFromVideoElement(input);
  } else if (input instanceof tf.Tensor) {
    return [input.shape[0], input.shape[1]];
  } else {
    throw new Error(`error: Unknown input type: ${input}.`);
}

export function getInputSize(input: BodyPixInput): [number, number] {
  if ((typeof (HTMLCanvasElement) !== 'undefined' &&
       input instanceof HTMLCanvasElement) ||
      (typeof (OffscreenCanvas) !== 'undefined' &&
          input instanceof OffscreenCanvas) ||
      (typeof (HTMLImageElement) !== 'undefined' &&
          input instanceof HTMLImageElement)) {
    return getSizeFromImageLikeElement(input);
  } else if (typeof (ImageData) !== 'undefined' && input instanceof ImageData) {
    return [input.height, input.width];
  } else if (typeof (HTMLVideoElement) !== 'undefined' && input instanceof HTMLVideoElement) {
    return getSizeFromVideoElement(input);
  } else if (input instanceof tf.Tensor) {
    return [input.shape[0], input.shape[1]];
  } else {
    throw new Error(`error: Unknown input type: ${input}.`);
}

export function getInputSize(input: BodyPixInput): [number, number] {
  if ((typeof (HTMLCanvasElement) !== 'undefined' &&
       input instanceof HTMLCanvasElement) ||
      (typeof (OffscreenCanvas) !== 'undefined' &&
          input instanceof OffscreenCanvas) ||
      (typeof (HTMLImageElement) !== 'undefined' &&
          input instanceof HTMLImageElement)) {
    return getSizeFromImageLikeElement(input);
  } else if (typeof (ImageData) !== 'undefined' && input instanceof ImageData) {
    return [input.height, input.width];
  } else if (typeof (HTMLVideoElement) !== 'undefined' && input instanceof HTMLVideoElement) {
    return getSizeFromVideoElement(input);
  } else if (input instanceof tf.Tensor) {
    return [input.shape[0], input.shape[1]];
  } else {
    throw new Error(`error: Unknown input type: ${input}.`);
}

export function getInputSize(input: BodyPixInput): [number, number] {
  if ((typeof (HTMLCanvasElement) !== 'undefined' &&
       input instanceof HTMLCanvasElement) ||
      (typeof (OffscreenCanvas) !== 'undefined' &&
          input instanceof OffscreenCanvas) ||
      (typeof (HTMLImageElement) !== 'undefined' &&
          input instanceof HTMLImageElement)) {
    return getSizeFromImageLikeElement(input);
  } else if (typeof (ImageData) !== 'undefined' && input instanceof ImageData) {
    return [input.height, input.width];
  } else if (typeof (HTMLVideoElement) !== 'undefined' && input instanceof HTMLVideoElement) {
    return getSizeFromVideoElement(input);
  } else if (input instanceof tf.Tensor) {
    return [input.shape[0], input.shape[1]];
  } else {
    throw new Error(`error: Unknown input type: ${input}.`);
}

export function getInputSize(input: BodyPixInput): [number, number] {
  if ((typeof (HTMLCanvasElement) !== 'undefined' &&
       input instanceof HTMLCanvasElement) ||
      (typeof (OffscreenCanvas) !== 'undefined' &&
          input instanceof OffscreenCanvas) ||
      (typeof (HTMLImageElement) !== 'undefined' &&
          input instanceof HTMLImageElement)) {
    return getSizeFromImageLikeElement(input);
  } else if (typeof (ImageData) !== 'undefined' && input instanceof ImageData) {
    return [input.height, input.width];
  } else if (typeof (HTMLVideoElement) !== 'undefined' && input instanceof HTMLVideoElement) {
    return getSizeFromVideoElement(input);
  } else if (input instanceof tf.Tensor) {
    return [input.shape[0], input.shape[1]];
  } else {
    throw new Error(`error: Unknown input type: ${input}.`);
}

export function getInputSize(input: BodyPixInput): [number, number] {
  if ((typeof (HTMLCanvasElement) !== 'undefined' &&
       input instanceof HTMLCanvasElement) ||
      (typeof (OffscreenCanvas) !== 'undefined' &&
          input instanceof OffscreenCanvas) ||
      (typeof (HTMLImageElement) !== 'undefined' &&
          input instanceof HTMLImageElement)) {
    return getSizeFromImageLikeElement(input);
  } else if (typeof (ImageData) !== 'undefined' && input instanceof ImageData) {
    return [input.height, input.width];
  } else if (typeof (HTMLVideoElement) !== 'undefined' && input instanceof HTMLVideoElement) {
    return getSizeFromVideoElement(input);
  } else if (input instanceof tf.Tensor) {
    return [input.shape[0], input.shape[1]];
  } else {
    throw new Error(`error: Unknown input type: ${input}.`);
}
const resizedAndPadded = tf.pad3d(resized, [[padT, padB], [padL, padR], [0, 0]]);

const padded = tf.pad3d(resized, [[padT, padB], [padL, padR]]);

const paddedBy = [[padT, padB], [padL, padR]];

export function scaleAndCropToInputTensorShape(tensor: tf.Tensor3D, inputTensorHeight: number, inputTensorWidth: number, resizedAndPaddedHeight: number, resizedAndPaddedWidth: number, [padT, padB], [padL, padR]): {number, number, number, number} {
  applySigmoidActivation = false;
  return tf.Tensor3D({
    resizedAndPaddedHeight, resizedAndPaddedWidth, true:
  };

  const resizedAndPadded = tf.image.resizeBilinear(tensor, [
    inputTensorHeight, inputTensorWidth]: [number, number],
    resizedAndPaddedHeight, resizedAndPaddedWidth: [number, number],
    [padT, padB], [padL, padR]): [number, number, number, number]);

  return resizedAndPadded;
}

export function scaleAndCropToInputTensorShape(tensor: tf.Tensor3D, inputTensorHeight: number, inputTensorWidth: number, resizedAndPaddedHeight: number, resizedAndPaddedWidth: number, [padT, padB], [padL, padR]): {number, number, number, number} {
  applySigmoidActivation = false;
  return tf.Tensor3D({
    resizedAndPaddedHeight, resizedAndPaddedWidth, true:
  };

  const resizedAndPadded = tf.image.resizeBilinear(tensor, [
    inputTensorHeight, inputTensorWidth]: [number, number],
    resizedAndPaddedHeight, resizedAndPaddedWidth: [number, number],
    [padT, padB], [padL, padR]): [number, number, number, number]);

  return resizedAndPadded;
}

export function removePaddingAndResizeBack(resizedAndPadded: tf.Tensor3D, [originalHeight, originalWidth]: [number, number], [padT, padB], [padL, padR]): tf.Tensor3D {
  return tf.tidy(() => {
    const batchedImage: tf.Tensor4D = tf.expandDims(resizedAndPadded);

    const originBound = {top: padT / (originalHeight + padT + padB - 1.0),
        left: padL / (originalWidth + padL + padR - 1.0),
        bottom: (padT + originalHeight - 1.0) / (originalHeight + padT + padB - 1.0),
        right: (padL + originalWidth - 1.0) / (originalWidth + padL + padR - 1.0)};

    return tf.squeeze(tf.image.cropAndResize(
        batchedImage, originBound, [0], [originalHeight, originalWidth]), [0]);
  });
}

export function resize2d(tensor: tf.Tensor2D, resolution: [number, number], nearestNeighbor?: boolean): tf.Tensor2D {
  return tf.tidy(() => {
    const batchedImage: tf.Tensor4D = tf.expandDims(tensor, 2);

    return tf.squeeze(tf.image.resizeBilinear(batchedImage, resolution, nearestNeighbor));
  });
}

export function padAndResizeTo(input: BodyPixInput, [targetH, targetW]: [number, number]): {resized: tf.Tensor3D, padding: Padding} {
  const [height, width] = getInputSize(input);
  const targetAspect = targetW / targetH;
  const aspect = width / height;
  let [padT, padB, padL, padR] = [0, 0, 0, 0];

  if (aspect < targetAspect) {
    // pads the width
    padT = 0;
    padB = 0;
    padL = Math.round(0.5 * (targetAspect * height - width));
    padR = Math.round(0.5 * (targetAspect * height - width));
  } else {
    // pads the height
    padT = Math.round(0.5 * ((1.0 / targetAspect) * width - height));
    padB = Math.round(0.5 * ((1.0 / targetAspect) * width - height));
    padL = 0;
    padR = 0;
  }

  const resized: tf.Tensor3D = tf.tidy(() => {
    let imageTensor = toInputTensor(input);
    imageTensor = tf.pad3d(imageTensor, [[padT, padB], [padL, padR], [0, 0]]);

    return tf.image.resizeBilinear(imageTensor, [targetH, targetW]);
  });

  return {resized, padding: {top: padT, left: padL, right: padR, bottom: padB}};
}

export async function toTensorBuffers3D(tensors: tf.Tensor3D[]): Promise<TensorBuffer3D[]> {
  return Promise.all(tensors.map(tensor => tensor.buffer()));
}

export function scalePose(pose: Pose, scaleY: number, scaleX: number, offsetY = 0, offsetX = 0): Pose {
  return {
    score: pose.score,
    keypoints: pose.keypoints.map(({score, part, position}) => ({
      score,
      part,
      position: {
        x: position.x * scaleX + offsetX,
        y: position.y * scaleY + offsetY
      }
    }))
  };
}

export function scalePoses(poses: Pose[], scaleY: number, scaleX: number, offsetY = 0, offsetX = 0) {
  return poses.map(pose => scalePose(pose, scaleY, scaleX, offsetY, offsetX));
}

export function flipPoseHorizontal(pose: Pose, imageWidth: number): Pose {
  return {
    score: pose.score,
    keypoints: pose.keypoints.map((keypoint) => ({
      x: imageWidth - 1 - position.x,
      y: position.y
    }))
  };
}

export function flipPosesHorizontal(poses: Pose[], imageWidth: number): Pose[] {
  return poses.map(pose => flipPoseHorizontal(pose, imageWidth));
}

export function scaleAndFlipPoses(poses: Pose[], [height, width]: [number, number], [inputResolutionHeight, inputResolutionWidth]: [number, number], padding: Padding, flipHorizontal: boolean) { return const scaleY = ((height + padding.top + padding.bottom) / (inputResolutionHeight));
  const scaleX = ((width + padding.left + padding.right) / (inputResolutionWidth));

  const scaledPoses = poses.map(pose => {
    const scaledPose = {
      score: pose.score,
      keypoints: pose.keypoints.map((keypoint) => ({
        x: scaleX * (keypoint.x - padding.left) - padding.right - (padding.top + padding.bottom) - 1,
        y: scaleY * (keypoint.y - padding.top) - padding.bottom - (padding.left + padding.right) - 1
      }))
    }

    return scaledPose;
  });

  return scaledPoses;
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```javascript
import * as tfconv from '@tensorflow/tfjs-converter';
import * as tf from '@tensorflow/tfjs-core';

import {BaseModel} from './base_model';
import {decodeOnlyPartSegmentation, decodePartSegmentation, toMaskTensor} from './decode_part_map';
import {MobileNet} from './mobilenet';
import {decodePersonInstanceMasks, decodePersonInstancePartMasks} from './multi_person/decode_instance_masks';
import {decodeMultiplePoses} from './multi_person/decode_multiple_poses';
import {ResNet} from './resnet';
import {mobileNetSavedModel, resNet50SavedModel} from './saved_models';
import {BodyPixArchitecture, BodyPixInput, BodyPixInternalResolution, BodyPixMultiplier, BodyPixOutputStride, BodyPixQuantBytes, Padding} from './types';
import {PartSegmentation, PersonSegmentation, SemanticPartSegmentation, SemanticPersonSegmentation} from './types';
import {getInputSize, padAndResizeTo, scaleAndCropToInputTensorShape, scaleAndFlipPoses, toInputResolutionHeightAndWidth, toTensorBuffers3D} from './util';

const APPLY_SIGMOID_ACTIVATION = true;
const FLIP_POSES_AFTER_SCALING = false;

/**
 * BodyPix model loading is configurable using the following config dictionary.
 *
 * `architecture`: BodyPixArchitecture. It determines which BodyPix architecture
 * to load. The supported architectures are: MobileNetV1 and ResNet50.
 *
 * `outputStride`: Specifies the output stride of the BodyPix model.
 * The smaller the value, the larger the output resolution, and more accurate the model at the cost of speed. Set this to a larger value to increase speed at the cost of accuracy. Stride 32 is supported for ResNet and stride 8,16,32 are supported for various MobileNetV1 models.
 *
 * `multiplier`: An optional number with values: 1.01, 1.0, 0.75, or 0.50. The value is used only by MobileNet architecture. It is the float multiplier for the depth (number of channels) for all convolution ops. The larger the value, the larger the size of the layers, and more accurate the model at the cost of speed. Set this to a smaller value to increase speed at the cost of accuracy.
 *
 * `modelUrl`: An optional string that specifies custom url of the model. This is useful for area/countries that don't have access to the model hosted on GCP. An optional number with values: 1, 2, or 4. This parameter affects weight quantization in the models. The available options are: 1 byte, 2 bytes, and 4 bytes. The higher the value, the larger the model size and thus the longer the loading time, the lower the value, the shorter the loading time but lower the accuracy.
 *
 */
export interface ModelConfig {
  architecture: BodyPixArchitecture;
  outputStride: BodyPixOutputStride;
  multiplier?: BodyPixMultiplier;
  modelUrl?: string;
  quantBytes?: BodyPixQuantBytes;
}

// The default configuration for loading MobileNetV1 based BodyPix.
// The default configuration for loading ResNet50 based BodyPix.
const MOBILENET_V1_CONFIG = {
  architecture: 'MobileNetV1',
  outputStride: 16,
  quantBytes: 4,
} as ModelConfig;

const RESNET_CONFIG = {
  architecture: 'ResNet50',
  outputStride: 32,
  quantBytes: 4,
} as ModelConfig;

// VALID_ARCHITECTURE: BodyPixArchitecture[] = ['MobileNetV1', 'ResNet50'];
// VALID_STRIDE: [16, 32, 32];
// VALID_MULTIPLIER: [1.0];

validateModelConfig(config: ModelConfig): BodyPixQuantBytes[] {
  if (config.architecture == null) {
    config.architecture = 'MobileNetV1';
  }
  if (VALID_ARCHITECTURE.indexOf(config.architecture) < 0) {
    throw new Error('Invalid architecture: $config.architecture. Should be one of [' + VALID_ARCHITECTURE.join(', ') + ']);
  }
  if (config.outputStride == null) {
    config.outputStride = 16;
  }
  if (config.quantBytes == null) {
    config.quantBytes = 4;
  }
  return;
}
```


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```javascript
== null) {
    config.outputStride = 16;
  }
  if (VALID_STRIDE[config.architecture].indexOf(config.outputStride) < 0) {
    throw new Error(`Invalid outputStride: ${config.outputStride}. ` +
                      `Should be one of ${{VALID_STRIDE[config.architecture]}} ` +
                      `for architecture ${config.architecture}.`);
  }

  if (config.multiplier == null) {
    config.multiplier = 1.0;
  }
  if (VALID_MULTIPLIER[config.architecture].indexOf(config.multiplier) < 0) {
    throw new Error(`Invalid multiplier: ${config.multiplier}. ` +
                      `Should be one of ${VALID_MULTIPLIER[config.architecture]} ` +
                      `for architecture: ${config.architecture}.`);
  }

  if (config.quantBytes == null) {
    config.quantBytes = 4;
  }
  if (VALID_QUANT_BYTES.indexOf(config.quantBytes) < 0) {
    throw new Error(`Invalid quantBytes: ${config.quantBytes}. ` +
                      `Should be one of ${VALID_QUANT_BYTES} ` +
                      `for architecture: ${config.architecture}.`);
  }

  return config;
}

/**
 * BodyPix inference is configurable using the
 * following config dictionary.
 *
 * `flipHorizontal`: If the left-right keypoint of poses/part segmentation
 * should be flipped/mirrored horizontally. This should be set to true for
 * videos where the video is by default flipped horizontally (i.e. a webcam),
 * and you want the person & body part segmentation to be returned in the proper
 * orientation.
 *
 * `internalResolution`: Defaults to 'medium'. The internal resolution
 * percentage that the input
 * is resized to before inference. The larger the internal resolution, the more accurate the model at the cost of slower
 * prediction times. Available values are 'low', 'medium', 'high', 'full', or a number
 * percentage value between 0 and 1. The values 'low', 'medium', 'high', and 'full'
 * map to 0.25, 0.5, 0.75, and 1.0 correspondingly.
 *
 * `segmentationThreshold`: The minimum that segmentation values must have to be considered part of the person. Affects the generation of the segmentation mask. More specifically, it is the threshold used to binarize the
 * intermediate person segmentation probability. The probability of each pixel belongs to a person is in range [0, 1]. If the probability is greater than the segmentationThreshold, it will be set to 1 otherwise 0.
 *
 */
export interface InferenceConfig {
  flipHorizontal?: boolean;
  internalResolution?: BodyPixInternalResolution;
  segmentationThreshold?: number;
}

/**
 * Person Inference Config
 *
 * `maxDetections`: Defaults to 10.
 * Maximum number of person pose detections per image. Only return
 * person pose that have root part score greater or equal to this value.
 *
 * `scoreThreshold`: Defaults to 0.4.
 * Only returns and uses person poses for instance segmentation assignment when the pose has root part score greater or equal to this value.
 *
 * `nmsRadius`: Defaults to 20.
 * Non-maximum suppression part distance in pixels. It needs to be strictly positive. Two pose keypoints suppress each other if they are less than 'nmsRadius' pixels away.
 *
 */
export interface PersonInferenceConfig extends InferenceConfig {
  maxDetections?: number;
  scoreThreshold?: number;
  nmsRadius?: number;
  minKeypointScore?: number;
  refineSteps?: number;
}

/**
 * Multiple Person Instance Inference Config
 *
 * `maxDetections`: Defaults to 10.
 * Maximum number of returned instance segmentation and pose detections per image. Only returns and uses person poses for instance segmentation assignment when the pose has root part score greater or equal to this value.
 *
 * `scoreThreshold`: Defaults to 0.4.
 * Non-maximum suppression part distance in pixels. It needs to be strictly positive. Two parts suppress each other if they are less than 'nmsRadius' pixels away.
 *
 * `minKeypointScore`: Default to 0.3. Keypoints above the score are used for matching and assigning segmentation mask to each person.
 *
 */
export interface MultiPersonInstanceInferenceConfig extends PersonInferenceConfig {
  maxDetections?: number;
  scoreThreshold?: number;
  nmsRadius?: number;
  refineSteps?: number;
}

export const PERSON_INFERENCE_CONFIG: PersonInferenceConfig = {
  flipHorizontal: false,
  internalResolution: 'medium',
  segmentationThreshold: 0.7,
  maxDetections: 10,
  scoreThreshold: 0.4,
  nmsRadius: 20,
  minKeypointScore: 0.3,
  refineSteps: 10
};

export const MULTI_PERSON_INSTANCE_INFERENCE_CONFIG: MultiPersonInstanceInferenceConfig = {
  flipHorizontal: false,
  internalResolution: 'medium',
  segmentationThreshold: 0.7,
  maxDetections: 10,
  scoreThreshold: 0.4,
  nmsRadius: 20,
  minKeypointScore: 0.3,
  refineSteps: 10
};
```

---

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+\n  \`Should be in range [0.0, 1.0]`\n) \n  \n  if (maxDetections <= 0) \n    throw new Error(`Invalid maxDetections ${maxDetections}.`);
+\n  \`Should be > 0`\n) \n  \n  if (scoreThreshold < 0.0 || scoreThreshold > 1.0) \n    throw new Error(`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}.`);

function validateMultiPersonInstanceInferenceConfig(
  config: MultiPersonInstanceInferenceConfig) {
  const {
    segmentationThreshold,
    maxDetections,
    scoreThreshold,
    nmsRadius,
    minKeypointScore,
    refineSteps
  } = config;

  if (segmentationThreshold < 0.0 || segmentationThreshold > 1.0) {
    throw new Error(`segmentationThreshold ${segmentationThreshold}. ` +
        `Should be in range [0.0, 1.0]`);
  }

  if (maxDetections <= 0) {
    throw new Error(`Invalid maxDetections ${maxDetections}.`);
  }

  if (scoreThreshold < 0.0 || scoreThreshold > 1.0) {
    throw new Error(`Invalid scoreThreshold ${scoreThreshold}.`);
  }

  if (nmsRadius <= 0) {
    throw new Error(`Invalid nmsRadius ${nmsRadius}.`);
  }

  if (minKeypointScore < 0 || minKeypointScore > 1) {
    throw new Error(`Invalid minKeypointScore ${minKeypointScore}.` +
        `Should be in range [0.0, 1.0]`);
  }

  if (refineSteps <= 0 || refineSteps > 20) {
    throw new Error(`Invalid refineSteps ${refineSteps}.`);
  }

  if (refineSteps <= 0) {
    throw new Error(`Invalid refineSteps ${refineSteps}.`);
  }

  if (nmsRadius <= 0) {
    throw new Error(`Invalid nmsRadius ${nmsRadius}.`);
  }

  if (minKeypointScore < 0 || minKeypointScore > 1) {
    throw new Error(`Invalid minKeypointScore ${minKeypointScore}.` +
        `Should be in range [0.0, 1.0]`);
  }

  if (refineSteps < 0 || refineSteps > 20) {
    throw new Error(`Invalid refineSteps ${refineSteps}.`);
  }

  return {
    segmentation: segmentationThreshold,
    maxDetections,
    scoreThreshold,
    nmsRadius,
    minKeypointScore,
    refineSteps
  };
}

export class BodyPix {
  baseModel: BaseModel;

  constructor(net: BaseModel) {
    this.baseModel = net;
  }

  private
  predictForPersonSegmentation(input: tf.Tensor3D): {
    segmentLogits: tf.Tensor3D,
    heatmapScores: tf.Tensor3D,
    offsets: tf.Tensor3D,
    displacementFwd: tf.Tensor3D,
    displacementBwd: tf.Tensor3D,
  } {
    const {
      segmentation,
      heatmapScores,
      offsets,
      displacementFwd,
      displacementBwd,
    } = this.baseModel.predict(input);
    return {
      segmentLogits: segmentation,
      heatmapScores,
      offsets,
      displacementFwd,
      displacementBwd,
    };
  }

  private
  predictForPersonSegmentationAndPart(input: tf.Tensor3D): {
    segmentLogits: tf.Tensor3D,
    partHeatmapLogits: tf.Tensor3D,
    heatmapScores: tf.Tensor3D,
    offsets: tf.Tensor3D,
    displacementFwd: tf.Tensor3D,
    displacementBwd: tf.Tensor3D,
  } {
    const {
      segmentation,
      partHeatmapScores,
      heatmapScores,
      offsets,
      displacementFwd,
      displacementBwd,
    } = this.baseModel.predict(input);
    return {
      segmentLogits: segmentation,
      partHeatmapLogits: partHeatmapScores,
      heatmapScores,
      offsets,
      displacementFwd,
      displacementBwd,
    };
  }

  private
  predictForMultiPersonInstanceSegmentationAndPart(input: tf.Tensor3D): {
    segmentLogits: tf.Tensor3D,
    partHeatmapScores: tf.Tensor3D,
    longOffsets: tf.Tensor3D,
    heatmapScores: tf.Tensor3D,
    longDisplacementFwd: tf.Tensor3D,
    longDisplacementBwd: tf.Tensor3D,
  } {
    const {
      segmentation,
      partHeatmaps,
      longOffsets,
      heatmapScores,
      longDisplacementFwd,
      longDisplacementBwd,
    } = this.baseModel.predict(input);
    return {
      segmentLogits: segmentation,
      partHeatmapScores: partHeatmaps,
      longOffsets,
      heatmapScores,
      longDisplacementFwd,
      longDisplacementBwd,
    };
  }

  /**
   * Given an image with people, returns a dictionary of all intermediate
   * tensors including: 1) a binary array with 1 for the pixels that are part of the
   * person, and 0 otherwise, 2) heatmapScores, 3) offsets, and 4) paddings.
   *
   * @param input
   * @param segmentationThreshold The minimum that segmentation values must have
   * to be considered part of the person. Affects the generation of the segmentation
   * mask.
   * @param scoreThreshold The minimum that score values must have
   * to be considered part of the person. Affects the generation of the scoreThreshold.
   * @param nmsRadius Radius for non-maximum suppression.
   * @param minKeypointScore Minimum keypoint score for a point to be considered
   * part of the person.
   * @param refineSteps Number of refinement steps to perform.
   * @param refineStepsDefaults Defaults to 'medium'. The internal resolution is resized to before inference. The larger the input resolution, the more accurate the model at the cost of slower prediction times. Available values are 'low', 'medium', 'high', 'full', or an integer percentage value between 0 and 1. The values 'low', 'medium', 'high', and 'full' map to 0.25, 0.5, 0.75, and 1.0 correspondingly. Remember to adjust these values for your hardware and use them to determine the optimal value for your use case.
   * @param poseEstimationDecoding Pose estimation decoding.
   * @param estimator Estimation decoding.
   * @param estimatorDefaults Defaults to 'medium'. The internal resolution is resized to before inference. The larger the input resolution, the more accurate the model at the cost of slower prediction times. Available values are 'low', 'medium', 'high', 'full', or an integer percentage value between 0 and 1. The values 'low', 'medium', 'high', and 'full' map to 0.25, 0.5, 0.75, and 1.0 correspondingly. Remember to adjust these values for your hardware and use them to determine the optimal value for your use case.
   * @param estimator Defaults to 'medium'. The internal resolution is resized to before inference. The larger the input resolution, the more accurate the model at the cost of slower prediction times. Available values are 'low', 'medium', 'high', 'full', or an integer percentage value between 0 and 1. The values 'low', 'medium', 'high', and 'full' map to 0.25, 0.5, 0.75, and 1.0 correspondingly. Remember to adjust these values for your hardware and use them to determine the optimal value for your use case.
   * @return A dictionary containing segmentation, heatmapScores, offsets, and padding.
* `displacementBwd`: A 3D Tensor of the keypoint backward displacement used by pose estimation.

* `padding`: The padding (unit pixels) being applied to the input image before it is fed into the model.

`segmentPersonActivation`:

```javascript
BodyPixInternalResolution, segmentationThreshold = 0.5): {
  segmentation: tf.Tensor2D,
  heatmapScores: tf.Tensor3D,
  offsets: tf.Tensor3D,
  displacementFwd: tf.Tensor3D,
  displacementBwd: tf.Tensor3D,
  padding: Padding,
  internalResolutionHeightAndWidth: [number, number]
}
```

```javascript
const {resized, padding} = padAndResizeTo(input, internalResolutionHeightAndWidth);

const {
  segmentation, heatmapScores, offsets, displacementFwd, displacementBwd
} = tf.tidy(() =>
  this.predictForPersonSegmentation(resized);

const resizedHeight, resizedWidth = resized.shape;
const scaledSegmentScores = scaleAndCropToInputTensorShape(segmentLogits, [height, width], [resizedHeight, resizedWidth], [[padding.top, padding.bottom], [padding.left, padding.right]], APPLY_SIGMOID_ACTIVATION);
```

```javascript
async segmentPerson(input: BodyPixInput, config: PersonInferenceConfig = PERSON_INFERENC_CONFIG): Promise<SemanticPersonSegmentation> {
  config = {...PERSON_INFERENC_CONFIG, ...config};

  validatePersonInferenceConfig(config);

  const {
    segmentation, heatmapScores, offsets, displacementFwd, displacementBwd
  } = this.segmentPersonActivation(input, config, internalResolution, segmentationThreshold);

  const result = await segmentation.data() as Uint8Array;

  const tensorBuffers = await toTensorBuffers3D(heatmapScores, offsets, displacementFwd, displacementBwd);

  const scoresBuf, offsetsBuf, displacementsFwdBuf, displacementsBwdBuf = tensorBuffers;

  let poses = decodeMultiplePoses(scoresBuf, offsetsBuf, displacementsFwdBuf, displacementsBwdBuf, this.baseModel.outputStride, config.maxDetections, config.scoreThreshold, config.nmsRadius);

  poses = scaleAndFlipPoses(poses, [height, width], internalResolutionHeightAndWidth, padding);

  return {height, width, data: result, allPoses: poses};
}
```
standard ImageNet pre-processing before inferring through the model. The image pixels should have values [0-255].

*param input - ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement
The input image to feed through the network.

*param config - MultiPersonInferenceConfig object that contains parameters for the BodyPix inference using multi-person decoding.

*return An array of PersonSegmentation object, each containing a width, height, a binary array (1 for the pixels that are part of the person, and 0 otherwise) and 2D pose. The array size corresponds to the number of pixels in the image. The width and height correspond to the dimensions of the image the binary array is shaped to, which are the same dimensions of the input image.

async segmentMultiPerson(input: BodyPixInput, config: MultiPersonInstanceInferenceConfig): Promise<PersonSegmentation[]> {
  const internalResolutionHeightAndWidth = toInputResolutionHeightAndWidth(config.internalResolution, this.baseModel.outputStride);
  const resized = padAndResizeTo(input, internalResolutionHeightAndWidth);
  const {segmentation, longOffsets, heatmapScores, offsets, displacementFwd, displacementBwd} = tf.tidy(() => {
    const segmentLogits = scaleAndCropToInputTensorShape(segmentLogits, [height, width], internalResolutionHeightAndWidth, [[padding.top, padding.bottom], [padding.left, padding.right]], APPLY_SIGMOID_ACTIVATION);
    const longOffsetsResized = false;
    let scaledLongOffsets;
    if (longOffsetsResized) {
      scaledLongOffsets = scaleAndCropToInputTensorShape(longOffsets, [height, width], internalResolutionHeightAndWidth, [[padding.top, padding.bottom], [padding.left, padding.right]], APPLY_SIGMOID_ACTIVATION);
    } else {
      scaledLongOffsets = longOffsets;
    }
    const segmentation = toMaskTensor(tf.squeeze(scaledSegmentScores), config.segmentationThreshold);
    const tensorBuffers = await toTensorBuffers3D([heatmapScores, offsets, displacementFwd, displacementBwd]);
    const scoresBuf, offsetsBuf, displacementsFwdBuf, displacementsBwdBuf = tensorBuffers;
    let poses = decodeMultiplePoses(scoresBuf, offsetsBuf, displacementsFwdBuf, displacementsBwdBuf, this.baseModel.outputStride, config.maxDetections, config.scoreThreshold, config.nmsRadius);
    const instanceMasks = await decodePersonInstanceMasks(segmentation, longOffsets, poses, height, width, this.baseModel.outputStride, internalResolutionHeightAndWidth, padding, config.scoreThreshold, config.refineSteps, config.minKeypointScore, config.maxDetections);
    return instanceMasks;
  });
  return this.predictForMultiPersonInstanceSegmentationAndPart(resized);
}
@return A dictionary containing `partSegmentation`, `heatmapScores`,
   * `offsets`, and `padding`:
   * - `partSegmentation`: A 2d Tensor with a part id from 0-24 for
   * the pixels that are part of a corresponding body part,
   * -1 otherwise.
   * - `heatmapScores`: A 3d Tensor of the keypoint heatmaps used by
   * single-person pose estimation decoding.
   * - `offsets`: A 3d Tensor of the keypoint offsets used by single-person pose
   * estimation decoding.
   * - `displacementFwd`: A 3d Tensor of the keypoint forward displacement
   * used by pose estimation decoding.
   * - `displacementBwd`: A 3d Tensor of the keypoint backward displacement used
   * by pose estimation decoding.
   * - `padding`: The padding (unit pixels) being applied to the input image
   * before it is fed into the model.
   * *
   * segmentPersonPartsActivation(input: BodyPixInput,
   * internalResolution: BodyPixInternalResolution,
   * segmentationThreshold = 0.5): {
   * partSegmentation:
   * heatmapScores:
   * offsets:
   * displacementFwd:
   * displacementBwd:
   * padding:
   * internalResolutionHeightAndWidth:
   * internalResolution, this.baseModel.outputStride, [height, width]);
   * const {resized, padding} = padAndResizeTo(input, internalResolutionHeightAndWidth =
   * toInputResolutionHeightAndWidth(internalResolution, this.baseModel.outputStride, [height, width]));
   * const {partSegmentation, heatmapScores, offsets, displacementFwd, displacementBwd} =
   * tf.tidy(() => {
   * segmentLogits,
   * partHeatmapLogits,
   * heatmapScores,
   * offsets,
   * displacementFwd,
   * displacementBwd } =
   * this.predictForPersonSegmentationAndPart(resized);
   * const [resizedHeight, resizedWidth] = resized.shape;
   * const scaledSegmentScores =
   * scaleAndCropToInputTensorShape(segmentLogits, [height, width], [resizedHeight, resizedWidth],
   * apply_sigmoid_activation);
   * const scaledPartHeatmapScore = scaleAndCropToInputTensorShape(partHeatmapLogits, [height, width],
   * [resizedHeight, resizedWidth], apply_sigmoid_activation);
   * const segmentation =
   * toMaskTensor(tf.squeeze(scaledSegmentScores), segmentationThreshold);
   * return {
   * partSegmentation:
   * heatmapScores:
   * offsets,
   * displacementFwd,
   * displacementBwd,
   * padding,
   * internalResolutionHeightAndWidth
   * }
   *
   * segmentMultiPersonPartsActivation(input: BodyPixInput, config: PersonInferenceConfig = PERSON_INFERENCE_CONFIG): {
   * config = {...PERSON_INFERENCE_CONFIG, ...config};
   * validatePersonInferenceConfig(config);
   * const {partSegmentation, heatmapScores, offsets,
   * displacementFwd, displacementBwd, padding,
   * internalResolutionHeightAndWidth } =
   * this.segmentPersonPartsActivation(input, config, internalResolution, config.segmentationThreshold);
   * const [height, width] = partSegmentation.shape;
   * const data = await partSegmentation.data() as Int32Array;
   * partSegmentation.dispose();
   * heatmapScores, offsets,
displacementFwd, displacementBwd])

const [scoresBuf, offsetsBuf, displacementsFwdBuf, displacementsBwdBuf] = tensorBuffers;

let poses = decodeMultiplePoses(scoresBuf, offsetsBuf, displacementsFwdBuf, displacementsBwdBuf); 

this.baseModel.outputStride, config.maxDetections, 

config.scoreThreshold, config.nmsRadius);

poses = scaleAndFlipPoses(poses, [height, width], internalResolutionHeightAndWidth, padding, FLIP_POSES_AFTER_SCALING);

heatmapScores.dispose();
offsets.dispose();
displacementFwd.dispose();
displacementBwd.dispose();

return [{height, width, data, allPoses: poses}];

/**
 * Given an image with multiple people, returns an array of Pose objects. Each element in the array corresponds to one of the people in the input image. In other words, it predicts instance-level multiple person body part segmentation & pose for each person. This does standard ImageNet pre-processing before inferring through the model. The image pixels should have values [0-255].
 *
 * @param input
 * ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement) The input image to feed through the network.
 *
 * @param config MultiPersonInferenceConfig object that contains parameters for the BodyPix inference using multi-person decoding.
 *
 * @return An array of Pose object, each containing a width, height, a flattened array (with part id from 0-24 for the parts that are part of a corresponding body part, and -1 otherwise) and 2D pose. The width and height correspond to the dimensions of the image. Each flattened part segmentation array size is equal to 'height' x 'width'.
 *
 * @param input
 *
 * @param config
 * MultiPersonInferenceConfig object that contains parameters for the BodyPix inference using multi-person decoding.
 *
 * @return An array of Pose object, each containing a width, height, a flattened array (with part id from 0-24 for the parts that are part of a corresponding body part, and -1 otherwise) and 2D pose. The width and height correspond to the dimensions of the image. Each flattened part segmentation array size is equal to 'height' x 'width'.
 */

async segmentMultiPersonParts(input: BodyPixInput, config: MultiPersonInstanceInferenceConfig = MULTI_PERSON_INSTANCE_INFERNECE_CONFIG): Promise<PartSegmentation[]> {

config = {...MULTI_PERSON_INSTANCE_INFERENCE_CONFIG, ...config};

validateMultiPersonInstanceInferenceConfig(config);

const [height, width] = getInputSize(input);

const internalResolutionHeightAndWidth = toInputResolutionHeightAndWidth(config, internalResolution, this.baseModel.outputStride, [height, width]);

const [resized, padding] = padAndResizeTo(input, internalResolutionHeightAndWidth);

const {segmentation, longOffsets, heatmapScoresRaw, offsetsRaw, displacementFwdRaw, displacementBwdRaw, partSegmentation, } = tf.tidy(() => {

const {segmentLogits, longOffsets, heatmapScores, offsets, displacementFwd, displacementBwd, partHeatmaps} =

this.predictForMultiPersonInstanceSegmentationAndPart(resized); // decoding with scaling

const scaledSegmentScores = scaleAndCropToInputTensorShape(segmentLogits, [height, width], internalResolutionHeightAndWidth, 

[[padding.top, padding.bottom], [padding.left, padding.right]]

APPLY_SIGMOID_ACTIVATION); // decoding with scaling

const scaledPartSegmentationScores = scaleAndCropToInputTensorShape(partHeatmaps, [height, width], internalResolutionHeightAndWidth, 

[[padding.top, padding.bottom], [padding.left, padding.right]]

APPLY_SIGMOID_ACTIVATION);

const constLongOffsets = longOffsets;

const segmentation = toMaskTensor(tf.squeeze(scaledSegmentScores), config.segmentationThreshold);

const partSegmentation = 

decodeOnlyPartSegmentation(scaledPartSegmentationScores);

return {segmentation, longOffsets: 


}: tensorBuffers = await toTensorBuffers3D([heatmapScoresRaw, offsetsRaw, displacementFwdRaw, displacementBwdRaw]);

const [scoresBuf, offsetsBuf, displacementsFwdBuf, displacementsBwdBuf] = tensorBuffers;

let poses = decodeMultiplePoses(scoresBuf, offsetsBuf, displacementsFwdBuf, displacementsBwdBuf); 

this.baseModel.outputStride, config, maxDetections, 

config.scoreThreshold, config.nmsRadius);

poses = scaleAndFlipPoses(poses, [height, width], internalResolutionHeightAndWidth, padding, FLIP_POSES_AFTER_SCALING);

const instanceMasks = await decodePersonInstancePartMasks(segmentation, longOffsets, partSegmentation, poses, height, width, this.baseModel.outputStride, internalResolutionHeightAndWidth, padding, config, scoreThreshold, config.refineSteps, config.minKeypointScore, config.maxDetections);

resized.dispose();

segmentation.dispose();

longOffsets.dispose();

heatmapScoresRaw.dispose();

})

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offsetsRaw.dispose();
return instanceMasks;
}

public dispose() {
this.baseModel.dispose();
}

/**
 * Loads the MobileNet BodyPix model.
 */
async function loadMobileNet(config: ModelConfig): Promise<BodyPix> {
const outputStride = config.outputStride;
const quantBytes = config.quantBytes;
const multiplier = config.multiplier;
if (tf == null) {
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 model.');
}
const url = mobileNetSavedModel(outputStride, multiplier, quantBytes);
const mobilenet = new MobileNet(graphModel, outputStride);
return new BodyPix(mobilenet);
}

/**
 * Loads the ResNet BodyPix model.
 */
async function loadResNet(config: ModelConfig): Promise<BodyPix> {
const outputStride = config.outputStride;
const quantBytes = config.quantBytes;
if (tf == null) {
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 model.');
}
const url = resNet50SavedModel(outputStride, quantBytes);
const resnet = new ResNet(graphModel, outputStride);
return new BodyPix(resnet);
}

/**
 * Loads the BodyPix model instance from a checkpoint, with the ResNet
 * or MobileNet architecture. The model to be loaded is configurable using the modelConfig.
 * Please find more details in the documentation of the ModelConfig dictionary.
 * The predefined `MOBILENET_V1_CONFIG` and `RESNET_CONFIG` can also be used as references for
 * defining your customized config.
 */
export async function load(config: ModelConfig = MOBILENET_V1_CONFIG): Promise<BodyPix> {
config = validateModelConfig(config);
if (config.architecture === 'ResNet50') {
return loadResNet(config);
} else if (config.architecture === 'MobileNetV1') {
return loadMobileNet(config);
} else {
return null;
}

export {cpuBlur} from './blur';
export {Color, PartSegmentation, PersonSegmentation} from './types';
export {SemanticPartSegmentation, SemanticPersonSegmentation} from './types';
export {getInputSize} from './util';

export type Canvas = HTMLCanvasElement | OffscreenCanvas;

const offScreenCanvases: {[name: string]: Canvas} = {};

type ImageType = HTMLImageElement|HTMLVideoElement|Canvas;
type HasDimensions = {
  width: number,
  height: number
};

function isSafari() {
return (/^((?!chrome|android).)*safari/i.test(navigator.userAgent));
}

function assertSameDimensions({width: widthA, height: heightA}: HasDimensions, {width: widthB, height: heightB}: HasDimensions, nameA: string, nameB: string) {
if (widthA !== widthB || heightA !== heightB) {
throw new Error(`error: dimensions must match. $nameA has dimensions $widthA x $heightA, $nameB has dimensions $widthB x $heightB`);
}
}

function flipCanvasHorizontal(canvas: Canvas) {
const ctx = canvas.getContext('2d');
ctx.scale(-1, 1);
ctx.translate(-canvas.width, 0);
}

function drawWithCompositing(ctx: CanvasRenderingContext2D|OffscreenCanvasRenderingContext2D, image: Canvas|ImageType, compositeOperation: string) {
const ctw = canvas.getContext('2d');
ctx.scale(-1, 1);
ctx.translate(-canvas.width, 0);
}

function drawWithCompositing(ctx: CanvasRenderingContext2D|OffscreenCanvasRenderingContext2D, image: Canvas|ImageType, compositeOperation: string) {
const ctx = _getCanvasContext(image, 0, 0, 0); failure
}

function createOffScreenCanvas(): Canvas {
const canvas = document.createElement('canvas');
}

function ensureOffscreenCanvasCreated(id: string): Canvas {
if (!offScreenCanvases[id]) {
offScreenCanvases[id] = createOffScreenCanvas(canvas);
}
}

function
drawAndBlurImageOnCanvas(image: ImageType, blurAmount: number, canvas: Canvas): void {
  const {height, width} = image;
  const ctx = canvas.getContext('2d');
  canvas.width = width;
  canvas.height = height;
  ctx.clearRect(0, 0, width, height);
  if (isSafari()) {
    cpuBlur(canvas, image, blurAmount);
  } else {
    // tslint:disable:no-any
    (ctx as any).filter = `blur(${blurAmount}px)`;
    ctx.drawImage(image, 0, 0, width, height);
  }
}

function drawAndBlurImageOnOffScreenCanvas(image: ImageType, blurAmount: number, offscreenCanvasName: string): Canvas {
  const canvas = ensureOffscreenCanvasCreated(offscreenCanvasName);
  if (blurAmount === 0) {
    renderImageToCanvas(image, canvas);
  } else {
    drawAndBlurImageOnCanvas(image, blurAmount, canvas);
  }
  return canvas;
}

function renderImageToCanvas(image: ImageType, canvas: Canvas) {
  const {width, height} = image;
  canvas.width = width;
  canvas.height = height;
  const ctx = canvas.getContext('2d');
  ctx.drawImage(image, 0, 0, width, height);
}

/**
 * Draw an image on a canvas
 */
function renderImageDataToCanvas(imageData: ImageData, canvas: Canvas) {
  canvas.width = imageData.width;
  canvas.height = imageData.height;
  const ctx = canvas.getContext('2d');
  ctx.putImageData(imageData, 0, 0);
}

function renderImageDataToOffScreenCanvas(imageData: ImageData, canvasName: string): Canvas {
  const canvas = ensureOffscreenCanvasCreated(canvasName);
  renderImageDataToCanvas(imageData, canvas);
  return canvas;
}

/**
 * Given the output from estimating multi-person segmentation, generates an image with foreground and background color at each pixel determined by the corresponding binary segmentation value at the pixel from the output. In other words, pixels where there is a person will be colored with foreground color and where there is not a person will be colored with background color.
 */
function toMask(personOrPartSegmentation: SemanticPersonSegmentation|SemanticPartSegmentation|PersonSegmentation|PartSegmentation[], foreground: Color = {r: 0, g: 0, b: 0, a: 0}, background: Color = {r: 0, g: 0, b: 0, a: 255}, drawContour = false, foregroundIds: number[] = [1], opacity = 0): ImageData {
  if (Array.isArray(personOrPartSegmentation) && personOrPartSegmentation.length === 0) {
    return null;
  }

  let multiPersonOrPartSegmentation: Array<SemanticPersonSegmentation|SemanticPartSegmentation|PersonSegmentation|PartSegmentation>;
  if (!Array.isArray(personOrPartSegmentation)) {
    multiPersonOrPartSegmentation = [personOrPartSegmentation];
  } else {
    multiPersonOrPartSegmentation = personOrPartSegmentation;
  }

  const {width, height} = multiPersonOrPartSegmentation[0];
  const bytes = new Uint8ClampedArray(width * height * 4);

  function drawStroke(bytes: Uint8ClampedArray, row: number, column: number, width: number, radius: number, color: Color = {r: 0, g: 255, b: 255, a: 255}) {
    for (let i = -radius; i <= radius; i++) {
      for (let j = -radius; j <= radius; j++) {
        const n = (row + i) * width + (column + j);
        bytes[4 * n + 0] = color.r;
        bytes[4 * n + 1] = color.g;
        bytes[4 * n + 2] = color.b;
        bytes[4 * n + 3] = color.a;
      }
    }
  }

  function isSegmentationBoundary(segmentationData: Uint8Array|Int32Array, row: number, column: number, width: number, height: number, foregroundIds: number[] = [1], radius = 1, min: boolean = true, numberOfPixels = 0) {
    if (!segmentationData || segmentationData.length === 0) {
      return false;
    }

    const n = (row + i) * width + (column + j);
    if (n < 0 || n >= segmentationData.length) {
      return false;
    }
    if (segmentationData[n] < 0) {
      return false;
    }
    if (segmentationData[n] <= 0) {
      return false;
    }

    if (segmentationData[n] === 255) {
      return true;
    }

    const binarySegmentation = toBinarySegmentation(segmentationData, row, column);
    if (binarySegmentation === 0) {
      return false;
    }

    const numberOfForegroundPixels = countForegroundPixels(binarySegmentation, row, column, width, height, foregroundIds);
    if (numberOfForegroundPixels === 0) {
      return false;
    }

    if (numberOfForegroundPixels < numberOfPixels) {
      return false;
    }

    return true;
  }

  for (let i = -radius; i <= radius; i++) {
    for (let j = -radius; j <= radius; j++) {
      const n = (row + i) * width + (column + j);
      if (n < 0 || n >= bytes.length) {
        continue;
      }

      const segmentation = toSegmentation(bytes, n);
      if (segmentation === 0) {
        continue;
      }

      if (segmentation === 255) {
        drawStroke(bytes, row, column, width, radius, {r: 255, g: 255, b: 255, a: 255});
      } else if (segmentation === 0) {
        drawStroke(bytes, row, column, width, radius, {r: 0, g: 0, b: 0, a: 0});
      } else if (segmentation === 1) {
        drawStroke(bytes, row, column, width, radius, foreground);}
      } else if (segmentation === 2) {
        drawStroke(bytes, row, column, width, radius, background);}
      } else { // Other cases, e.g., segmentation === 3, 4, ...
        drawStroke(bytes, row, column, width, radius, {r: 0, g: 0, b: 0, a: 0});
      }
    }
  }

  return bytes;
}
drawAndBlurImageOnOffScreenCanvas

```javascript
ctx.drawImage(blurredMask, 0, 0, width, height);
})();
```

```javascript
ctx.restore();
```

```javascript
if (flipHorizontal) {
flipCanvasHorizontal(canvas);
}
```

```javascript
if (Array.isArray(multiPersonSegmentation)) {
const blurredMask = drawAndBlurImageOnOffScreenCanvas(maskImage, CANVAS_NAMES.blurredMask);
const blurredImage = drawAndBlurImageOnOffScreenCanvas(image, backgroundBlurAmount);
```
multiPersonSegmentation.length === 0) {
  cx.drawImage(blurredImage, 0, 0);
  return;
}

const personMask = createPersonMask(multiPersonSegmentation, edgeBlurAmount);

if (flipHorizontal) {
  flipCanvasHorizontal(canvas);
}

// draw the original image on the final canvas
const [height, width] = getInputSize(image);
ctx.drawImage(image, 0, 0, width, height);

// "destination-in" - "The existing canvas content is kept where both the
// new shape and existing canvas content overlap. Everything else is made
// transparent."
ctx.drawImage(blurredImage, 0, 0);

return;
}

const bodyPartMask = createBodyPartMask(multiPersonPartSegmentation, bodyPartIdsToMask, edgeBlurAmount);

ctx.save();
if (flipHorizontal) {
  flipCanvasHorizontal(canvas);
}

// draw the original image on the final canvas
const [height, width] = getInputSize(image);
ctx.drawImage(image, 0, 0, width, height);

// "destination-in" - "The existing canvas content is kept where both the
// new shape and existing canvas content overlap. Everything else is made
// transparent."
ctx.drawImage(blurredImage, 0, 0);

return;
}

// drawWithCompositing: "The existing canvas content is kept where both the
// new shape and existing canvas content overlap. Everything else is made
// transparent."

// "destination-over" - "The existing canvas content is kept where both the
// new shape and existing canvas content overlap. Everything else is made
// transparent."
ctx.drawImage(blurredImage, 0, 0);

return;
}

function createBodyPartMask(multiPersonPartSegmentation, bodyPartIdsToMask, edgeBlurAmount) {
  const backgroundMaskImage = toMask(multiPersonPartSegmentation, {
    r: 0, g: 0, b: 0, a: 0
  }, true, bodyPartIdsToMask);

  const backgroundMask = renderImageDataToOffScreenCanvas(backgroundMaskImage, CANVAS_NAMES.mask);
  if (edgeBlurAmount === 0) {
    return backgroundMask;
  } else {
    return drawAndBlurImageOnOffScreenCanvas(backgroundMask, edgeBlurAmount, CANVAS_NAMES.blurredMask);
  }
}

/**
 * Given a personSegmentation and an image, draws the image
 * with its background * blurred onto the canvas.
 * @param canvas The canvas to draw the background-blurred
 * image onto.
 * @param backgroundBlurAmount How many pixels in the background blend into
 * each pixel * other. Defaults to 3. Should be an integer between 1 and 20.
 * @param bodyPartIdsToBlur Default to [0, 1] (left-face and right-face).
 * @param flipHorizontal If the output should be flipped horizontally. Defaults
 * to false.
 * @param partSegmentation A SemanticPartSegmentation or an array of
 * PartSegmentation objects.
 * @param bodyPartIdsToBlur Default to [0, 1] (left-face and right-face).
 * @param backgroundBlurAmount How many pixels in the background blend into
 * each pixel * other. Defaults to 3. Should be an integer between 1 and 20.
 * @param edgeBlurAmount How many
 * pixels to blur on the edge between the person
 * and the background by. Defaults to 3. Should be an integer
 * between 0 and 20.
 * @param flipHorizontal If the output should be flipped horizontally. Defaults
 * to false.
 */

export function blurBodyPart(canvas, image, partSegmentation, bodyPartIdsToBlur = [0, 1], backgroundBlurAmount = 3, edgeBlurAmount = 3, flipHorizontal = false) {
  const blurredImage = drawAndBlurImageOnOffScreenCanvas(image, backgroundBlurAmount, CANVAS_NAMES.blurred);

  canvas.width = blurredImage.width;
  canvas.height = blurredImage.height;
  canvas.getContext('2d').unwrap();

  const ctx = canvas.getContext('2d');

  // "destination-in" - "The existing canvas content is kept where both the
  // new shape and existing canvas content overlap. Everything else is made
  // transparent."
  ctx.drawImage(blurredImage, 0, 0);

  // "destination-over" - "The existing canvas content is kept where both the
  // new shape and existing canvas content overlap. Everything else is made
  // transparent."
  ctx.drawImage(blurredImage, 0, 0);

  return;
}
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/orange-open-source

```
// method copied from bGlur in https://codepen.io/zhaojun/pen/zZmRQe
export function cpuBlur(
    canvas: HTMLCanvasElement|OffscreenCanvas,
    image:
        HTMLImageElement|HTMLVideoElement|HTMLCanvasElement|OffscreenCanvas,
    blur: number) {
  const
    ctx = canvas.getContext('2d');

  let sum = 0;
  const delta = 5;
  const alphaLeft = 1 / (2 * Math.PI * delta * delta);
  const step = blur < 3 ? 1 : 2;
  for (let y = -blur; y <= blur; y += step) {
    for (let x = -blur; x <= blur; x += step) {
      const weight =
          alphaLeft * Math.exp(-(x * x + y * y) / (2 * delta * delta));
      sum +=
          weight;
    }
    for (let y = -blur; y <= blur; y += step) {
      for (let x = -blur; x <= blur; x += step) {
        ctx.globalAlpha = alphaLeft *
            Math.exp(-(x * x + y * y) / (2 * delta * delta)) / sum * blur;
        ctx.drawImage(image, x, y);
      }
    }
  }
  ctx.globalAlpha = 1;
}
```

```
/**
 * @license
 * Copyright 2020 Google Inc. All Rights Reserved.
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 */
```

```
export const PART_CHANNELS: string[] = [
    'left_face',
    'right_face',
    'left_upper_arm_front',
    'right_upper_arm_front',
    'left_upper_arm_back',
    'right_upper_arm_back',
    'left_lower_arm_front',
    'right_lower_arm_front',
    'left_lower_arm_back',
    'right_lower_arm_back',
    'left_hand',
    'right_hand',
    'torso_front',
    'torso_back',
    'left_upper_leg_front',
    'right_upper_leg_front',
    'left_upper_leg_back',
    'right_upper_leg_back',
    'left_lower_leg_front',
    'right_lower_leg_front',
    'left_lower_leg_back',
    'right_lower_leg_back',
    'left_feet',
    'right_feet'];
```

```
// This code is auto-generated, do not modify this file!
const version = '2.2.0';
export {version};
```

```
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```

```
// This code is auto-generated, do not modify this file!

constPART_CHANNELS: string[] = [
    'left_face',
    'right_face',
    'left_upper_arm_front',
    'right_upper_arm_front',
    'left_upper_arm_back',
    'right_upper_arm_back',
    'left_lower_arm_front',
    'right_lower_arm_front',
    'left_lower_arm_back',
    'right_lower_arm_back',
    'left_hand',
    'right_hand',
    'torso_front',
    'torso_back',
    'left_upper_leg_front',
    'right_upper_leg_front',
    'left_upper_leg_back',
    'right_upper_leg_back',
    'left_lower_leg_front',
    'right_lower_leg_front',
    'left_lower_leg_back',
    'right_lower_leg_back',
    'left_feet',
    'right_feet'];
```

/!

```
*!\n// method copied from bGlur in https://codepen.io/zhaojun/pen/zZmRQe\nexport function cpuBlur(canvas: HTMLCanvasElement|OffscreenCanvas,\n    image: HTMLImageElement|HTMLVideoElement|HTMLCanvasElement|OffscreenCanvas,\n    blur: number) {\n  const\n    ctx = canvas.getContext('2d');\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 +=\n          weight;\n    }
    for (let y = -blur; y <= blur; y += step) {\n      for (let x = -blur; x <= blur; x += step) {\n        ctx.globalAlpha = alphaLeft *
            Math.exp(-(x * x + y * y) / (2 * delta * delta)) / sum * blur;
        ctx.drawImage(image, x, y);
      }
    }
  }
  ctx.globalAlpha = 1;
}
```

```
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 */
```

```
export const PART_CHANNELS: string[] = [
    'left_face',
    'right_face',
    'left_upper_arm_front',
    'right_upper_arm_front',
    'left_upper_arm_back',
    'right_upper_arm_back',
    'left_lower_arm_front',
    'right_lower_arm_front',
    'left_lower_arm_back',
    'right_lower_arm_back',
    'left_hand',
    'right_hand',
    'torso_front',
    'torso_back',
    'left_upper_leg_front',
    'right_upper_leg_front',
    'left_upper_leg_back',
    'right_upper_leg_back',
    'left_lower_leg_front',
    'right_lower_leg_front',
    'left_lower_leg_back',
    'right_lower_leg_back',
    'left_feet',
    'right_feet'];
```

```
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Found in path(s):
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/body-pix.min.js.map

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

```
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```

```
import * as tf from '@tensorflow/tfjs-core';

//
// Takes the sigmoid of the part heatmap output and generates a 2d one-hot tensor with ones where the part's score has the maximum value.
//
// @param partHeatmapScores
//
// toFlattenedOneHotPartMap(partHeatmapScores: tf.Tensor3D): tf.Tensor2D {
const numParts = partHeatmapScores.shape[2];
  const partMapLocations = tf.argMax(partHeatmapScores, 2);

    const partMapFlattened = tf.reshape(partMapLocations, [-1]);
    return tf.oneHot(partMapFlattened, numParts) as tf.Tensor2D;
}

//
// Takes the sigmoid of the segmentation output, and generates a segmentation mask with a 1 or 0 at each pixel where there is a person or not a person. The segmentation threshold determines the threshold of a score for a pixel to be considered part of a person.
//
// @param segmentScores
// @param segmentationThreshold
//
    return tf.tidy(() => tf.cast(tf.greater(segmentScores, tf.scalar(threshold)), 'int32') as tf.Tensor2D);  
```
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\n * 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 *\n * export function decodePartSegmentation(\n * segmentationMask: tf.Tensor2D,\n * partHeatmapScores: tf.Tensor3D): tf.Tensor2D {\n * const [partMapHeight,\n * partMapWidth, numParts] = partHeatmapScores.shape;\n * return tf.tidy(() => {\n * \n * const flattenedMap =\n * toFlattenedOneHotPartMap(partHeatmapScores);\n * return const partNumbers = tf.expandDims(tf.range(0, numParts, 1, \n * 'int32'), 1);\n * const partMapFlattened =\n * tf.cast(tf.matmul(flattenedMap, partNumbers as tf.Tensor2D), \n * 'int32');\n * const partMap = tf.reshape(partMapFlattened, [partMapHeight, \n * partMapWidth]);\n * const partMapShiftedUpForClipping = tf.add(partMap, tf.scalar(1, \n * 'int32'));\n * return tf.sub(tf.scalar(1, 'int32'), partMapShiftedUpForClipping);\n * }));\n * export function decodeOnlyPartSegmentation(partHeatmapScores: tf.Tensor3D): tf.Tensor2D {\n * \n * const partMapHeight, partMapWidth, numParts = partHeatmapScores.shape;\n * return tf.tidy(() => {\n * \n * const flattenedMap = toFlattenedOneHotPartMap(partHeatmapScores);\n * const partNumbers = tf.expandDims(tf.range(0, numParts, 1, \n * 'int32'), 1);\n * \n * tf.cast(tf.matmul(flattenedMap, partNumbers as tf.Tensor2D), \n * 'int32');\n * \n * const partMap = tf.reshape(partMapFlattened, [partMapHeight, \n * partMapWidth]);\n * const partMapShiftedUpForClipping = tf.add(partMap, tf.scalar(1, \n * 'int32'));\n * return tf.sub(tf.scalar(1, 'int32'), partMapShiftedUpForClipping);\n * }));\n *\n * export function decodePartSegmentation(\n * segmentationMask: tf.Tensor2D,\n * partHeatmapScores: tf.Tensor3D): tf.Tensor2D {\n * const [partMapHeight,\n * partMapWidth, numParts] = partHeatmapScores.shape;\n * return tf.tidy(() => {\n * \n * const flattenedMap =\n * toFlattenedOneHotPartMap(partHeatmapScores);\n * return const partNumbers = tf.expandDims(tf.range(0, numParts, 1, \n * 'int32'), 1);\n * const partMapFlattened =\n * tf.cast(tf.matmul(flattenedMap, partNumbers as tf.Tensor2D), \n * 'int32');\n * const partMap = tf.reshape(partMapFlattened, [partMapHeight, \n * partMapWidth]);\n * const partMapShiftedUpForClipping = tf.add(partMap, tf.scalar(1, \n * 'int32'));\n * return tf.sub(tf.scalar(1, 'int32'), partMapShiftedUpForClipping);\n * }));\n *\n * export function decodeOnlyPartSegmentation(partHeatmapScores: tf.Tensor3D): tf.Tensor2D {\n * \n * const partMapHeight, partMapWidth, numParts = partHeatmapScores.shape;\n * return tf.tidy(() => {\n * \n * const flattenedMap = toFlattenedOneHotPartMap(partHeatmapScores);\n * const partNumbers = tf.expandDims(tf.range(0, numParts, 1, \n * 'int32'), 1);\n * \n * tf.cast(tf.matmul(flattenedMap, partNumbers as tf.Tensor2D), \n * 'int32');\n * \n * const partMap = tf.reshape(partMapFlattened, [partMapHeight, \n * partMapWidth]);\n * const partMapShiftedUpForClipping = tf.add(partMap, tf.scalar(1, \n * 'int32'));\n * return tf.sub(tf.scalar(1, 'int32'), partMapShiftedUpForClipping);\n * }));\n *\n * import * as tfconv from '@tensorflow/tfjs-converter';\n * import * as tf from '@tensorflow/tfjs-core';\n * import {BodyPixOutputStride} from './types';\n *\n * export abstract class BaseModel {\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 * abstract preprocessInput(input: tf.Tensor3D): tf.Tensor3D;\n *\n * /**\n * Predicts intermediate Tensor representations.\n * @param input The input RGB image of the base\n * model.\n * @return A Tensor of shape: ['inputResolution', 'inputResolution', 3].\n *\n * @return A dictionary of base\n * 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\n * represents the segmentation of all\n * people.\n * - longOffsets: A Tensor3D that represents the long offsets used\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 * segmentation: tf.Tensor3D;\n * partHeatmaps: tf.Tensor3D;\n * longOffsets: tf.Tensor3D;\n * const predict(input: tf.Tensor3D): {\n * heatmapScores: tf.Tensor3D;\n * offsets: tf.Tensor3D;\n * segmentation: tf.Tensor3D;\n * partHeatmaps: tf.Tensor3D;\n * longOffsets: tf.Tensor3D;\n *\n * const namedResults = this.nameOutputResults(results3d);\n *\n * return {\n * heatmapScores:

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tf.sigmoid(namedResults.heatmap),
        offsets: namedResults.offsets,
        displacementFwd: namedResults.displacementFwd,
        segmentation: namedResults.segmentation,
        partHeatmaps: namedResults.partHeatmaps,
        longOffsets: namedResults.longOffsets,
        partOffsets: namedResults.partOffsets
      };
    });
  }

  // Because MobileNet and ResNet predict() methods output a different order for
  // these values, we have a method that needs to be implemented to order them.
  abstract nameOutputResults(results: tf.Tensor3D[]): {
    heatmap:
    tf.Tensor3D,
    offsets: tf.Tensor3D,
    displacementFwd: tf.Tensor3D,
    segmentation: tf.Tensor3D,
    partHeatmaps: tf.Tensor3D,
    longOffsets: tf.Tensor3D,
    partOffsets: tf.Tensor3D
  };

  /**
   * Releases the CPU and GPU memory allocated by the model.
   */
  dispose() {
    this.model.dispose();
  }
}

import * as tf from '@tensorflow/tfjs-core';

import {BaseModel} from './base_model';

export class MobileNet extends BaseModel {
  preprocessInput(input: tf.Tensor3D): tf.Tensor3D {
    // Normalize the pixels
    // between [0, 255] to be between [-1, 1].
    return tf.tidy(() => tf.sub(tf.div(input, 127.5), 1.0));
  }

  nameOutputResults(results: tf.Tensor3D[]): {
    const [
      offsets,
      segmentation,
      partHeatmaps,
      longOffsets,
      heatmap,
      displacementFwd,
      displacementBwd,
      partOffsets,
    ] = results;
    return {
      offsets,
      segmentation,
      partHeatmaps,
      longOffsets,
      heatmap,
      displacementFwd,
      displacementBwd,
      partOffsets
    };
  }
}

import * as tf from '@tensorflow/tfjs-core';

export type Tuple<T> = [T, T];
export type StringTuple = Tuple<string>;
export type NumberTuple = Tuple<number>;

export const PART_NAMES = [
  'nose', 'leftEye', 'rightEye', 'leftEar', 'rightEar',
  'leftShoulder', 'leftElbow', 'leftWrist', 'leftHip', 'leftKnee',
  'leftAnkle', 'rightEye', 'rightEar', 'rightShoulder', 'rightElbow',
  'rightWrist', 'rightHip', 'rightKnee', 'rightAnkle', 'rightShoulder',
  'rightElbow', 'rightWrist', 'rightHip', '
];

export const NUM_KEYPOINTS = PART_NAMES.length;

export type NumberDict = {
  [jointName: string]: number;
}

export const PART_IDS = PART_NAMES.reduce((result: NumberDict, jointName, i): NumberDict => {
  result[jointName] = i;
  return result;
}, {});

export const CONNECTED_PART_NAMES: StringTuple[] = [
  ['leftHip', 'leftShoulder'],
  ['leftElbow', 'leftShoulder'],
  ['leftElbow', 'leftWrist'],
  ['leftHip', 'leftKnee'],
  ['leftKnee', 'leftAnkle'],
  ['rightHip', 'rightKnee'],
  ['rightKnee', 'rightAnkle'],
  ['rightShoulder', 'rightElbow'],
  ['rightElbow', 'rightWrist'],
  ['rightHip', 'rightShoulder'],
  ['rightShoulder', 'rightElbow'],
  ['rightElbow', 'rightWrist'],
  ['rightHip', 'rightKnee'],
  ['rightKnee', 'rightAnkle'],
  ['leftKnee', 'leftAnkle'],
  ['leftWrist', 'leftElbow'],
  ['leftShoulder', 'leftElbow'],
  ['leftElbow', 'leftHip'],
  ['rightElbow', 'rightHip'],
  ['leftWrist', 'leftHip'],
  ['leftShoulder', 'leftElbow'],
  ['leftElbow', 'leftHip'],
  ['leftKnee', 'leftAnkle'],
  ['rightKnee', 'rightAnkle'],
  ['rightShoulder', 'rightElbow'],
  ['rightElbow', 'rightWrist'],
  ['rightShoulder', 'rightHip'],
];

export const CONNECTED_PART_INDICES =
CONNECTED_PART_NAMES.map((jointNameA, jointNameB) =>
    ([PART_IDS[jointNameA],
      PART_IDS[jointNameB]]));

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 *
 *=============================================================================

import {NUM_KEYPOINTS} from '../keypoints';
import {Padding, Part, TensorBuffer3D, Vector2D} from
    '@types';

const getScale = (height, width, inputResolutionY,
    inputResolutionX) => [
    const padding: Padding = [
    const padT = Math.ceil((padB - left) / 2);
    const padL = Math.ceil((padR - right) / 2);
    return [
    const scaleX = inputResolutionX / (padL + padR + width);
    const scaleY = inputResolutionY / (padT + padB + height);
    ];

    **/
matchesEmbeddingToInstance(location: Pair, longOffsets: Float32Array, poses: Pose[], numKptForMatching: number, [padT, padL]: [number, number], outputResolutionX: number, [height, width]: [number, number], stride: number, refineSteps: number): number {
  const newPos = convertToPosition({x, y});
  const nn = newPos.y * outputResolutionX + newPos.x;
  const dy = longOffsets[NUM_KEYPOINTS * (2 * nn + 1) + keypointIndex];
  const dx = longOffsets[NUM_KEYPOINTS * (2 * nn + 2) + keypointIndex];
  y = y + dy;
  x = x + dx;
  return {x, y};
}

function matchEmbeddingToInstance(location: Pair, longOffsets: Float32Array, poses: Pose[], numKptForMatching: number, [padT, padL]: [number, number], outputResolutionX: number, [height, width]: [number, number], stride: number, refineSteps: number): number {
  const embed: Pair[] = [];
  const convertToPosition = (pair: Pair) =>
    convertToPositionInOutput(pair, [padT, padL], [scaleX, scaleY], stride);

  for (let keypointsIndex = 0; keypointsIndex < numKptForMatching; keypointsIndex++) {
    const embedding = getEmbedding(location, keypointsIndex, convertToPosition, outputResolutionX,
      longOffsets, refineSteps, [height, width]);
    embed.push(embedding);
  }

  let kMin = -1;
  let kMinDist = Infinity;
  for (let k = 0; k < poses.length; k++) {
    const dist = computeDistance(embed, poses[k]);
    if (dist < kMinDist) {
      kMin = k;
      kMinDist = dist;
    }
  }
  return kMin;
}

function getOutputResolution(inputResolutionY: number, inputResolutionX: number, stride: number): [number, number] {
  const outputResolutionX = Math.round((inputResolutionX - 1.0) / stride + 1.0);
  const outputResolutionY = Math.round((inputResolutionY - 1.0) / stride + 1.0);
  return [outputResolutionX, outputResolutionY];
}

export function decodeMultipleMasksCPU(segmentation: Uint8Array, longOffsets: Float32Array, posesAboveScore: Pose[], height: number, width: number, stride: number, [padT, padL]: [number, number], [scaleX, scaleY]: [number, number], refineSteps: number, numKptForMatching = 5): Uint8Array[] {
  const dataArrays = posesAboveScore.map(x => new Uint8Array(height * width).fill(0));
  const getScale = (height, width) =>
    Math.round((height - 1.0) / stride + 1.0);

  for (let i = 0; i < height; i += 1) {
    for (let j = 0; j < width; j += 1) {
      const n = i * width + j;
      const prob = segmentation[n];
      if (prob == 1) {
        const kMin = matchEmbeddingToInstance({x: j, y: i}, longOffsets, posesAboveScore, numKptForMatching,
          [padT, padL], [scaleX, scaleY], outputResolutionX, [height, width], stride,
          refineSteps);
        if (kMin >= 0) {
          dataArrays[kMin][n] = 1;
        }
      }
    }
  }
  return dataArrays;
}

export function decodeMultiplePartMasksCPU(segmentation: Uint8Array, longOffsets: Float32Array, partSegmentation: Uint8Array, posesAboveScore: Pose[], height: number, width: number, stride: number, padT: number, padL: number, [scaleX, scaleY]: [number, number], refineSteps: number, numKptForMatching = 5): Int32Array[] {
  const dataArrays = posesAboveScore.map(x => new Int32Array(height * width).fill(-1));
  const getScale = getScale(50, 50);
  for (let i = 0; i < height; i += 1) {
    for (let j = 0; j < width; j += 1) {
      const n = i * width + j;
      const prob = segmentation[n];
      if (prob == 1) {
        const kMin = matchEmbeddingToInstance({x: j, y: i}, longOffsets, posesAboveScore, numKptForMatching,
          [padT, padL], [scaleX, scaleY], outputResolutionX, [height, width], stride,
          refineSteps);
        if (kMin >= 0) {
          dataArrays[kMin][n] = partSegmentation[n];
        }
      }
    }
  }
  return dataArrays;
}
[inHeight, inWidth]: [number, number], padding: Padding, refineSteps: number, minKptScore: number,
maxNumPeople: number): tf.TensorInfo {
  // The height/width of the image/canvas itself.
  const [origHeight, origWidth] = segmentation.shape;
  // The height/width of the output of the model.
  const [outHeight, outWidth] = longOffsets.shape.slice(0, 2);
  const shapedLongOffsets = tf.reshape(longOffsets, [outHeight, outWidth, 2, NUM_KEYPOINTS]);
  // Make pose tensor of shape [MAX_NUM_PEOPLE, NUM_KEYPOINTS, 3] where h // the last 3 coordinates correspond to the score, h and w coordinate of that
  const poseVals = new Float32Array(maxNumPeople * NUM_KEYPOINTS + 3).fill(0);
  for (let i = 0; i < posesAboveScore.length; i++) {
    const poseOffset = i * NUM_KEYPOINTS + 3;
    const pose = posesAboveScore[i];
    for (let kp = 0; kp < NUM_KEYPOINTS; kp++) {
      const keypoint = pose.keypoints[kp];
      poseVals[poseOffset + kp * 3] = keypoint.position.y;
      poseVals[poseOffset + kp * 3 + 1] = keypoint.position.x;
    }
  }
  // This is done(Tyler): convert from output space h/w to strided space.
  const minDist = 100000.0;
  let iMin = -1;
  for (let i = 0; i < maxNumPeople; i++) {
    let numKpt = 0;
    let curDistSum = 0.0;
    for (let k = 0; k < NUM_KEYPOINTS; k++) {
      const dy = sampleLongOffsets(stridedH, stridedW, 0, k);
      const dx = sampleLongOffsets(stridedH, stridedW, 1, k);
      const y = float(h) + dy;
      const x = float(w) + dx;
      for (let s = 0; s < refineSteps; s++) {
        const yRounded = round(min(y, float(height - 1.0)));
        const xRounded = round(min(x, float(width - 1.0)));
        const dy = sampleLongOffsets(yRounded, xRounded, 0, k);
        const dx = sampleLongOffsets(yRounded, xRounded, 1, k);
        const y = y + dy;
        const x = x + dx;
      }
      const poseScore = getPoses(i, k, 0);
      const poseY = getPoses(i, k, 1);
      if (poseScore > minKptScore) {
        numKpt = numKpt + 1;
        curDistSum = curDistSum + dist(x, y, poseX, poseY);
      }
    }
    if (numKpt > 0 && curDistSum / float(numKpt) < minDist) {
      minDist = curDistSum / float(numKpt);
    }
    if (curDistSum / float(numKpt) < minDist) {
      iMin = i;
    }
  }
  // Done(Tyler): convert from output space h/w to strided space.
  return float(stridedH);
}

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```
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```
import * as tf from '@tensorflow/tfjs-core';
import {getBackend} from '@tensorflow/tfjs-core';

import {Padding, PartSegmentation, PersonSegmentation, Pose} from '../types';
import {decodeMultipleMasksCPU, decodeMultiplePartMasksCPU} from './decode_multiple_masks_cpu';
import {decodeMultipleMasksWebGl} from './decode_multiple_masks_webgl';

export function toPersonKSegmentation(segmentation: tf.Tensor2D, k: number): tf.Tensor2D {
  return tf.tidy(() => tf.cast(tf.equal(segmentation, tf.scalar(k)), 'int32') as tf.Tensor2D);
}

export function toPersonKPartSegmentation(segmentation: tf.Tensor2D, bodyParts: tf.Tensor2D, k: number): tf.Tensor2D {
  return tf.tidy(() => tf.sub(tf.mul(tf.cast(tf.equal(segmentation, tf.scalar(k)), 'int32'), tf.add(bodyParts, 1)), 1));
}

function isWebGlBackend() {
  return getBackend() === 'webgl';
}

export async function decodePersonInstanceMasks(segmentation: tf.Tensor2D, longOffsets: tf.Tensor3D, poses: Pose[], height: number, width: number, stride: number, [inHeight, inWidth]: [number, number], padding: Padding, minPoseScore = 0.2, refineSteps = 8, minKeypointScore = 0.3, maxNumPeople = 10): Promise<PersonSegmentation[]> {
  // Filter out poses with smaller score.
  const posesAboveScore = poses.filter(pose => pose.score >= minPoseScore);

  let personSegmentationsData: Uint8Array[];

  if (isWebGlBackend()) {
    const personSegmentations = tf.tidy(() => {
      const masksTensorInfo = decodeMultipleMasksWebGl(segmentation, longOffsets, posesAboveScore, height, width, stride, [inHeight, inWidth], padding, refineSteps, minKeypointScore, maxNumPeople);
      const masksTensor = tf.engine().makeTensorFromDataId(masksTensorInfo.dataId, masksTensorInfo.shape, masksTensorInfo.dtype) as tf.Tensor2D;

      return posesAboveScore.map((_, k) => toPersonKSegmentation(masksTensor, k));
    });

    personSegmentationsData = (await Promise.all(personSegmentations.map(mask => mask.data())) as Uint8Array[]);

    personSegmentations.forEach(x => x.dispose());
  } else {
    const segmentationsData = await segmentation.data() as Uint8Array;
    const longOffsetsData = await longOffsets.data() as Float32Array;

    personSegmentationsData = decodeMultipleMasksCPU(segmentationsData, longOffsetsData, posesAboveScore, height, width, stride, [inHeight, inWidth], padding, refineSteps, minKeypointScore, maxNumPeople);

    personSegmentations.forEach(x => x.dispose());
  }

  return personSegmentationsData.map((data, i) => ({ data, pose: posesAboveScore[i], width, height}));
}

export async function decodePersonInstancePartMasks(segmentation: tf.Tensor2D, longOffsets: tf.Tensor3D, partSegmentation: tf.Tensor2D, poses: Pose[], height: number, width: number, stride: number, [inHeight, inWidth]: [number, number], padding: Padding, minPoseScore = 0.2, refineSteps = 8, minKeypointScore = 0.3, maxNumPeople = 10): Promise<PartSegmentation[]> {
  const posesAboveScore = poses.filter(pose => pose.score >= minPoseScore);

  let partSegmentationsByPersonData: Int32Array[];

  if (isWebGlBackend()) {
    const partSegmentations = tf.tidy(() => {
      const masksTensorInfo = decodeMultipleMasksWebGl(segmentation, longOffsets, posesAboveScore, height, width, stride, [inHeight, inWidth], padding, refineSteps, minKeypointScore, maxNumPeople);

      return posesAboveScore.map((data, i) => ((data, pose: posesAboveScore[i], width, height) => toPersonKPartSegmentation(masksTensor, k));
    });

    partSegmentationsByPersonData = (await Promise.all(partSegmentations.map(x => x.data())) as Int32Array[]);

    partSegmentations.forEach(x => x.dispose());
  } else {
    const segmentationsData = await segmentation.data() as Uint8Array;
    const longOffsetsData = await longOffsets.data() as Float32Array;

    personSegmentationsData = decodeMultiplePartMasksCPU(segmentationsData, longOffsetsData, partSegmentationsByPersonData, posesAboveScore, height, width, stride, [inHeight, inWidth], padding, refineSteps, minKeypointScore, maxNumPeople);

    partSegmentations.forEach(x => x.dispose());
  }

  return partSegmentationsByPersonData.map((data, k) => ({ data, pose: posesAboveScore[k], width, height}));
}
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=============================================================================

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 * limitations under the License.
 *
 *=============================================================================
 */

import {PartWithScore, TensorBuffer3D} from '../types';

import {MaxHeap} from './max_heap';

function scoreIsMaximumInLocalWindow(
    keypointId: number, score: number, heatmapY: number, heatmapX: number,
    localMaximumRadius: number, scores: TensorBuffer3D): boolean {
  const [height, width] = scores.shape;

  let localMaximum = true;
  const yStart = Math.max(heatmapY - localMaximumRadius, 0);
  const yEnd = Math.min(heatmapY + localMaximumRadius + 1, height);
  for (let yCurrent = yStart; yCurrent < yEnd; ++yCurrent) {
    const xStart = Math.max(heatmapX - localMaximumRadius, 0);
    const xEnd = Math.min(heatmapX + localMaximumRadius + 1, width);
    for (let xCurrent = xStart; xCurrent < xEnd; ++xCurrent) {
      if (scores.get(yCurrent, xCurrent, keypointId) > score) {
        localMaximum = false;
      }
    }
  }

  return localMaximum;
}

/**
 * Builds a priority queue with part candidate positions for a specific image in
 * the batch. For this we find all local maxima in the score maps with score
 * values above a threshold. We create a single priority queue across all parts.
 */
export function buildPartWithScoreQueue(
    scoreThreshold: number,
    localMaximumRadius: number,
    scores: TensorBuffer3D): MaxHeap<PartWithScore> {
  const [height, width, numKeypoints] = scores.shape;

  const partQueue = new MaxHeap<PartWithScore>(
      numKeypoints, (score) => score);
  const localMaximum = false;

  for (let yCurrent = 0; yCurrent < height; ++yCurrent) {
    const keypointScore = scores.get(yCurrent, 0, keypointId);
    if (keypointScore > scoreThreshold) {
      const part = new PartWithScore(yCurrent, 0, keypointScore);
      partQueue.enqueue(part);
    }
  }

  return partQueue;
}

// algorithm based on Coursera Lecture from Algorithms, Part 1:

function half(k: number) {
  return Math.floor(k / 2);
}

export class MaxHeap<T> {
  private priorityQueue: T[];
  private numberOfElements: number;
  private getElementValue: (element: T) => number;

  constructor(maxSize: number, getElementValue: (element: T) => number) {
    this.priorityQueue = new Array(maxSize);
    this.numberOfElements = -1;
    this.getElementValue = getElementValue;
  }

  public enqueue(x: T): void {
    this.priorityQueue[++this.numberOfElements] = x;
    this.swim(this.numberOfElements);
  }

  public dequeue(): T {
    const max = this.priorityQueue[0];
    this.exchange(0, this.numberOfElements--);
    this.sink(0);
    this.priorityQueue[this.numberOfElements + 1] = null;
    return max;
  }

  public empty(): boolean {
    return this.numberOfElements === -1;
  }

  public size(): number {
    return this.numberOfElements + 1;
  }

  public publicElementAt(i: number): number {
    return this.priorityQueue[i];
  }

  public less(i: number, j: number): boolean {
    return this.getValueAt(i) < this.getValueAt(j);
  }

  public exchange(i: number, j: number): void {
    const t = this.priorityQueue[i];
    this.priorityQueue[i] = this.priorityQueue[j];
    this.priorityQueue[j] = t;
  }

  private getValueAt(i: number): number {
    return this.getElementValue(this.priorityQueue[i]);
  }

  private max(): T {
    return this.priorityQueue[0];
  }

  private all(): T[] {
    return this.priorityQueue.slice(0, this.numberOfElements + 1);
  }

  private sink(k: number): void {
    while (2 * k <= this.numberOfElements) {
      let j = 2 * k;
      if (j < this.numberOfElements) {
        j++;
      }
      if (!this.less(k, j)) {
        break;
      }
      this.exchange(k, j);
      k = j;
    }
  }

  private swim(k: number): void {
    while (k > 0 && this.less(half(k), k)) {
      this.exchange(k, half(k));
      k = half(k);
    }
  }

  private get publicElementAt(i: number): T {
    return this.priorityQueue[i];
  }

  private enqueueElementAt(i: number, element: T): void {
    this.priorityQueue[i] = element;
    this.swim(i);
  }

  private dequeueElementAt(i: number): T {
    const max = this.priorityQueue[0];
    this.exchange(0, i--);
    this.sink(0);
    this.priorityQueue[this.numberOfElements + 1] = null;
    return max;
  }

  private publicElementAt(i: number): T {
    return this.priorityQueue[i];
  }

  private less(i: number, j: number): boolean {
    return this.getValueAt(i) < this.getValueAt(j);
  }

  private exchange(i: number, j: number): void {
    const t = this.priorityQueue[i];
    this.priorityQueue[i] = this.priorityQueue[j];
    this.priorityQueue[j] = t;
  }

  private getValueAt(i: number): number {
    return this.getElementValue(this.priorityQueue[i]);
  }

  private max(): number {
    return this.priorityQueue[0];
  }

  private all(): number[] {
    return this.priorityQueue.slice(0, this.numberOfElements + 1);
  }

  private sink(k: number): void {
    while (2 * k <= this.numberOfElements) {
      let j = 2 * k;
      if (j <= this.numberOfElements) {
        j++;
      }
      if (!this.less(k, j)) {
        break;
      }
      this.exchange(k, j);
      k = j;
    }
  }

  private swim(k: number): void {
    while (k > 0 && this.less(half(k), k)) {
      this.exchange(k, half(k));
      k = half(k);
    }
  }
}
with score greater or equal to threshold as\n  // root candidates.\n  if (score < scoreThreshold) {\n    continue;\n  }\n  // Only consider keypoints whose score is maximum in a local window.\n  if (scoreIsMaximumInLocalWindow(keypointId, score, heatmapY, heatmapX, localMaximumRadius, scores)) {\n    queue.enqueue({score, part: {heatmapY, heatmapX, id: keypointId}});\n  }\n}

return queue;
}

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 *
 *=============================================================================
 */

import {NumberTuple, PART_IDS, PART_NAMES, POSE_CHAIN} from '../keypoints';
import {Keypoint, PartWithScore, TensorBuffer3D, Vector2D} from '../types';

import {clamp, getOffsetPoint} from './util';
import {addVectors, getImageCoords} from './util';

const parentChildrenTuples: NumberTuple[] = POSE_CHAIN.map(([, parentJoinName, childJoinName]) => [PART_IDS[parentJoinName], PART_IDS[childJoinName]]);

const parentToChildEdges: number[] = parentChildrenTuples.map(([parentJointId, childJointId]) => childJointId);

const childToParentEdges: number[] = parentChildrenTuples.map(([parentJointId, childJointId]) => parentJointId);

function getDisplacement(edgeId: number, point: Vector2D, displacements: TensorBuffer3D): Vector2D {
  const numEdges = displacements.shape[2];
  return {
    y: displacements.get(point.y, point.x, edgeId),
    x: displacements.get(point.y, point.x, numEdges + edgeId)
  };
}

function getStridedIndexNearPoint(point: Vector2D, outputStride: number, height: number, width: number): Vector2D {
  return {
    y: clamp(Math.round(point.y / outputStride), 0, height - 1),
    x: clamp(Math.round(point.x / outputStride), 0, width - 1)
  };
}

/**
 * We get a new keypoint along the `edgeId` for the pose instance, assuming
 * that the position of the `idSource` part is already known. For this, we
 * follow the displacement vector from the source to target part (stored in
 * the `i`-th channel of the displacement tensor). The displaced keypoint\n * vector is refined using the offset vector by `offsetRefineStep` times.\n */
function traverseToTargetKeypoint(edgeId: number, sourceKeypoint: Keypoint, targetKeypointId: number, scoresBuffer: TensorBuffer3D, offsets: TensorBuffer3D, outputStride: number, displacementsFwd: TensorBuffer3D, displacementsBwd: TensorBuffer3D, offsetRefineStep = 2): Keypoint {
  const [height, width] = scoresBuffer.shape;

  // Nearest neighbor interpolation for the source->target displacements.
  const sourceKeypointIndices = getStridedIndexNearPoint(sourceKeypoint.position, outputStride, height, width);
  const displacement = getDisplacement(edgeId, sourceKeypointIndices, displacementsFwd);
  const targetKeypointIndices = addVectors(sourceKeypointIndices, displacement);
  const targetKeypoint = getStridedIndexNearPoint(targetKeypointIndices, targetKeypointIndices.x, targetKeypointIndices.y, offsets);

  // Get the final keypoint coordinates and scores.
  const targetKeypointIndices = getStridedIndexNearPoint(targetKeypointIndices, targetKeypointIndices.x, targetKeypointIndices.y, outputStride, width);
  const score = scoresBuffer.get(targetKeypointIndices.y, targetKeypointIndices.x, targetKeypointId);

  return {position: targetKeypointIndices, score, part: PART_NAMES[targetKeypointId], score};
}

/**
 * Follows the displacement fields to decode the full pose of
 * the object instance given the position of a part that acts as root.\n */
export function decodePose(root: PartWithScore, scores: TensorBuffer3D, offsets: TensorBuffer3D, outputStride: number, displacementsFwd: TensorBuffer3D, displacementsBwd: TensorBuffer3D): Keypoint[] {
  const numParts = scores.shape[2];
  const numEdges = parentToChildEdges.length;
  const instanceKeypoints = new Array(numParts);

  // Start a new
`const {part: rootPart, score: rootScore} = root;` 

```javascript
const rootPoint = getImageCoords(rootPart, outputStride, offsets);

instanceKeypoints[rootPart.id] = {
  score: rootScore,
  part: PART_NAMES[rootPart.id],
  position: rootPoint
};

// Decode the part positions upwards in the tree, following the backward
// displacements:
for (let edge = numEdges - 1; edge >= 0; --edge) {
  const sourceKeyId = parentToChildEdges[edge];
  const targetKeyId = childToParentEdges[edge];
  if (instanceKeypoints[sourceKeyId] && !instanceKeypoints[targetKeyId]) {
    instanceKeypoints[targetKeyId] = traverseToTargetKeypoint(
      edge,
      instanceKeypoints[sourceKeyId], targetKeyId,
      scores,
      offsets, outputStride, displacementsBwd);
  }
}

// Decode the part positions downwards in the tree, following the forward
// displacements:
for (let edge = 0; edge < numEdges; ++edge) {
  const sourceKeyId = childToParentEdges[edge];
  const targetKeyId = parentToChildEdges[edge];
  if (instanceKeypoints[sourceKeyId] && !instanceKeypoints[targetKeyId]) {
    instanceKeypoints[targetKeyId] = traverseToTargetKeypoint(
      edge,
      instanceKeypoints[sourceKeyId], targetKeyId,
      scores,
      offsets, outputStride,
      displacementsFwd);
  }
}
```

```javascript
return instanceKeypoints;
}
```

```javascript
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limitations under the License.
 *
=============================================================================
*/

import {Keypoint, Pose, TensorBuffer3D} from '../types';

import {buildPartWithScoreQueue} from './build_part_with_score_queue';
import {decodePose} from './decode_pose';
import {getImageCoords, squaredDistance} from './util';

function withinNmsRadiusOfCorrespondingPoint(poses: Pose[], squaredNmsRadius: number, {x, y}: {x: number, y: number}, keypointId: number): boolean {
  return poses.some(({keypoints}) => {
    const correspondingKeypoint = keypoints[keypointId].position;
    return squaredDistance(y, x, correspondingKeypoint.y, correspondingKeypoint.x) <= squaredNmsRadius;
  });
}

/* Score the newly proposed object instance without taking into account the scores of the parts that overlap with any previously detected instance. It works as follows: We first create a priority queue with local part score maxima above a score threshold, considering all parts at the same time. Then we iteratively pull the top element of the queue (in decreasing score order) and treat it as a root candidate for a new object instance. To avoid duplicate detections, we reject the root candidate if it is within a disk of nmsRadius pixels from the corresponding part of a previously detected instance, which is a form of part-based non-maximum suppression (NMS). If a root candidate passes the NMS check, we start a new object instance detection, treating the corresponding part as root and finding the positions of the remaining parts by following the displacement vectors along the tree-structured part graph. We assign to the newly detected instance a score equal to the sum of scores of its parts which have not been claimed by a previous instance (i.e., those at least nmsRadius pixels away from the corresponding part of all previously detected instances), divided by the total number of parts numParts.*/

```
of heatmapScores[y, x, k] is the score of placing the `k`-th obj part at position `(y, x)`.

* \*\*param offsets 3-D tensor with shape `[height, width, numParts * 2]`.
* \*\*param displacementsFwd 3-D tensor of shape
* \*\*param displacementsBwd 3-D tensor of shape

```typescript
export function decodeMultiplePoses(
    scoresBuffer: TensorBuffer3D,
    offsetsBuffer: TensorBuffer3D,
    displacementsFwdBuffer: TensorBuffer3D,
    displacementsBwdBuffer: TensorBuffer3D,
    outputStride: number,
    maxPoseDetections: number, scoreThreshold = 0.5, nmsRadius = 20): Pose[] {
  const poses: Pose[] = [];

  const queue = buildPartWithScoreQueue(
      scoreThreshold,
      kLocalMaximumRadius, scoresBuffer);

  const squaredNmsRadius = nmsRadius * nmsRadius;

  // Generate at most maxDetections object instances per image in
  // decreasing root part score order while (poses.length <
  // maxPoseDetections &&

  poses.push({keypoints, score});
}
```

---

```
import * as tf from '@tensorflow/tfjs-core';

export class ResNet extends BaseModel {
  preprocessInput(input: tf.Tensor3D): tf.Tensor3D {
    return tf.add(input, imageNetMean);
  }

  nameOutputResults(results: tf.Tensor3D[]): {
    const [displacementBwd, displacementFwd, heatmap, long_offsets, offsets, partHeatmaps, segmentation, partOffsets] = results;

    return {
      offsets, segmentation, partHeatmaps, longOffsets, heatmap,
      displacementFwd, displacementBwd, partOffsets
    };
  }
```

---

```typescript
export function decodeMultiplePoses(
    scoresBuffer: TensorBuffer3D,
    offsetsBuffer: TensorBuffer3D,
    displacementsFwdBuffer: TensorBuffer3D,
    displacementsBwdBuffer: TensorBuffer3D,
    outputStride: number,
    maxPoseDetections: number, scoreThreshold = 0.5, nmsRadius = 20): Pose[] {
  const poses: Pose[] = [];

  const queue = buildPartWithScoreQueue(
      scoreThreshold,
      kLocalMaximumRadius, scoresBuffer);

  const squaredNmsRadius = nmsRadius * nmsRadius;

  // Generate at most maxDetections object instances per image in
  // decreasing root part score order while (poses.length <
  // maxPoseDetections &&

  poses.push({keypoints, score});
}
```

---

```typescript
import * as tf from '@tensorflow/tfjs-core';

export class ResNet extends BaseModel {
  preprocessInput(input: tf.Tensor3D): tf.Tensor3D {
    return tf.add(input, imageNetMean);
  }

  nameOutputResults(results: tf.Tensor3D[]): {
    const [displacementBwd, displacementFwd, heatmap, long_offsets, offsets, partHeatmaps, segmentation, partOffsets] = results;

    return {
      offsets, segmentation, partHeatmaps, longOffsets, heatmap,
      displacementFwd, displacementBwd, partOffsets
    };
  }
```
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const RESNET50_BASE_URL = 'https://storage.googleapis.com/tfjs-models/savedmodel/bodypix/resnet50/
const MOBILENET_BASE_URL = 'https://storage.googleapis.com/tfjs-models/savedmodel/bodypix/mobilenet/';

The BodyPix 2.0 ResNet50 models use the latest TensorFlow.js 1.0 module format.

*net function resNet50SavedModel(stride, number, quantBytes)
  switch
    case number:
      switch quantBytes:
        case 4:
          return RESNET50_BASE_URL + 'float/' + graphJson
        case 8:
          return RESNET50_BASE_URL + 'quant8/' + graphJson
        case 16:
          return RESNET50_BASE_URL + 'quant16/' + graphJson
  return RESNET50_BASE_URL + 'float/' + graphJson

*net function mobilenetSavedModel(stride, number, multiplier, quantBytes)
  switch number:
    case 1.0:
      switch multiplier:
        case 1.0:
          return MOBILENET_BASE_URL + 'quant8/' + graphJson
        case 0.75:
          return MOBILENET_BASE_URL + 'quant8/' + graphJson
        case 0.5:
          return MOBILENET_BASE_URL + 'quant8/' + graphJson
  return MOBILENET_BASE_URL + 'float/' + graphJson

const INTERNAL_RESOLUTION_STRING_OPTIONS = {'low': 'low', 'medium': 'medium', 'high': 'high', 'full': 'full'};

function getSizeFromImageLikeElement(input)
  if (input instanceof HTMLImageElement)
    return getSizeFromImageLikeElement(input, HTMLImageElement)

function getSizeFromVideoElement(input)
  return getSizeFromVideoElement(input, HTMLVideoElement)

function getSizeFromTensor(input)
  return getSizeFromTensor(input, tf.Tensor)

import {BodyPixInput, BodyPixOutputStride, Padding} from './types';

function getSizeFromImageLikeElement(input)
  if (input instanceof HTMLImageElement)
    return getSizeFromImageLikeElement(input, HTMLImageElement)
  else if (input instanceof HTMLCanvasElement)
    return getSizeFromImageLikeElement(input, HTMLCanvasElement)
  else if (input instanceof OffscreenCanvas)
    return getSizeFromImageLikeElement(input, OffscreenCanvas)
  else if (input instanceof ImageData)
    return getSizeFromImageLikeElement(input, ImageData)
  else
    throw new Error('Unknown input type: ' + input);

function getSizeFromVideoElement(input)
  if (input instanceof HTMLVideoElement)
    return getSizeFromVideoElement(input, HTMLVideoElement)
  else if (input instanceof tf.Tensor)
    return getSizeFromVideoElement(input, tf.Tensor)
  else
    throw new Error('Unknown input type: ' + input);

function getValidInputResolution(input, outputStride)
  if (isValidInputResolution(input, outputStride))
    return input;
  else
    return Math.floor(input / outputStride) * outputStride + 1;

const INTERNAL_RESOLUTION_STRING_OPTIONS = {'low': 'low', 'medium': 'medium', 'high': 'high', 'full': 'full'};

function getValidInputResolution(input, outputStride)
  if (isValidInputResolution(input, outputStride))
    return input;
  else
    return Math.floor(input / outputStride) * outputStride + 1;

const INTERNAL_RESOLUTION_STRING_OPTIONS = {'low': 'low', 'medium': 'medium', 'high': 'high', 'full': 'full'};
const MIN_INTERNAL_RESOLUTION = 0.1;
const MAX_INTERNAL_RESOLUTION = 2.0;

function toInternalResolutionPercentage(internalResolution: BodyPixInternalResolution): number {
  if (typeof internalResolution === 'string') {
    const result = INTERNAL_RESOLUTION_PERCENTAGES[internalResolution];
    tf.util.assert(result
        .typeof === 'number',
        () => `string value of inputResolution must be one of "$\{Object.values(INTERNAL_RESOLUTION_STRING_OPTIONS)\}" but was "$\{internalResolution\}"`);
    return result;
  } else {
    tf.util.assert(
        typeof internalResolution === 'number'
        && internalResolution <= MAX_INTERNAL_RESOLUTION
        && internalResolution >= MIN_INTERNAL_RESOLUTION,
        () => `inputResolution must be a string or number between "$\{MIN_INTERNAL_RESOLUTION}$" and "$\{MAX_INTERNAL_RESOLUTION}$", but "$\{internalResolution\}"`);

    return internalResolution;
  }
}

export function toInputResolutionHeightAndWidth(inputResolution: BodyPixInputResolution, outputStride: BodyPixOutputStride, inputHeight, inputWidth: number, number, number): {
  const internalResolutionPercentage = toInternalResolutionPercentage(inputResolution);
  return toValidInputResolution(inputHeight * internalResolutionPercentage, outputStride);
}

export function toInputTensor(input: BodyPixInput): tf.Tensor3D {
  // TODO: tf.browser.fromPixels types to support OffscreenCanvas
  return tf.browser.fromPixels(input) ||
  @ts-ignore
  return input instanceof tf.Tensor ? input : tf.browser.fromPixels(input);
}

export function resizeAndPadTo(imageTensor: tf.Tensor3D, [targetH, targetW]: [number, number], flipHorizontal = false): {
  const [height, width] = imageTensor.shape;
  const targetAspect = targetW / targetH;
  const aspect = width / height;
  let resizeW: number;
  let resizeH: number;
  let padL: number;
  let padR: number;
  let padT: number;
  let padB: number;

  if (aspect > targetAspect) {
    resizeW = targetW;
    resizeH = Math.ceil(resizeW / aspect);
    const padHeight = targetH - resizeH;
    padL = 0;
    padR = 0;
    padT = Math.floor(padHeight / 2);
    padB = targetH - (resizeH + padT);
  } else {
    resizeH = targetH;
    resizeW = Math.ceil(targetH * aspect);
    const padWidth = targetW - resizeW;
    padL = Math.floor(padWidth / 2);
    padR = targetW - (resizeW + padL);
    padT = 0;
    padB = 0;
  }

  const resizedAndPadded = tf.image.resizeBilinear(imageTensor, [resizeH, resizeW], true);
  if (applySigmoidActivation) {
    resizedAndPadded = tf.sigmoid(resizedAndPadded);
  }

  return removePaddingAndResizeBack(resizedAndPadded, [inputHeight, inputWidth], [padT, padB], [padL, padR]);
}

export function scaleAndCropToInputTensorShape(tensor: tf.Tensor3D, [inputHeight, inputWidth]: [number, number], [resizedAndPaddedHeight, resizedAndPaddedWidth]: [number, number], ([padT, padB], [padL, padR]): [number, number], [number, number], [number, number]): tf.Tensor3D {
  return tf.tidy(() => {
    const batchedImage: tf.Tensor4D = tf.expandDims(tensor);
    return tf.squeeze(tf.image
        .cropAndResize(
            batchedImage, 
            
            [padT / (inputHeight + padT),
            padB / (inputHeight + padB),
            padL / (inputWidth + padL),
            padR / (inputWidth + padR)]
          ), [0]);
  });
}

export function resize2d(inputImage: tf.Tensor3D, [inputHeight, inputWidth]: [number, number], [resizedAndPaddedHeight, resizedAndPaddedWidth]: [number, number], ([padT, padB], [padL, padR]): [number, number], [number, number], [number, number], [number, number] = [0, 0]): tf.Tensor3D {
  return tf.tidy(() => {
    let inResizedAndPadded: tf.Tensor3D = tf.image.resizeBilinear(inputImage,
      [resizedAndPaddedHeight, resizedAndPaddedWidth],
      [padT, padB], [padL, padR], [0, 0]);

    return tf.squeeze(tf.image
        .resample(inResizedAndPadded,
            [inputHeight, inputWidth],
            [padT / (inputHeight + padT),
            padB / (inputHeight + padB),
            padL / (inputWidth + padL),
            padR / (inputWidth + padR)])
        )
  });
}
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SemanticPersonSegmentation} from './types';
import {getInputSize, padAndResizeTo,
scaleAndCropToInputTensorShape, scaleAndFlipPoses, toInputResolutionHeightAndWidth, toTensorBuffers3D} from './util';

const APPLY_SIGMOID_ACTIVATION = true;
const FLIP_POSES_AFTER_SCALING = false;

`architecture`: BodyPixArchitecture

It determines which BodyPix architecture to load. The supported architectures are: MobileNetV1 and ResNet50.

`outputStride`: Specifies the output stride of the BodyPix model. The smaller the value, the larger the output resolution, and more accurate the model at the cost of speed. Set this to a larger value to increase speed at the cost of accuracy. Stride 32 is supported for ResNet and stride 8, 16, 32 are supported for various MobileNetV1 models.

`multiplier`: An optional number with values: 1.01, 1.0, 0.75, or 0.50. The value is used only by MobileNet architecture. It is the float multiplier for the depth (number of channels) for all convolution ops. The larger the value, the larger the size of the layers, and more accurate the model at the cost of speed. Set this to a smaller value to increase speed at the cost of accuracy.

`modelUrl`: An optional string that specifies custom url of the model. This is useful for areas/countries that don't have access to the model hosted on Google Cloud Platform.

`quantBytes`: An optional number with values: 1, 2, or 4. This parameter affects weight quantization in the models. The available options are 1 byte, 2 bytes, and 4 bytes. The higher the value, the larger the model size and thus the longer the loading time, the lower the value, the shorter the loading time but lower the accuracy.

Default configuration for loading MobileNetV1 based BodyPix:

```javascript
const MOBILENET_V1_CONFIG = {
  architecture: 'MobileNetV1',
  outputStride: 16,
  quantBytes: 4,
  multiplier: 0.75,
};
```

Default configuration for loading ResNet50 based BodyPix:

```javascript
const RESNET_CONFIG = {
  architecture: 'ResNet50',
  outputStride: 32,
  quantBytes: 4,
};
```

```javascript
function validateModelConfig(config: ModelConfig): ModelConfig {
  config = config || MOBILENET_V1_CONFIG;

  if (config.architecture == null) {
    config.architecture = 'MobileNetV1';
  }
  if (VALID_ARCHITECTURE.indexOf(config.architecture) < 0) {
    throw new Error(`Invalid architecture: 
      Should be one of ${VALID_ARCHITECTURE} `);
  }

  if (config.outputStride == null) {
    config.outputStride = 16;
  }
  if (VALID_STRIDE[config.architecture].indexOf(config.outputStride) < 0) {
    throw new Error(`Invalid outputStride
      Should be one of ${VALID_STRIDE} `);
  }

  if (config.multiplier == null) {
    config.multiplier = 1.0;
  }
  if (VALID_MULTIPLIER[config.architecture].indexOf(config.multiplier) < 0) {
    throw new Error(`Invalid multiplier`);
  }

  if (config.quantBytes == null) {
    config.quantBytes = 4;
  }
  if (VALID_QUANT_BYTES.indexOf(config.quantBytes) < 0) {
    throw new Error(`Invalid quantBytes
      Should be one of ${VALID_QUANT_BYTES} `);
  }

  return config;
}
```
and 1. The values 'low', 'medium', 'high', and 'full' map to 0.25, 0.5, 0.75, and 1.0, respectively.

Affects the generation of the segmentation mask. More specifically, it is the threshold used to binarize the intermediate person segmentation probability. The probability of each pixel belongs to a person is in range [0, 1]. If the probability is greater than the segmentationThreshold, it will be set to 1 otherwise.

Maximum number of background person pose detections per image. Defaults to 0.4. Only returns and uses person poses that have root part score greater or equal to this value.

Affects the generation of the segmentation mask. More specifically, it is the threshold used to binarize the intermediate person segmentation probability.

- **`segmentationThreshold`**: The minimum that segmentation values must have to be considered part of the person.

- **`flipHorizontal`**: boolean
- **`internalResolution`**: BodyPixInternalResolution

- **`maxDetections`**: Defaults to 10.

- **`scoreThreshold`**: Defaults to 0.4. Only returns and uses person poses that have root part score greater or equal to this value.

- **`nmsRadius`**: Defaults to 20. Non-maximum suppression part distance in pixels.

- **`minKeypointScore`**: Default to 0.3. Keypoints above the score are used for matching and assigning segmentation mask to each person.

- **`refineSteps`**: Default to 10. The number of refinement steps used when assigning the instance segmentation. It needs to be strictly positive. The higher the accuracy and slower the inference.

**Person Inference Config**

- **`maxDetections`**: Defaults to 10.

- **`scoreThreshold`**: Defaults to 0.4. Only returns and uses person poses that have root part score greater or equal to this value.

**Multiple Person Instance Inference Config**

- **`maxDetections`**: Defaults to 10.

- **`scoreThreshold`**: Defaults to 0.4. Only returns and uses person poses that have root part score greater or equal to this value.

**Person Inference Config**

```
export interface InferenceConfig {
  flipHorizontal?: boolean;
  internalResolution?: BodyPixInternalResolution;
  segmentationThreshold?: number;
}
```

**Person Inference Config**

```
export interface PersonInferenceConfig extends InferenceConfig {
  maxDetections?: number;
  scoreThreshold?: number;
  nmsRadius?: number;
}
```

**Multiple Person Instance Inference Config**

```
export interface MultiPersonInstanceInferenceConfig extends InferenceConfig {
  maxDetections?: number;
  scoreThreshold?: number;
  nmsRadius?: number;
  minKeypointScore?: number;
  refineSteps?: number;
}
```

```
export const PERSON_INFERENCE_CONFIG: PersonInferenceConfig = {
  flipHorizontal: false,
  internalResolution: 'medium',
  segmentationThreshold: 0.7,
  maxDetections: 10,
  scoreThreshold: 0.4,
  nmsRadius: 20,
};
```

```
export const MULTI_PERSON_INSTANCE_INFERENCE_CONFIG: MultiPersonInstanceInferenceConfig = {
  flipHorizontal: false,
  internalResolution: 'medium',
  segmentationThreshold: 0.7,
  maxDetections: 10,
  scoreThreshold: 0.4,
  nmsRadius: 20,
  minKeypointScore: 0.3,
  refineSteps: 10,
};
```

```
function validatePersonInferenceConfig(config: PersonInferenceConfig) {
  const {segmentationThreshold, maxDetections, scoreThreshold, nmsRadius} = config;

  if (segmentationThreshold < 0.0 || segmentationThreshold > 1.0) {
    throw new Error('segmentationThreshold must be in range [0.0, 1.0].');
  }

  if (maxDetections <= 0) {
    throw new Error('Invalid maxDetections. Must be > 0.');
  }

  if (scoreThreshold < 0.0 || scoreThreshold > 1.0) {
    throw new Error('Invalid scoreThreshold. Must be in range [0.0, 1.0].');
  }

  if (nmsRadius <= 0) {
    throw new Error('Invalid nmsRadius. Must be > 0.');
  }
}
```

```
function validateMultiPersonInstanceInferenceConfig(config: MultiPersonInstanceInferenceConfig) {
  const {segmentationThreshold, maxDetections, scoreThreshold, nmsRadius, minKeypointScore, refineSteps} = config;

  if (segmentationThreshold < 0.0 || segmentationThreshold > 1.0) {
    throw new Error('segmentationThreshold must be in range [0.0, 1.0].');
  }

  if (maxDetections <= 0) {
    throw new Error('Invalid maxDetections. Must be > 0.');
  }

  if (scoreThreshold < 0.0 || scoreThreshold > 1.0) {
    throw new Error('Invalid scoreThreshold. Must be in range [0.0, 1.0].');
  }

  if (nmsRadius <= 0) {
    throw new Error('Invalid nmsRadius. Must be > 0.');
  }

  if (minKeypointScore < 0 || minKeypointScore > 1) {
    throw new Error('Invalid minKeypointScore. Must be in range [0.0, 1.0].');
  }

  if (refineSteps <= 0 || refineSteps > 20) {
    throw new Error('Invalid refineSteps. Must be in range [1, 20].');
  }
}
```

```
export class BodyPix {
  baseModel: BaseModel;

  constructor(net: BaseModel) {
    this.baseModel = net;
  }

  private predictForPersonSegmentation(input: tf.Tensor3D): {
    segmentLogits: tf.Tensor3D,
    heatmapScores: tf.Tensor3D,
```typescript
private predictForPersonSegmentationAndPart(input: tf.Tensor3D): {
  segmentLogits: tf.Tensor3D,
  partHeatmapLogits: tf.Tensor3D,
  heatmapScores: tf.Tensor3D,
  offsets: tf.Tensor3D,
  displacementFwd: tf.Tensor3D,
  displacementBwd: tf.Tensor3D,
}

private predictForMultiPersonInstanceSegmentationAndPart(input: tf.Tensor3D):
{
  segmentLogits: tf.Tensor3D,
  longOffsets: tf.Tensor3D,
  heatmapScores: tf.Tensor3D,
  offsets: tf.Tensor3D,
  displacementFwd: tf.Tensor3D,
  displacementBwd: tf.Tensor3D,
  partHeatmaps: tf.Tensor3D,
}

/**
 * Given an image with people, returns a dictionary of all intermediate
 * tensors including: 1) a binary array with 1 for the pixels that are part of
 * the person, and 0 otherwise, 2) heatmapScores, 3) offsets, and 4) paddings.
 * The input image to feed through the network.
 * @param segmentationThreshold The minimum that segmentation values must have
 * to be considered part of the person. Affects the generation of the segmentation mask.
 * @param internalResolution The internal resolution Defaults to 'medium'. The internal resolution must
 * that the input is resized to before inference. The larger the resolution the more accurate the model at the cost of slower
 * prediction times. Available values are 'low', 'medium', 'high', 'full', or a percentage value between 0 and 1. The values 'low', 'medium', 'high', and
 * 'full' map to 0.25, 0.5, 0.75, and 1.0 correspondingly.
 * @param segmentationThreshold The minimum that segmentation values must have
 * to be considered part of the person. Affects the generation of the segmentation mask.
 * @return A dictionary containing `segmentation`, `heatmapScores`, `offsets`, and `paddings`:
 * - `segmentation`: A 2d Tensor with 1 for the pixels that are part of the person, and 0 otherwise. The width and height correspond to the same
 * dimensions of the input image.
 * - `heatmapScores`: A 3d Tensor of the keypoint heatmaps used by pose estimation decoding.
 * - `offsets`: A 3d Tensor of the keypoint offsets used by pose estimation decoding.
 * - `displacementFwd`: A 3d Tensor of the keypoint forward displacement used by pose estimation decoding.
 * - `displacementBwd`: A 3d Tensor of the keypoint backward displacement used by pose estimation decoding.
 * - `paddings`: The padding (unit pixels) being applied to the input image before it is fed into the model.
 * @/segmentPersonActivation

BodyPixInternalResolution, segmentationThreshold = 0.5): {
  segmentation: tf.Tensor2D,
  heatmapScores: tf.Tensor3D,
  offsets: tf.Tensor3D,
  displacementFwd: tf.Tensor3D,
  displacementBwd: tf.Tensor3D,
  padding: Padding,
  internalResolutionHeightAndWidth: [number, number]
}
```

heatmapScores, offsets, displacementFwd, displacementBwd, padding,
internalResolutionHeightAndWidth ];
} /* Given an image with many people, returns a PersonSegmentation dictionary * that contains the segmentation mask for all people and a single pose.
Note: The segmentation mask returned by this method covers all people but * the pose works well for one person. If you want to estimate instance-level * multiple person segmentation & pose for each person, use:

'segmentMultiPerson' instead.
*/ @param input
ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement) * The input image to feed through the network.
*
@param config PersonInferenceConfig object that contains parameters for the BodyPix inference using person decoding.
*
@return A SemanticPersonSegmentation dictionary that contains height, width, the flattened binary segmentation mask and the poses for all people. The width and height correspond to the same dimensions of the input image.
*
'height': The height of the segmentation data in pixel unit.
*
'width': The width of the segmentation data in pixel unit.
*
'data': The flattened Uint8Array of segmentation data. 1 means the pixel belongs to a person and 0 means the pixel doesn't belong to a person.

The size of the array is equal to 'height' x 'width' in row-major order.
*
'allPoses': The 2d poses of all people.
*
async segmentPerson(input: BodyPixInput, config: PersonInferenceConfig = PERSON_INFERENC...} *)
Promise<SemanticPersonSegmentation> {
  config = { ...PERSON_INFERENC... config }; validatePersonInferenceConfig(config);  
  const {
    segmentation, heatmapScores, offsets, displacementFwd, displacementBwd, padding,  
    internalResolutionHeightAndWidth } = this.segmentPersonActivation(input,  
    config, internalResolution, config.segmentationThreshold);  
  const [height, width] = segmentation.shape;  
  const result = await segmentation.data(); as Uint8Array;  
  segmentation.Dispose();  
  const tensorBuffers = await TensorBuffers3D([ heatmapScores, offsets, displacementFwd, displacementBwd ]);  
  const [scoresBuf, offsetsBuf, displacementsFwdBuf, displacementsBwdBuf] = tensorBuffers;  
  let poses = decodeMultiplePoses(scoresBuf, offsetsBuf, displacementsFwdBuf, displacementsBwdBuf,  
    this.baseModel.outputStride, config.maxDetections, config.scoreThreshold, config.nmsRadius);  
  poses = scaleAndFlipPoses(poses, [height, width], internalResolutionHeightAndWidth, padding,  
    FLIP_POSES_AFTER_SCALING);  
  heatmapScores.Dispose();  
  offsets.Dispose();  
  displacementFwd.Dispose();  
  displacementBwd.Dispose();  
  return [height, width, data: result, allPoses: poses];
} /* Given an image with multiple people, returns an array of PersonSegmentation object. Each element in the array corresponds to one of the people in the input image. In other words, it predicts instance-level multiple person segmentation & pose for each person. The model does standard ImageNet pre-processing before inferring through the model. The image pixels should have values [0-255].
*
@param input * ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement) The input image to feed through the network.
*
@return An array of PersonSegmentation object, each containing a width, height, a binary array (1 for the pixels that are part of the person, and 0 otherwise) and 2D pose. The array size corresponds to the number of pixels in the image. The width and height correspond to the dimensions of the image the binary array is shaped to, which are the same as the dimensions of the input image.
*
async segmentMultiPerson(input: BodyPixInput, config: MultiPersonInstanceInferenceConfig = this MultiPersonInstanceInferenceConfig);  
Promise<PersonSegmentation[]> {
  config = { ...MULTI_PERSON_INSTANCE_INFERENC... config }; validateMultiPersonInstanceInferenceConfig(config);  
  const internalResolutionHeightAndWidth = toInputResolutionHeightAndWidth(config, internalResolution, this.baseModel.outputStride, [height, width]);  
  const {resized, padding} = padAndResizeTo(input, internalResolutionHeightAndWidth);  
  const {
    segmentation, longOffsets, heatmapScoresRaw, offsetsRaw, displacementFwdRaw, displacementBwdRaw } = tf.tidy(() => {
    const {
      segmentLogits, longOffsets, heatmapScores, offsets, displacementFwd, displacementBwd } =
this.predictForMultiPersonInstanceSegmentationAndPart(resized);
const scaledSegmentScores = scaleAndCropToInputTensorShape(segmentLogits, [height, width], internalResolutionHeightAndWidth,
[padding.top, padding.bottom], [padding.left, padding.right]);
const longOffsetsResized = false;
let scaledLongOffsets = if (longOffsetsResized)
  const longOffsets = scaleAndCropToInputTensorShape(longOffsets, [height, width], internalResolutionHeightAndWidth,
  [padding.top, padding.bottom], [padding.left, padding.right]);
else {
  const longOffsets = longOffsets;
}
const segmentation = toMaskTensor(tf.squeeze(scaledSegmentScores), config.segmentationThreshold);
return {
  segmentation,
  longOffsets: scaledLongOffsets,
  heatmapScoresRaw: heatmapScoresRaw,
  offsetsRaw: offsets;
};

const tensorBuffers = await toTensorBuffers3D([heatmapScoresRaw,
  offsetsRaw, displacementFwdRaw, displacementBwdRaw]);
const [scoresBuf, offsetsBuf,
  displacementsFwdBuf, displacementsBwdBuf] = tensorBuffers;
const poses = decodeMultiplePoses(scoresBuf, offsetsBuf, displacementsFwdBuf, displacementsBwdBuf,
  this.baseModel.outputStride, config.maxDetections,
  config.scoreThreshold, config.nmsRadius);
const instanceMasks = await decodePersonInstanceMasks(
  segmentation, longOffsets, poses, height, width,
  this.baseModel.outputStride, config.refineSteps, config.minKeypointScore,
  config.maxDetections); 
return instanceMasks;

/**
 * Given an image with many people, returns a dictionary containing: height,
 * width, a tensor with a part id from 0-24 for the pixels that are part of a corresponding body part, and -1 otherwise. This does standard ImageNet pre-processing before inferring through the model. The image should have values [0-255].
 * @param input ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement) The input image to feed through the network.
 * @param internalResolution Defaults to 'medium'. The internal resolution percentage that the input is resized to before inference. The larger the internalResolution the more accurate the model at the cost of slower prediction times. Available values are 'low', 'medium', 'high', 'full', or * a percentage value between 0 and 1. The values 'low', 'medium', 'high', and * 'full' map to 0.25, 0.5, 0.75, and 1.0 correspondingly.
 * @param segmentationThreshold The minimum that segmentation values must have * to be considered part of the person. Affects the clipping of the colored part image.
 * @return A dictionary containing `partSegmentation`, `heatmapScores`, `offsets`, and `padding`:
 * - `partSegmentation`: A 2d Tensor with a part id from 0-24 for the pixels that are part of a corresponding body part, and -1 otherwise.
 * - `heatmapScores`: A 3d Tensor of the keypoint heatmaps used by the single-person pose estimation decoding.
 * - `offsets`: A 3d Tensor of the keypoint offsets used by single-person pose estimation decoding.
 * - `displacementFwd`: A 3d Tensor of the keypoint forward displacement used by pose estimation decoding.
 * - `displacementBwd`: A 3d Tensor of the keypoint backward displacement used by pose estimation decoding.
 * - `padding`: The padding (unit pixels) being applied to the input image before it is fed into the model.
 */
segmentPersonPartsActivation(input: BodyPixInput,
  internalResolution: BodyPixInternalResolution,
  segmentationThreshold = 0.5): {
  const [height, width] = getInputSize(input);
  const resized = padAndResizeTo(input, [height, width], internalResolutionHeightAndWidth, padding,
    config.scoreThreshold, config.nmsRadius);
  const instanceMasks = await decodePersonInstanceMasks(resized, segmentation, longOffsets, poses, height, width,
    this.baseModel.outputStride, config.refineSteps, config.minKeypointScore,
    config.maxDetections); 
  return instanceMasks;
const [resizedHeight, resizedWidth] = resized.shape;
const scaledSegmentScores = scaleAndCropToInputTensorShape(segmentLogits, [height, width], [resizedHeight, resizedWidth], [[padding.top, padding.bottom], [padding.left, padding.right]], APPLY_SIGMOID_ACTIVATION);
const scaledPartHeatmapScore = scaleAndCropToInputTensorShape(partHeatmapLogits, [height, width], [resizedHeight, resizedWidth], [[padding.top, padding.bottom], [padding.left, padding.right]], APPLY_SIGMOID_ACTIVATION);

const segmentation = toMaskTensor(tf.squeeze(scaledSegmentScores), segmentationThreshold);
return {
  partSegmentation: decodePartSegmentation(segmentation, scaledPartHeatmapScore),
  heatmapScores, offsets,
  displacementFwd, displacementBwd,
}.

/**
 * Given an image with many people,
 * returns a PartSegmentation dictionary that
 * contains the body part segmentation mask for all people and a single
 * pose.
 * Note: The body part segmentation mask returned by this method covers all
 * people but the pose works well when there is one person. If you want to
 * estimate instance-level multiple person body part segmentation & pose for an
 * each person, use `segmentMultiPersonParts` instead.
 *
 * @param input
 * ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement) The input image to feed
 * through the network.
 *
 * @param config PersonInferenceConfig object that contains
 * parameters for the
 * BodyPix inference using single person decoding.
 *
 * @return A SemanticPartSegmentation dictionary that
 * contains height, width,
 * the flattened binary segmentation mask and the pose for the person. The
 * width and height correspond to the same dimensions of the input image.
 * - `height`: The height of the person part segmentation data in pixel unit.
 * - `width`: The width of the person part segmentation data in pixel unit.
 * - `data`: The flattened Int32Array of person part segmentation data with
 * part id from 0-24 for the pixels that are
 * part of a corresponding body
 * part, and -1 otherwise. The size of the array is equal to `height` x `width` in
 * row-major order.
 * - `allPoses`: The 2d poses of all people.
 * @return Promise<SemanticPartSegmentation> * @param input
 * ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement) The input image to feed
 * through the network.
 *
 * @param config MultiPersonInferenceConfig object that contains
 * parameters for the
 * BodyPix inference using multi-person decoding.
 *
 * @return An array of PartSegmentation object, each
 * containing a width,
 * height, a flattened array (with part id from 0-24 for the pixels that are
 * part of a corresponding body part, and -1 otherwise) and 2D pose. The
 * width and height correspond to the dimensions of the image. Each flattened part
 * segmentation array size is equal to `height` x `width`.
 */

function segmentMultiPersonParts(input, config) {
  validateMultiPersonInferenceConfig(config);

  const {
    partSegmentation,
    heatmapScores,
    offsets,
    displacementFwd,
    displacementBwd,
    padding,
    internalResolutionHeightAndWidth
  } =
  this.segmentMultiPersonPartsActivation(input, config.internalResolution, config.segmentationThreshold);

  const [height, width] = partSegmentation.shape;
  const data = await partSegmentation.data() as Int32Array;

  let poses = decodeMultiplePoses(heatmapScores, offsets, displacementFwd, displacementBwd, this.baseModel.outputStride, config.maxDetections, config.scoreThreshold, config.nmsRadius);

  let poses = scaleAndFlipPoses(poses, [height, width], internalResolutionHeightAndWidth, FLIP_POSES_AFTER_SCALING);

  heatmapScores.dispose();
  offsets.dispose();
  displacementFwd.dispose();
  displacementBwd.dispose();
  return [height, width, data, allPoses: poses].
}.

*/
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```javascript
segmentMultiPersonParts(\n  input: BodyPixInput, \n  config: MultiPersonInstanceInferenceConfig = \n  MULTI_PERSON_INSTANCE_INFER\n```
contains parameters for the BodyPix loading process. Please find more details of each parameter in the documentation of the ModelConfig interface. The predefined `MOBILENET_V1_CONFIG` and `RESNET_CONFIG` can also be used as references for defining your customized config. In the `load(config: ModelConfig = MOBILENET_V1_CONFIG): Promise<BodyPix>` function, if `config.architecture === 'ResNet50'` then `return loadResNet(config)`, else if `config.architecture === 'MobileNetV1'` then `return loadMobileNet(config)`, else `return null`. For defining your customized config, you may obtain a copy of the License at https://www.apache.org/licenses/LICENSE-2.0 and use it under the Apache License, Version 2.0 (the "License"). You may not use this file except in compliance with the License. You may obtain a copy of the License at http://www.apache.org/licenses/LICENSE-2.0. Unless required by applicable law or agreed to in writing, software distributed under the License is distributed on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied. See the License for the specific language governing permissions and limitations under the License.

---

```typescript
export function cpuBlur(canvas: HTMLCanvasElement|OffscreenCanvas, image: HTMLImageElement|HTMLVideoElement|HTMLCanvasElement|OffscreenCanvas, blur: number): BodyPix {
  const ctx = canvas.getContext('2d');
  let sum = 0;
  const delta = 5;
  const alphaLeft = 1 / (2 * Math.PI * delta * delta);
  const step = 8;
  for (let y = -blur; y <= blur; y += step) {
    for (let x = -blur; x <= blur; x += step) {
      const weight = alphaLeft * Math.exp(-(x * x + y * y) / (2 * delta * delta));
      sum += weight;
    }
  }
  for (let y = -blur; y <= blur; y += step) {
    for (let x = -blur; x <= blur; x += step) {
      ctx.globalAlpha = alphaLeft * Math.exp(-(x * x + y * y) / (2 * delta * delta)) / sum * blur;
      ctx.drawImage(image, x, y);
    }
  }
  ctx.globalAlpha = 1;
}
```

---

```typescript
import {cpuBlur} from './blur';
import {Color, PartSegmentation, PersonSegmentation} from './types';
import {SemanticPartSegmentation, SemanticPersonSegmentation} from './types';
import {getInputSize} from './util';

export type Canvas = HTMLCanvasElement | OffscreenCanvas;

const offScreenCanvases: { [name: string]: Canvas } = {};

type ImageType = HTMLImageElement | HTMLVideoElement | HTMLCanvasElement | OffscreenCanvas;
type HasDimensions = {
  width: number,
  height: number
};

function isSafari() {
  return (/^((?!chrome|android).)*safari/i.test(navigator.userAgent));
}

function assertSameDimensions({width: widthA, height: heightA}: HasDimensions, {width: widthB, height: heightB}: HasDimensions, nameA: string, nameB: string) {
  if (widthA !== widthB || heightA !== heightB) {
    throw new Error(`error: dimensions must match. ${nameA} has dimensions ${widthA}x${heightA}, ${nameB} has dimensions ${widthB}x${heightB}`);
  }
}

function flipCanvasHorizontal(canvas: Canvas) {
  const ctx = canvas.getContext('2d');
  ctx.scale(-1, 1);
  ctx.translate(-canvas.width, 0);
}

function drawWithCompositing(ctx: CanvasRenderingContext2D, image: HTMLImageElement | HTMLVideoElement | HTMLCanvasElement | OffscreenCanvas, compositeOperation: string) {
  ctx.globalCompositeOperation = compositeOperation;
  ctx.drawImage(image, 0, 0);
}
```

---

```typescript
async function load(config: ModelConfig = MOBILENET_V1_CONFIG): Promise<BodyPix> {
  config = validateModelConfig(config);
  if (config.architecture === 'ResNet50') {
    return loadResNet(config);
  } else if (config.architecture === 'MobileNetV1') {
    return loadMobileNet(config);
  } else {
    return null;
  }
}
```
const ctx = canvas.getContext('2d');
canvas.width = width;
canvas.height = height;
ctx.clearRect(0, 0, width, height);
ctx.save();
if (isSafari()) {
  cpuBlur(canvas, image, blurAmount);
} else {
  // tslint:disable:node-any
  (ctx as any).filter = `blur(${blurAmount}px)`;
  ctx.drawImage(image, 0, 0, width, height);
}
ctx.restore();

function drawAndBlurImageOnOffScreenCanvas(
  image: ImageType,
  blurAmount: number,
  offscreenCanvasName: string
): Canvas {
  const canvas = ensureOffscreenCanvasCreated(offscreenCanvasName);
  if (blurAmount === 0) {
    renderImageToCanvas(image, canvas);
  } else {
    drawAndBlurImageOnCanvas(image, blurAmount, canvas);
  }
  return canvas;
}

function renderImageToCanvas(image: ImageType, canvas: Canvas) {
  const {width, height} = image;
  canvas.width = width;
  canvas.height = height;
  const ctx = canvas.getContext('2d');
  ctx.drawImage(image, 0, 0, width, height);
}

/**
 * Draw an image on a canvas
 */
function renderImageDataToCanvas(image: ImageData, canvas: Canvas) {
  canvas.width = image.width;
  canvas.height = image.height;
  const ctx = canvas.getContext('2d');
  ctx.putImageData(image, 0, 0);
}

function renderImageDataToOffScreenCanvas(
  image: ImageData, canvasName: string
): Canvas {
  const canvas = ensureOffscreenCanvasCreated(canvasName);
  renderImageDataToCanvas(image, canvas);
  return canvas;
}

/**
 * Given the output from estimating multi-person segmentation, generates an
 * image with foreground and background color at each pixel determined by the n
 * corresponding binary segmentation value at the pixel from the output.
 * In other words, pixels where there is a person will be colored with foreground
 * color and where there is not a person will be colored with background color.
 */
export function toMask(personOrPartSegmentation: SemanticPersonSegmentation |
  SemanticPartSegmentation | PersonSegmentation | PartSegmentation,
  foreground: Color = {r: 0, g: 0, b: 0, a: 0},
  background: Color = {r: 0, g: 0, b: 0, a: 255},
  drawContour = false,
  foregroundIds = [1]: number[]): ImageData {
  if (Array.isArray(personOrPartSegmentation) &&
      personOrPartSegmentation.length === 0) {
    return null;
  }

  let multiPersonOrPartSegmentation:
  Array<SemanticPersonSegmentation | SemanticPartSegmentation | PersonSegmentation | PartSegmentation>;
  if (!Array.isArray(personOrPartSegmentation)) {
    multiPersonOrPartSegmentation = [personOrPartSegmentation];
  } else {
    multiPersonOrPartSegmentation = personOrPartSegmentation;
  }
  const {width, height} = multiPersonOrPartSegmentation[0];
  const bytes = new Uint8ClampedArray(width * height * 4);
  function drawStroke(bytes: Uint8ClampedArray, row: number, column: number, width: number, radius: number, color: Color = {r: 0, g: 255, b: 255, a: 255}) {
    for (let i = -radius; i <= radius; i++) {
      for (let j = -radius; j <= radius; j++) {
        const n = (row + i) * width + (column + j);
        if (!foregroundIds.some(id => id === segmentationData[n])) {
          numberBackgroundPixels += 1;
        }
      }
    }
  }

  function isSegmentationBoundary(segmentationData: Uint8Array, row: number, column: number, width: number, foregroundIds: number[]): boolean {
    let numberBackgroundPixels = 0;
    for (let i = -radius; i <= radius; i++) {
      for (let j = -radius; j <= radius; j++) {
        const n = (row + i) * width + (column + j);
        if (n >= 0 && n < bytes.length) {
          if (foregroundIds.some(id => id === segmentationData[n])) {
            numberBackgroundPixels += 1;
          }
        }
      }
    }
    return numberBackgroundPixels === 0;
  }

  function drawContourSegmentationBoundary(imageData: ImageData, row: number, column: number, width: number, height: number) {
    const ctx = imageData.getContext('2d');
    ctx.drawImage(imageData, 0, 0, width, height);
  }

  let segmentationData: number[] = new Uint8ClampedArray(width * height);
  for (let i = 0; i < width; i++) {
    for (let j = 0; j < height; j++) {
      let segmentationDataIndex = i * width + j;
      if (drawContourSegmentationBoundary(segmentationData, i, j)) {
        segmentationData[segmentationDataIndex] = 255;
      }
    }
  }

  return segmentationData;
}
\[\begin{align*}
\text{function drawAndBlurImageOnOffScreenCanvas(mask, maskBlurAmount, CANVAS_NAMES.blurredMask);} & \quad \text{renderImageDataToOffScreenCanvas(maskImage, CANVAS_NAMES.mask);} \\
\text{const blurredMask = (maskImage)} & \quad \text{assertSameDimensions({width, height}, maskImage, 'image', 'mask');} \\
\text{flipCanvasHorizontal(canvas);} & \quad \text{if width;} \\
\text{const ctx = canvas.getContext('2d');} & \quad \text{ctx.save();} \\
\text{if (flipHorizontal)} & \quad \text{const [height, width] = getInputSize(image);} \\
\text{drawMask(canvas, image: ImageType, maskImage: ImageData|null, maskOpacity = 0.7, maskBlurAmount = 0, flipHorizontal = false);} & \quad \text{ctx.drawImage(image, 0, 0);} \\
\text{ctx.globalAlpha = maskOpacity;} & \quad \text{if (maskImage)} \\
\text{multiPersonOrPartSegmentation.length; k++)} & \quad \text{const partId = multiPersonOrPartSegmentation[k].data[i].id;} \\
\text{isBoundary = isSegmentBoundary(multiPersonOrPartSegmentation[k].data[i], j, width, CANVAS_NAMES.lowres-part-mask);} & \quad \text{if (drawContour & i - 1 >= 0 &amp; i + 1 < height &amp; j - 1 >= 0 &amp; j + 1 < width &amp; isBoundary)} \\
\text{numberBackgroundPixels > 0;} & \quad \text{return numberBackgroundPixels > 0;} \\
\text{for (let i = 0; i < height; i += 1)} & \quad \text{for (let i = 0; j < width; j += 1)} \\
\text{const n = i * width + j;} & \quad \text{const n = i * width + j;} \\
\text{bytes[4 * n + 0] = background.r;} & \quad \text{bytes[4 * n + 0] = background.r;} \\
\text{bytes[4 * n + 1] = background.g;} & \quad \text{bytes[4 * n + 1] = background.g;} \\
\text{bytes[4 * n + 2] = background.b;} & \quad \text{bytes[4 * n + 2] = background.b;} \\
\text{bytes[4 * n + 3] = background.a;} & \quad \text{bytes[4 * n + 3] = background.a;} \\
\text{for (let k = 0; k < multiPersonOrPartSegmentation.length; k++)} & \quad \text{for (let k = 0; k < multiPersonOrPartSegmentation.length; k++)} \\
\text{if (foregroundIds.some(id => id === multiPersonOrPartSegmentation[k].data[n]))} & \quad \text{if (foregroundIds.some(id => id === multiPersonOrPartSegmentation[k].data[n]))} \\
\text{bytes[4 * n] = foreground.r;} & \quad \text{bytes[4 * n] = foreground.r;} \\
\text{bytes[4 * n + 1] = foreground.g;} & \quad \text{bytes[4 * n + 1] = foreground.g;} \\
\text{bytes[4 * n + 2] = foreground.b;} & \quad \text{bytes[4 * n + 2] = foreground.b;} \\
\text{bytes[4 * n + 3] = foreground.a;} & \quad \text{bytes[4 * n + 3] = foreground.a;} \\
\end{align*}\]
Given an image and a mask Image of type ImageData, draws the image with the an * pixelated mask on top of it onto a canvas. * @param canvas The canvas to be drawn onto. * An * @param image The original image to apply the mask to. * @param maskImage An ImageData containing the mask. Ideally this should be generated by toColoredPartMask. * @param maskOpacity The opacity of the mask when drawing it on top of then * image. Defaults to 0.7. Should be a float between 0 and 1. * @param maskBlurAmount How many pixels to blur the mask by. Defaults to 0. * Should be an integer between 0 and 20. * @param flipHorizontal If the result should be flipped horizontally. Defaults to false. * @param pixelCellWidth The width of each pixel cell. Default to 10 px. * @export function drawPixelatedMask(n canvas: Canvas, image: ImageType, * maskImage: ImageData, * maskOpacity = 0.7, maskBlurAmount = 0, flipHorizontal = false, pixelCellWidth = 10.0) { const [height, width] = getInputSize(image); assertSameDimensions({ width, height }, maskImage, 'image', 'mask'); const mask = renderImageDataToOffScreenCanvas(maskImage, CANVAS_NAMES.mask); const blurredMask = drawAndBlurImageOnOffScreenCanvas(n mask, maskBlurAmount, CANVAS_NAMES.blurredMask); canvas.width = blurredMask.width; canvas.height = blurredMask.height; const ctx = canvas.getContext('2d'); ctx.drawImage(blurredMask, 0, 0, blurredMask.width, blurredMask.height); ctx.imageSmoothingEnabled = false; ctx.drawImage(offscreenCanvas, 0, 0, offscreenCanvas.width, offscreenCanvas.height, 0, 0, canvas.width, canvas.height); // Draws horizontal lines that are 'pixelCellWidth' apart from each other. for (let i = 0; i < offscreenCanvas.width; i++) { const strokeStyle = '#ffffff'; ctx.beginPath(); ctx.moveTo(pixelCellWidth * i, 0); ctx.lineTo(pixelCellWidth * i, canvas.height); ctx.stroke(); } for (let i = 0; i < offscreenCanvas.height; i++) { ctx.beginPath(); ctx.moveTo(0, pixelCellWidth * i); ctx.lineTo(canvas.width, pixelCellWidth * i); ctx.stroke(); } ctx.globalAlpha = 1.0 - maskOpacity; ctx.drawImage(image, 0, 0, blurredMask.width, blurredMask.height); ctx.restore(); } function createPersonMask(multiPersonSegmentation: PersonSegmentation[], backgroundBlurAmount: number): Canvas { const backgroundMaskImage = toMask(multiPersonSegmentation, { r: 0, g: 0, b: 0, a: 255 }); const backgroundMask = renderImageDataToOffScreenCanvas(backgroundMaskImage, CANVAS_NAMES.mask); if (edgeBlurAmount === 0) { return backgroundMask; } else { return drawAndBlurImageOnOffScreenCanvas(backgroundMask, edgeBlurAmount, CANVAS_NAMES.blurredMask); } } function drawPersonMask(canvas: Canvas, image: ImageType, multiPersonSegmentation: SemanticPersonSegmentation[], personSegmentation: PersonSegmentation[], backgroundBlurAmount: number): Canvas { const blurredImage = drawAndBlurImageOnOffScreenCanvas(image, backgroundBlurAmount, CANVAS_NAMES.blurred); canvas.width = blurredImage.width; canvas.height = blurredImage.height; const ctx = canvas.getContext('2d'); if (Array.isArray(multiPersonSegmentation) && multiPersonSegmentation.length === 0) { return blurredImage; } else { return drawBokehEffect(canvas, image, multiPersonSegmentation); } }
```
const personMask = createPersonMask(multiPersonSegmentation, edgeBlurAmount);

ctx.save();
if (flipHorizontal) {
    flipCanvasHorizontal(canvas);
}

// draw the original image on the final canvas
const [height, width] = getInputStream(image);
ctx.drawImage(image, 0, 0, width, height);

// "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."
// crop what's not the person using the mask from the original image
drawWithCompositing(ctx, personMask, 'destination-in');

// "destination-over" - "The existing canvas content is kept where both the\n// new shape and existing canvas content overlap. Everything else is made\n// transparent."
// draw the blurred background on top of the original image where it doesn't overlap.
drawWithCompositing(ctx, blurredImage, 'destination-over');

ctx.restore();

function createBodyPartMask(
    multiPersonPartSegmentation: SemanticPartSegmentation|PartSegmentation[],
    bodyPartIdsToMask: number[], edgeBlurAmount: number): Canvas {

    const backgroundMaskImage = toMask(multiPersonPartSegmentation, {r: 0, g: 0, b: 0, a: 0}, {r: 0, g: 0, b: 0, a: 255}, true, bodyPartIdsToMask);

    const backgroundMask = renderImageDataToOffScreenCanvas(backgroundMaskImage, CANVAS_NAMES.mask);
    if (edgeBlurAmount === 0) {
        return backgroundMask;
    } else {
        return drawAndBlurImageOnOffScreenCanvas(backgroundMask, edgeBlurAmount, CANVAS_NAMES.blurredMask);
    }
}

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 */

export const PART_CHANNELS: string[] = [
    'left_face',
    'right_face',
    'left_upper_arm_front',

    // rest of the CHANNELS
    ...
];
```
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 *=============================================================================

import * as tf from '@tensorflow/tfjs-core';

/**
 * Takes the sigmoid of the part heatmap output and
 * generates a 2d one-hot tensor with ones where the part's score has the maximum value.
 * @param partHeatmapScores
 * @returns the maximum value
 * @param numParts
 */
function toFlattenedOneHotPartMap(partHeatmapScores: tf.Tensor3D): tf.Tensor2D {
  const numParts = partHeatmapScores.shape[2];
  const partMapLocations = tf.argmax(partHeatmapScores, 2);
  const partMapFlattened = tf.reshape(partMapLocations, [-1]);
  return tf.oneHot(partMapFlattened, numParts) as tf.Tensor2D;
}

  return tf.mul(image, mask);
}

/**
 * Takes the sigmoid of the segmentation output, and generates a segmentation mask with a 1 or 0 at each pixel where there is a person or not a person. The segmentation threshold determines the threshold of a score for a pixel to be considered part of a person.
 * @param segmentScores
 * @param segmentationThreshold
 * @returns a segmentation mask
 */
export function toMaskTensor(segmentScores: tf.Tensor2D, threshold: number): tf.Tensor2D {
  return tf.tidy(() => {
    const flattenedMap = tf.cast(tf.greater(segmentScores, tf.scalar(threshold)), 'int32')
    return tf.oneHot(flattenedMap, numParts) as tf.Tensor2D;
  });
}

/**
 * Takes the sigmoid of the person and part map output, and returns a 2d tensor with the corresponding value at each pixel corresponding to the highest value. These part ids are clipped by the segmentation mask. Wherever a pixel is clipped by the segmentation mask, its value will set to -1, indicating that there is no part in that pixel.
 * @param segmentScores
 * @param partHeatmapScores
 * @returns a 2d tensor with the corresponding value at each pixel corresponding to the highest value.
 */
export function decodePartSegmentation(segmentationMask: tf.Tensor2D, partHeatmapScores: tf.Tensor3D, numParts: number) {
  return tf.tidy(() => {
    const flattenedMap = tf.mul(tf.greater(segmentationMask, 0), partHeatmapScores)
    return flattenedMap;
  });
}
```
toFlattenedOneHotPartMap(partHeatmapScores):\n  num const partNumbers = tf.expandDims(tf.range(0, numParts, 1, \n    int32), 1);\n  const partMapFlattened = tf.cast(tf.matMul(flattenedMap, partNumbers as tf.Tensor2D), \n    int32);\n  const partMap = tf.reshape(partMapFlattened, [partMapHeight, partMapWidth]);\n  const partMapShiftedUpForClipping = tf.add(partMap, tf.scalar(1, int32));\n  return tf.sub(tf.reduceMax(partMapShiftedUpForClipping, \n    axis=-1, keepdims=True), tf.scalar(1, int32));\n}

export function decodeOnlyPartSegmentation(partHeatmapScores: tf.Tensor3D):\n  return tf.tidy(() => {
    const [partMapHeight, partMapWidth, numParts] = partHeatmapScores.shape;\n    const flattenedMap = toFlattenedOneHotPartMap(partHeatmapScores);\n    const partNumbers = tf.expandDims(tf.range(0, numParts, 1, int32), 1);\n    const partMapFlattened = tf.cast(tf.matMul(flattenedMap, partNumbers as tf.Tensor2D), int32);\n    const partMap = tf.reshape(partMapFlattened, [partMapHeight, partMapWidth]);\n  });

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import * as tfconv from '@tensorflow/tfjs-converter';
import * as tf from '@tensorflow/tfjs-core';
import {BodyPixOutputStride} from './types';

/**
 * 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\n * for creating such BodyPix base models. Currently both MobileNet (in\n * ./mobilenet.ts) and ResNet (in \n * ./resnet.ts) implements the BaseModel\n * interface. New base models that conform \n * to the BaseModel interface \n * can be added to BodyPix.\n */
export abstract class BaseModel {
  constructor(
    protected readonly model: tfconv.GraphModel,
    public readonly outputStride: BodyPixOutputStride) {
    const inputShape = this.model.inputs[0].shape as [number, number, number, number];
    tf.util.assert((inputShape[1] === -1) && (inputShape[2] === -1), () => `Input shape [\${inputShape[1]}, \${inputShape[2]}] \n  * Predicts intermediate TensorFlow representations.\n */\n  predict(input: tf.Tensor3D): {
    heatmapScores: tf.Tensor3D,
    offsets: tf.Tensor3D,
    displacementFwd: tf.Tensor3D,
    displacementBwd: tf.Tensor3D,
    segmentation: tf.Tensor3D,
    partHeatmaps: tf.Tensor3D,
    longOffsets: tf.Tensor3D,
    partOffsets: tf.Tensor3D\n  } {
    return tf.tidy(() => {
      const asFloat = this.preprocessInput(tf.cast(input, 'float32'));
      const asBatch = tf.expandDims(asFloat, 0);
      const results = this.model.predict(asBatch) as tf.Tensor4D[];
      const results3d: tf.Tensor3D[] = results.map(y => tf.squeeze(y, [0]));
      const namedResults = this.nameOutputResults(results3d);
      return {
        heatmapScores: tf.sigmoid(namedResults.heatmap),
        offsets: namedResults.offsets,
        displacementFwd: namedResults.displacementFwd,
        segmentation: namedResults.segmentation,
        partHeatmaps: namedResults.partHeatmaps,
        longOffsets: namedResults.longOffsets,
        partOffsets: namedResults.partOffsets\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[]): {
    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\n      * instance grouping.\n    * - partHeatmaps: A Tensor3D that represents the body part segmentation.\n  }

import * as tf from '@tensorflow/tfjs-core';
import {BaseModel} from './base_model';

export class MobileNet extends BaseModel {
  preprocessInput(input: tf.Tensor3D): tf.Tensor3D {
    // Normalize the pixels [0, 255] to be between [-1, 1].
    return tf.tidy(() => tf.sub(tf.div(input, 127.5), 1.0));
  }

  nameOutputResults(results: tf.Tensor3D[]):
    const
      offsets,
      segmentation,
      partHeatmaps,
      longOffsets,
      heatmap,
      displacementFwd,
      displacementBwd,
      partOffsets,
    ] = results;

    return {
      offsets,
      segmentation,
      partHeatmaps,
      longOffsets,
      heatmap,
      displacementFwd,
      displacementBwd,
      partOffsets
    };
  }
}

const CONNECTED_PART_NAMES: string[] = [
  ['leftHip', 'leftShoulder'],
  ['leftElbow', 'leftShoulder'],
  ['leftElbow', 'leftWrist'],
  ['leftHip', 'rightHip'],
  ['rightHip', 'rightKnee'],
  ['rightKnee', 'rightAnkle'],
];

const CONNECTED_PART_INDICES = CONNECTED_PART_NAMES.map((
  [jointNameA, jointNameB]) =>
    [PART_IDS[jointNameA], PART_IDS[jointNameB]]);
import {NUM_KEYPOINTS} from '../keypoints';

export function getScale(
    [height, width]: [number, number],
    [inputResolutionY, inputResolutionX]: [number, number],
  return [inputResolutionY / (padT + padB + height), inputResolutionX / (padL + padR + width)];
}

export function getOffsetPoint(
    y: number, x: number, keypoint: number, offsets: TensorBuffer3D: Vector2D): Vector2D {
  return {x: offsets.get(y, x, keypoint), y: offsets.get(y, x, keypoint + NUM_KEYPOINTS)};
}

export function getImageCoords(
    part: Part, outputStride: number, offsets: TensorBuffer3D: Vector2D): Vector2D {
  const {heatmapY, heatmapX, id: keypoint} = part;
  return {x: part.heatmapX * outputStride + x, y: part.heatmapY * outputStride + y};
}

export function clampVector(a: Vector2D, min: number, max: number): Vector2D {
  return {y: clamp(a.y, min, max), x: clamp(a.x, min, max)};
}

export function squaredDistance(
    y1: number, x1: number, y2: number, x2: number): number {
  const dy = y2 - y1;
  const dx = x2 - x1;
  return dy * dy + dx * dx;
}

export function addVectors(a: Vector2D, b: Vector2D): Vector2D {
  return {x: a.x + b.x, y: a.y + b.y};
}

function computeDistance(embedding: Pair[], pose: Pose, minPartScore = 0.3) {
  let distance = 0.0;
  let numKpt = 0;
  for (let p = 0; p < embedding.length; p++) {
    if (pose.keypoints[p].score > minPartScore) {
      numKpt += 1;
      distance += (embedding[p].x - pose.keypoints[p].position.x) ** 2 +
        (embedding[p].y - pose.keypoints[p].position.y) ** 2;
    }
  }
  if (numKpt === 0) {
    distance = Infinity;
  } else {
    distance = distance / numKpt;
  }
  return distance;
}

function matchEmbeddingToInstance(
    location: Pair, longOffsets: Float32Array, poses: Pose[], numKptForMatching: number,
    [padT, padL]: [number, number],
    [scaleX, scaleY]: [number, number], outputResolutionX: number,
    [height, width]: [number, number], stride: number, refineSteps: number) {
  let pair = posToPair(location);
  let dx = longOffsets[NUM_KEYPOINTS * (2 * nn + 1) + keypointIndex];
  let dy = longOffsets[NUM_KEYPOINTS * (2 * nn + 2) + keypointIndex];
  let x = location.x + dx;
  let y = location.y + dy;
  let x = Math.min(x, width - 1);
  let y = Math.min(y, height - 1);
  let newPos = convertToPosition(location);
const convertToPosition = (pair: Pair) =>
  convertToPositionInOuput(pair, [padT, padL], [scaleX, scaleY], stride);

for (let keypointsIndex = 0; keypointsIndex < numKptForMatching;
     keypointsIndex++) {
  const embedding = getEmbedding(
    location, keypointsIndex, convertToPosition, outputResolutionX,
    longOffsets, refineSteps, [height, width]);
  embed.push(embedding);
}

let kMin = -1;
let kMinDist = Infinity;
for (let k = 0; k < poses.length; k++) {
  const dist = computeDistance(embed, poses[k]);
  if (dist < kMinDist) {
    kMin = k;
    kMinDist = dist;
  }
}

return kMin;

export function decodeMultipleMasksCPU(
    segmentation: Uint8Array, longOffsets: Float32Array,
    numKptForMatching = 5): Uint8Array[] {
  const dataArrays =
      segmentation.map(x => new Uint8Array(x.height * x.width).fill(0));

  const {top: padT, left: padL} = padding;
  const [scaleX, scaleY] =
      getScale([height, width], [inHeight, inWidth], padding);
  const [outputResolutionX, outputResolutionY] =
      getOutputResolution([inputResolutionX, inputResolutionY], stride);

  for (let i = 0; i < height; i += 1) {
    for (let j = 0; j < width; j += 1) {
      const prob = segmentation[i * width + j];
      if (prob === 1) {
        const kMin = matchEmbeddingToInstance(
          {x: j, y: i}, longOffsets, posesAboveScore, numKptForMatching,
          [padT, padL], [scaleX, scaleY], outputResolutionX, [height, width],
          stride, refineSteps);
        if (kMin >= 0) {
          dataArrays[kMin][i * width + j] = 1;
        }
      }
    }
  }

  return dataArrays;
}

export function decodeMultiplePartMasksCPU(
    segmentation: Uint8Array, longOffsets: Float32Array,
    partSegmentation: Uint8Array, posesAboveScore: Pose[],
    numKptForMatching = 5): Int32Array[] {
  const dataArrays =
      posesAboveScore.map(x => new Int32Array(x.height * x.width).fill(-1));

  const {top: padT, left: padL} = padding;
  const [scaleX, scaleY] =
      getScale([height, width], [inHeight, inWidth], padding);
  const [outputResolutionX, outputResolutionY] =
      getOutputResolution([inHeight, inWidth], stride);

  for (let i = 0; i < height; i += 1) {
    for (let j = 0; j < width; j += 1) {
      const prob = segmentation[i * width + j];
      if (prob === 1) {
        const kMin = matchEmbeddingToInstance(
          {x: j, y: i}, longOffsets, posesAboveScore, numKptForMatching,
          [padT, padL], [scaleX, scaleY], outputResolutionX, [height, width],
          stride, refineSteps);
        if (kMin >= 0) {
          dataArrays[kMin][i * width + j] = partSegmentation[i * width + j];
        }
      }
    }
  }

  return dataArrays;
}

============================================================================

import * as tf from '@tensorflow/tfjs-core';
import * as tf_webgl from '@tensorflow/tfjs-backend-webgl';

import {NUM_KEYPOINTS} from '../keypoints';
import {Padding, Pose} from '../types';
import {getScale} from './util';

export function decodeMultipleMasksWebGl(
    segmentation: tf.Tensor2D, longOffsets: tf.Tensor3D,
    posesAboveScore: Pose[], height: number, width: number, stride: number,
    numKptForMatching = 5): tf.TensorInfo {
  // The height/width of the image/canvas itself.
  const [origHeight, origWidth] = segmentation.shape;
  // The height/width of the output of the model.
  const [outHeight, outWidth] = longOffsets.shape.slice(0, 2);
  const kMin = matchEmbeddingToInstance(
    {x: 0, y: 0}, longOffsets, posesAboveScore, numKptForMatching,
    [padT, padL], [scaleX, scaleY], outputResolutionX, [height, width],
    stride, refineSteps);
  // Make pose tensor of shape [MAX_NUM_PEOPLE, NUM_KEYPOINTS, 3] where
  // the last 3 coordinates correspond to the score, h and w coordinate of that

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  return tf.TensorInfo.create({
    shape: [kMin + 1, NUM_KEYPOINTS, 3],
    dtype: tf.float32
  });
}

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 */

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keypoint.

const poseVals = new Float32Array(maxNumPeople * NUM_KEYPOINTS * 3).fill(0.0);

for (let i = 0; i < posesAboveScore.length; i++) {
    const poseOffset = i * NUM_KEYPOINTS * 3;
    for (let kp = 0; kp < NUM_KEYPOINTS; kp++) {
        const keypoint = pose.keypoints[kp];
        poseVals[poseOffset + kp * 3] = keypoint.score;
    }
}

const [scaleX, scaleY] = getScale([height, width], [inHeight, inWidth], padding);

const posesTensor = tf.tensor(poseVals, [maxNumPeople, NUM_KEYPOINTS, 3]);

const program: tf_webgl.GPGPUProgram = {
    variableNames: ['segmentation', 'longOffsets', 'poses'],
    outputShape: [origHeight, origWidth],
    userCode: `int convertToPositionInOutput(int pos, int pad, float scale, int stride)
    {
        return round(((float(pos + pad) + 1.0) * scale - 1.0) / float(stride));
    }

    float convertToPositionInOutputFloat(int pos, int pad, float scale, int stride)
    {
        return ((float(pos + pad) + 1.0) * scale - 1.0) / float(stride);
    }

    float dist(float x1, float y1, float x2, float y2)
    {
        return pow(x1 - x2, 2.0) + pow(y1 - y2, 2.0);
    }

    int findNearestPose(int h, int w)
    {
        float prob = getSegmentation(h, w);
        if (prob < 1.0) {
            return -1;
        }

        float stridedH = convertToPositionInOutputFloat(h, padT, scaleY, stride);
        float stridedW = convertToPositionInOutputFloat(w, padL, scaleX, stride);

        int iMin = -1;
        for (int i = 0; i < maxNumPeople; i++) {
            float dy = sampleLongOffsets(stridedH, stridedW, 0, k);
            float dx = sampleLongOffsets(stridedH, stridedW, 1, k);
            float dx = sampleLongOffsets(yStrided, xStrided, 0, k);
            float dx = sampleLongOffsets(yStrided, xStrided, 1, k);
            int numKpt = 0;
            for (int k = 0; k < NUM_KEYPOINTS; k++) {
                int numKpt = 0;
                for (int k = 0; k < NUM_KEYPOINTS; k++) {
                    float poseY = getPoses(i, k, 0);
                    float poseX = getPoses(i, k, 1);
                    if (poseScore > minKptScore) {
                        numKpt = numKpt + 1;
                        curDistSum = curDistSum + dist(x, y, poseX, poseY);
                    }
                }
            }
        }
    }

    void main()
    {
        ivec2 coords = getOutputCoords();
        int nearestPose = findNearestPose(coords[0], coords[1]);
        setOutput(float(nearestPose));
    }

    const webglBackend = tf.backend() as tf_webgl.MathBackendWebGL;
    return webglBackend.compileAndRun(program, [segmentation, shapedLongOffsets, posesTensor]);
`};

export function toPersonKSegmentation(
    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() {
 return getBackend() === 'webgl';
}\nexport async function decodePersonInstanceMasks(\n segmentation: tf.Tensor2D, longOffsets: tf.Tensor3D, poses: Pose[],\n height: number, width: number, stride: number,\n number, number), padding: Padding, minPoseScore = 0.2, refineSteps = 8, minKeypointScore = 0.3, \n maxNumPeople = 10): Promise<PersonSegmentation[]> {\n // Filter out poses with smaller score.
 const posesAboveScore = poses.filter(pose => pose.score >= minPoseScore);\n let personSegmentationsData: Uint8Array[];\n if (isWebGlBackend()) {
 const masksTensor = tf.engine().makeTensorFromDataId(\n masksTensorInfo.dataId, \n masksTensorInfo.shape, \n masksTensorInfo.dtype) as tf.Tensor2D;\n return tf.tidy(\n () => toPersonKSegmentation(masksTensor, k));\n}\n\npersonSegmentationsData = (\n await Promise.all(\n personSegmentations.map(mask => mask.data())) as Uint8Array[]);\n forEach(x => x.dispose());\n else {
 const segmentationsData = await segmentation.data() as Uint8Array;\n const longOffsetsData = await longOffsets.data() as Float32Array;\n return tf.tidy(\n () => decodeMultipleMasksCPU(\n segmentation, longOffsetsData, posesAboveScore, height, width, \n stride, [height, width], padding, refineSteps);\n)}\n\nexport async function decodePersonInstancePartMasks(\n segmentation: tf.Tensor2D, longOffsets: tf.Tensor3D,\n partSegmentation: tf.Tensor2D, poses: Pose[],\n height: number, width: number, stride: number,\n [height, width]: number, number), padding: Padding, minPoseScore = 0.2, refineSteps = 8, minKeypointScore = 0.3, \n maxNumPeople = 10): Promise<PartSegmentation[]> {\n let partSegmentationsByPersonData = tf.tidy(\n () => \n decodeMultiplePartMasksWebGl(\n segmentation, longOffsets, posesAboveScore, height, width, \n stride, [height, width], padding, refineSteps, minKeypointScore, \n maxNumPeople);\n return tf.tidy(\n () => decodeMultiplePartMasksCPU(\n segmentation, longOffsetsData, partSegmentationsByPersonData, \n posesAboveScore, height, width, stride, [height, width], padding, \n refineSteps);\n)}
function half(k: number) {
  return Math.floor(k / 2);
}

export class MaxHeap<T> {
  private priorityQueue: T[];
  private numberOfElements: number;
  private getElementValue: (element: T) => number;

  constructor(maxSize: number, getElementValue: (element: T) => number) {
    this.priorityQueue = new Array(maxSize);
    this.numberOfElements = -1;
    this.getInputElementValue = getElementValue;
    this.public enqueue(x: T) { void {
      this.priorityQueue[++this.numberOfElements] = x;
      this.swim(this.numberOfElements);
    }
    this.public dequeue(): T { const max = this.priorityQueue[0];
      return this.exchange(0, this.numberOfElements--);
      this.sink(0);
      this.priorityQueue[this.numberOfElements + 1] = null;
    }
    this.public empty(): boolean { return this.numberOfElements == -1;
    }
    this.public size(): number { return this.numberOfElements + 1;
    }
    this.public all(): T[] { return this.priorityQueue.slice(0, this.numberOfElements + 1);
    }
    this.public max(): T { return this.priorityQueue[0];
    }
    this.private getValueAt(i: number): number { return this.getElementValue(this.priorityQueue[i]);
    }
    this.private less(i: number, j: number): boolean { return this.getValueAt(i) < this.getValueAt(j);
    }
    this.private exchange(i: number, j: number): void { const t =
      this.priorityQueue[i];
      this.priorityQueue[i] = this.priorityQueue[j];
      this.priorityQueue[j] = t;
    }
    this.private swim(i: number): void { while (i > 0 &&
      this.less(half(i), i)) {
      this.exchange(i, half(i));
      i = half(i);
    }
    this.private sink(i: number): void { while (2 * i <= this.numberOfElements) {
      let j = 2 * i;
      if (j < this.numberOfElements &&
        this.less(j, j + 1)) {
        j++;
      }
      if (!this.less(i, j)) {
        break;
      }
      this.exchange(i, j);
      i = j;
    }
  }
}

import {PartWithScore, TensorBuffer3D} from '../types';

import {MaxHeap} from './max_heap';

function scoreIsMaximumInLocalWindow(
    keypointId: number, score: number, heatmapY: number, heatmapX: number,
    localMaximumRadius: number, scores: TensorBuffer3D): boolean {
  const [height, width] = scores.shape;

  let localMaximum = true;
  const yStart = Math.max(heatmapY -
    localMaximumRadius, 0);
  const yEnd = Math.min(heatmapY + localMaximumRadius + 1, height);
  for (let yCurrent = yStart; yCurrent < yEnd; ++yCurrent) {
    const xStart = Math.max(heatmapX - localMaximumRadius, 0);
    const xEnd = Math.min(heatmapX + localMaximumRadius + 1, width);
    for (let xCurrent = xStart; xCurrent < xEnd; ++xCurrent) {
      if (scores.get(yCurrent, xCurrent, keypointId) > score) {
        localMaximum = false;
        break;
      }
    }
    if (!localMaximum) {
      break;
    }
    return localMaximum;
  }
}

/**
 * Builds a priority queue with part candidate positions for a specific image in
 * the batch. For this we find all local maxima in the score maps with score
 * values above a threshold. We create a single priority queue across all parts.
 * export function buildPartWithScoreQueue(scoreThreshold: number,
 *  localMaximumRadius: number, scores: TensorBuffer3D): MaxHeap<T> {
 *  const [height, width] = scores.shape;
 *  let localMaximum = true;
 *  const yStart = Math.max(heatmapY -
 *    localMaximumRadius, 0);
 *  const yEnd = Math.min(heatmapY + localMaximumRadius + 1, height);
 *  for (let yCurrent = yStart; yCurrent < yEnd; ++yCurrent) {
 *    const xStart = Math.max(heatmapX - localMaximumRadius, 0);
 *    const xEnd = Math.min(heatmapX + localMaximumRadius + 1, width);
 *    for (let xCurrent = xStart; xCurrent < xEnd; ++xCurrent) {
 *      if (scores.get(yCurrent, xCurrent, keypointId) > score) {
 *        localMaximum = false;
 *        break;
 *      }
 *    }
 *    if (!localMaximum) {
 *      break;
 *    }
 *    return localMaximum;
 *  }
 *}
 */

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=============================================================================

*/

import {NumberTuple, PART_IDS, PART_NAMES, POSE_CHAIN} from '../keypoints';
import {Keypoint, PartWithScore, TensorBuffer3D, Vector2D} from '../types';

import {clamp, getOffsetPoint} from './util';
import {addVectors, getImageCoords} from './util';

const parentChildrenTuples: NumberTuple[] =
POSE_CHAIN.map(([parentJoinName, childJoinName]): NumberTuple =>
[PART_IDS[parentJoinName], PART_IDS[childJoinName]]);

const parentToChildEdges: number[] =
parentChildrenTuples.map(([, childJointId]) => childJointId);

const childToParentEdges: number[] =
parentChildrenTuples.map(([parentJointId]) => parentJointId);

function getDisplacement(
  edgeId: number, point: Vector2D, displacements: TensorBuffer3D): Vector2D {
  const numEdges = displacements.shape[2] / 2;
  return {
    y: displacements.get(point.y, point.x, edgeId),
    x: displacements.get(point.y, point.x, numEdges + edgeId)
  };
}

function getStridedIndexNearPoint(
  point: Vector2D, outputStride: number, height: number,
  width: number): Vector2D {
  return {
    y: clamp(Math.round(point.y / outputStride), 0, height - 1),
    x: clamp(Math.round(point.x / outputStride), 0, width - 1)
  };
}

/**
 * We get a new keypoint along the `edgeId` for the pose instance, assuming
 * that the position of the `idSource` part is already known. For this, we
 * follow the displacement vector from the source to target part (stored in
 * the `i`-t channel of the displacement tensor). The displaced keypoint
 * vector is refined using the offset vector by `offsetRefineStep` times.
 * The `edgeId` for the pose instance, assuming
 * that the position of the `idSource` part is already known. For this, we
 * follow the displacement vector from the source to target part (stored in
 * the `i`-t channel of the displacement tensor). The displaced keypoint
 * vector is refined using the offset vector by `offsetRefineStep` times.
 */
function traverseToTargetKeypoint(
  edgeId: number, sourceKeypoint: Keypoint, targetKeypointId: number,
  scoresBuffer: TensorBuffer3D, offsets: TensorBuffer3D, outputStride: number,
  displacements: TensorBuffer3D, offsetRefineStep = 2): Keypoint {
  const [height, width] = scoresBuffer.shape;

  // Nearest neighbor interpolation for the source->target displacements.
  const sourceKeypointIndices =
getStridedIndexNearPoint(sourceKeypoint.position, outputStride, height, width);
  const score = scoresBuffer.get(sourceKeypointIndices.y, sourceKeypointIndices.x, targetKeypointId);

  return {position: targetKeypoint, part: PART_NAMES[targetKeypointId], score};
}

/**
 * Follows the displacement fields to decode the full pose of
 * the object instance, assuming
 * that the position of the `idSource` part is already known. For this, we
 * follow the displacement vector from the source to target part (stored in
 * the `i`-t channel of the displacement tensor). The displaced keypoint
 * vector is refined using the offset vector by `offsetRefineStep` times.
 * The `edgeId` for the pose instance, assuming
 * that the position of the `idSource` part is already known. For this, we
 * follow the displacement vector from the source to target part (stored in
 * the `i`-t channel of the displacement tensor). The displaced keypoint
 * vector is refined using the offset vector by `offsetRefineStep` times.
 */
export function decodePose(
  root: PartWithScore, scores: TensorBuffer3D, offsets: TensorBuffer3D,
  outputStride: number, displacementsFwd: TensorBuffer3D,
  displacementsBwd: TensorBuffer3D): Keypoint[] {
  const numParts = scores.shape[2];
  const numEdges = parentToChildEdges.length;

  const instanceKeypoints: Keypoint[] = new Array(numParts);

  // Start a new detection instance at the position of the root.
  const rootPart = root.part;
  const rootScore = root.score;

  const instanceKeypoints =
getStridedIndexNearPoint(rootPart.outputStride, height, width);
  const instanceKeypoints[instanceKeypointId].x = rootPart.x;
  const instanceKeypoints[instanceKeypointId].y = rootPart.y;

  // Decode the part positions upwards in the tree,
  // following the backward displacements.
  for (let edge = numEdges - 1; edge >= 0; --edge) {
    const sourceKeyPointId = parentToChildEdges[edge];
    const targetKeyPointId = childToParentEdges[edge];
    const instanceKeypoints =
getStridedIndexNearPoint(targetKeyPointId.outputStride, height, width);
    const score = scoresBuffer.get(targetKeyPointIndices.y, targetKeyPointIndices.x, targetKeypointId);

    return {position: targetKeypointId, part: PART_NAMES[targetKeypointId], score};
  }
}

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instanceKeypoints[targetKeypointId] = traverseToTargetKeypoint(
  edge,
instanceKeypoints[sourceKeypointId], scores, 
offsets, outputStride, displacementsBwd);
}
}

// Decode the part positions downwards in the tree, following the forward
// displacements.
for (let
  edge = 0; edge < numEdges; ++edge) {
  const sourceKeypointId = childToParentEdges[edge];
  const targetKeypointId = parentToChildEdges[edge];
  if (instanceKeypoints[sourceKeypointId] &&
      !instanceKeypoints[targetKeypointId]) {
    instanceKeypoints[targetKeypointId] = traverseToTargetKeypoint(
      edge,
instanceKeypoints[sourceKeypointId], targetKeypointId, scores, 
offsets, outputStride, 
displacementsFwd);
    return instanceKeypoints[targetKeypointId];
  }
}

// Decode the part positions downwards in the tree, following the forward
// displacements.
for (let
  edge = 0; edge < numEdges; ++edge) {
  const sourceKeypointId = childToParentEdges[edge];
  const targetKeypointId = parentToChildEdges[edge];
  if (instanceKeypoints[sourceKeypointId] &&
      !instanceKeypoints[targetKeypointId]) {
    instanceKeypoints[targetKeypointId] = traverseToTargetKeypoint(
      edge, instanceKeypoints[sourceKeypointId], targetKeypointId, scores, 
offsets, outputStride, 
displacementsBwd);
    return instanceKeypoints[targetKeypointId];
  }
}

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 *
 */

import {Keypoint, Pose, TensorBuffer3D} from '../types';
import {buildPartWithScoreQueue} from './build_part_with_score_queue';
import {decodePose} from './decode_pose';
import {getImageCoords, squaredDistance} from './util';

function withinNmsRadiusOfCorrespondingPoint(
    poses: Pose[],
squaredNmsRadius: number, {x, y}: {x: number, y: number},
    keypointId: number): boolean {
  return
    poses.some(({keypoints}) => {
      const correspondingKeypoint = keypoints[keypointId].position;
      return
        squaredDistance(
               y, x, correspondingKeypoint.y, correspondingKeypoint.x) <=
        squaredNmsRadius;
    });
}

/* Score the newly proposed object instance without taking into account
 * the
 * scores of the parts that overlap with any previously detected
 * instance.
 * We use a priority queue to select the root candidates in decreasing
 * score order.
 * We reject the root candidate if it is within a disk of size
 * nmsRadius pixels
 * from the corresponding part of a previously detected
 * instance, which is a form of part-based non-maximum suppression
 * (NMS). If the
 * root candidate passes the NMS check, we start a new object instance
 * detection, treating the
 * corresponding part as root and finding the
 * positions of the remaining parts by following the displacement
 * vectors along the tree-structured part graph. We assign to the newly detected
 * instance a score equal to the sum of scores of its parts which have not
 * been claimed by a previous instance (i.e., those at least nmsRadius
 * pixels away from the corresponding part of all previously detected
 * instances), divided by the total number of parts numParts.
 * @param heatmapScores 3-D tensor with shape `[height, width, numParts]`.
 * The value
 * of heatmapScores[y, x, k] is the score of placing the `k`-th
 * object part at position `(y, x)`.
 * @param offsets 3-D tensor with shape `[height, width, numParts * 2]`. The value of
 * offsets[y, x, k] is the
 * short range offset vector of the `k`-th
 * object part at heatmap position `(y, x)`.
 * @param displacementsFwd 3-D tensor of shape` [height, width, 2 * num_edges]`,
 * where `num_edges = num_parts - 1` is the
 * number of edges (parent-child pairs) in the tree. It contains the forward
 * displacements between consecutive part from the root towards the leaves.
 * @param displacementsBwd 3-D tensor of
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shape
 * [height, width, 2 * num_edges], where `num_edges = num_parts - 1` is the number of edges (parent-child pairs) in the tree. It contains the backward displacements between consecutive part from the root towards the leaves. * `@param outputStride The output stride that was used when feed-forwarding through the PoseNet model. Must be 32, 16, or 8.` * `@param maxPoseDetections Maximum number of returned instance detections per image.` * `@param scoreThreshold Only return instance detections that have root part score greater or equal to this value. Defaults to 0.5.` * `@param nmsRadius Non-maximum suppression part distance. It needs to be strictly positive. Two parts suppress each other if they are less than `nmsRadius` pixels away. Defaults to 20.` * `@return An array of poses and their scores, each containing keypoints and the corresponding keypoint scores.`

```typescript
export function decodeMultiplePoses(
    scoresBuffer: TensorBuffer3D,
    offsetsBuffer: TensorBuffer3D,
    displacementsFwdBuffer: TensorBuffer3D,
    displacementsBwdBuffer: TensorBuffer3D,
    outputStride: number,
    maxPoseDetections: number,
    scoreThreshold = 0.5,
    nmsRadius = 20): Pose[] {

    const poses: Pose[] = [];

    const queue = buildPartWithScoreQueue(
        scoreThreshold,
        kLocalMaximumRadius, scoresBuffer);

    const squaredNmsRadius = nmsRadius * nmsRadius;

    // Generate at most maxDetections object instances per image.
    // decreasing root part score order.
    while (poses.length < maxPoseDetections && queue.length > 0) {
        // The top element in the queue is the next root candidate.
        const root = queue.dequeue();

        // Part-based non-maximum suppression: We reject a root candidate if it is
        within a disk of `nmsRadius` pixels from the corresponding part of a previously detected instance.

        const rootImageCoords = getImageCoords(root.part, outputStride, offsetsBuffer);
        if (withinNmsRadiusOfCorrespondingPoint(poses, squaredNmsRadius, rootImageCoords, root.part.id)) {
            continue;
        }

        const keypoints = decodePose(root, scoresBuffer, offsetsBuffer, outputStride, displacementsFwdBuffer,
            displacementsBwdBuffer);

        const score = getInstanceScore(poses, squaredNmsRadius, keypoints);

        poses.push({keypoints, score});
    }

    return poses;
}
```

---

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 */

const RESNET50_BASE_URL = 'https://storage.googleapis.com/tfjs-models/savedmodel/bodypix/resnet50/';
const MOBILENET_BASE_URL = 'https://storage.googleapis.com/tfjs-models/savedmodel/bodypix/mobilenet/';

// The BodyPix 2.0 ResNet50 models use the latest TensorFlow.js 1.0 model format
export function resNet50SavedModel(stride: number,
quantBytes: number): string {
  const graphJson = `model-stride${stride}.json`;
  if (quantBytes === 4) {
    return RESNET50_BASE_URL + `float/` + graphJson;
  } else {
    return RESNET50_BASE_URL + `quant${quantBytes}/` + graphJson;
  }
}

// The BodyPix 2.0 MobileNetV1 models use the latest TensorFlow.js 1.0 model
// format.
export function mobileNetSavedModel(stride: number, multiplier: number, quantBytes: number): string {
  const graphJson = `model-stride${stride}.json`;
  if (quantBytes === 4) {
    return MOBILENET_BASE_URL + `float/` + graphJson;
  } else {
    return MOBILENET_BASE_URL + `quant${quantBytes}/` + graphJson;
  }
}

export function getSizeFromImageLikeElement(input: BodyPixInput, Padding: number): [number, number] {
  if (typeof (HTMLCanvasElement) !== 'undefined' &&
      input instanceof HTMLCanvasElement) {
    return getSizeFromImageLikeElement(input);
  } else if (typeof (ImageData) !== 'undefined' && input instanceof ImageData) {
    return [input.height, input.width];
  } else if (typeof (HTMLVideoElement) !== 'undefined' && input instanceof HTMLVideoElement) {
    return getSizeFromVideoElement(input);
  } else if (input instanceof tf.Tensor) {
    return [input.shape[0], input.shape[1]];
  } else {
    throw new Error(`error: Unknown input type: ${input}.`);
  }
}

export function toValidInputResolution(inputResolution: number, outputStride: BodyPixOutputStride): number {
  if (isValidInputResolution(inputResolution, outputStride)) {
    return inputResolution;
  }

  return Math.floor(inputResolution / outputStride) * outputStride + 1;
}

const INTERNAL_RESOLUTION_STRING_OPTIONS = {
  low: 'low',
  medium: 'medium',
  high: 'high',
  full: 'full'
};

const INTERNAL_RESOLUTION_PERCENTAGES = {
  low: 0.25,
  medium: 0.5,
  high: 0.75,
  full: 1.0
};

const MIN_INTERNAL_RESOLUTION = 0.1;
const MAX_INTERNAL_RESOLUTION = 2.0;

export function toInternalResolutionPercentage(inputResolution: number): number {
  if (typeof inputResolution === 'string') {
    const result = INTERNAL_RESOLUTION_PERCENTAGES[inputResolution.toLowerCase()] || 0;
    return result;
  }

  const low = INTERNAL_RESOLUTION_STRING_OPTIONS.low;
  const medium = INTERNAL_RESOLUTION_STRING_OPTIONS.medium;
  const high = INTERNAL_RESOLUTION_STRING_OPTIONS.high;
  const full = INTERNAL_RESOLUTION_STRING_OPTIONS.full;

  for (const option in INTERNAL_RESOLUTION_STRING_OPTIONS) {
    const percentage = INTERNAL_RESOLUTION_PERCENTAGES[option];
    if (percentage === result) {
      return option;
    }
  }

  return option;
}

function isValidInputResolution(inputResolution: number, outputStride: BodyPixOutputStride): boolean {
  return (inputResolution - 1) % outputStride === 0;
}

// The BodyPix 2.0 MobileNetV1 models use the latest TensorFlow.js 1.0 model
// format.
export function mobileNetSavedModel(stride: number, multiplier: number, quantBytes: number): string {
  const graphJson = `model-stride${stride}.json`;
  if (quantBytes === 4) {
    return MOBILENET_BASE_URL + `float/` + graphJson;
  } else {
    return MOBILENET_BASE_URL + `quant${quantBytes}/` + graphJson;
  }
}

// The BodyPix 2.0 MobileNetV1 models use the latest TensorFlow.js 1.0 model
// format.
=== 'number',
    ...,

} else {
    tf.util.assert(
        typeof internalResolution === 'number' &
        internalResolution <= MAX_INTERNAL_RESOLUTION &
        internalResolution >= MIN_INTERNAL_RESOLUTION,
        () =>
            `inputResolution must be a string or number between ${
                \[
                    \text{MIN\_INTERNAL\_RESOLUTION} \rightleftharpoons \text{MAX\_INTERNAL\_RESOLUTION} \rightleftharpoons \text{number}
                \]\}
                , but was ${\text{number}}`);

    return internalResolution;
  }
}

export function
  toInputResolutionHeightAndWidth(
    internalResolution: BodyPixInternalResolution,
    outputStride: BodyPixOutputStride,
    [inputHeight, inputWidth]: [number, number]): [number, number] {
  const
    internalResolutionPercentage =
        toInternalResolutionPercentage(internalResolution);

  return 
    [toValidInputResolution(
        inputHeight * internalResolutionPercentage, outputStride),
        toValidInputResolution(
        inputWidth * internalResolutionPercentage, outputStride)];
}

export function
  toInputTensor(input: BodyPixInput) {
    ...;
}

export function
  resizeAndPadTo(
    imageTensor: tf.Tensor3D, [targetH, targetW]: [number, number],
    flipHorizontal = false): {
  resizedAndPadded: tf.Tensor3D,
  paddedBy: [[number, number], [number, number]]
} else {
  resizedAndPadded: tf.Tensor3D
} paddedBy: [[number, number], [number, number]]){
  const
    resizeH = targetH * aspect;
    resizeW = targetW * aspect;

  const
    padT = Math.floor((padHeight / 2));
    padL = Math.floor((padWidth / 2));
    padR = Math.floor((padWidth + padL));
    padB = Math.floor((padHeight + padL));

  const
    resizedAndPadded = tf.tidy(() =>
        // resize to have larger dimension match the shape.
        let resized:
            tf.Tensor3D;
        if (flipHorizontal) {
          resized = tf.image.resizeBilinear(
              tf.reverse(imageTensor, 1),
              [targetH, targetW], true);
        } else {
          resized = tf.image.resizeBilinear(imageTensor, [targetH, targetW], true);
        }

        resizedAndPadded =...
    };

    return resizedAndPadded;
}

// TODO: tf.browser.fromPixels types to support OffscreenCanvas
// @ts-ignore
return input instanceof tf.Tensor ? input : tf.browser.fromPixels(input);

export function
  scaleAndCropToInputTensorShape(
    tensor: tf.Tensor3D,
    [inputTensorHeight, inputTensorWidth]: [number, number],
    [resizedAndPaddedHeight, resizedAndPaddedWidth]: [number, number],
    [[padT, padB], [padL, padR]]: [[number, number], [number, number]],
    applySigmoidActivation = false): tf.Tensor3D {
  return...
}

export function
  removePaddingAndResizeBack(
    resizedAndPadded: tf.Tensor3D,
    [originalHeight, originalWidth]: [number, number],
    [[padT, padB], [padL, padR]]: [[number, number], [number, number]]):
    tf.Tensor3D {
  return...
}

export function
  resize2d(
    tensor: tf.Tensor2D, resolution: [number, number],
    nearestNeighbor?: boolean): tf.Tensor2D {
  return...
}
pads the width
    pad = Math.round(0.5 * (targetAspect * height - width));
    padR = Math.round(0.5 * (targetAspect * height - width));
} else {
    // pads the height
    padT = Math.round(0.5 * (1.0 / targetAspect * width - height));
    padB = Math.round(0.5 * (1.0 / targetAspect * width - height));
} padL = 0; padR = 0;

const resized: tf.Tensor3D = tf.tidy(() => {
    let imageTensor = tf.pad3d(imageTensor, [[padT, padB], [padL, padR], [0, 0]]);

    return tf.image.resizeBilinear(imageTensor, [targetH, targetW]);
})

export function scalePose(pos: Pose, scale: number, offset: number): Pose {
    return {
        position: {
            x: pos.x * scale + offset,
            y: pos.y * scale + offset
        }
    }
}

export function scalePoses(poses: Pose[], scale: number, offset: number): Pose[] {
    return poses.map(pose => scalePose(pose, scale, offset));
}

export function flipPoseHorizontal(pose: Pose, width: number): Pose {
    return {
        position: {
            x: width - 1 - pose.position.x,
            y: pose.position.y
        }
    }
}

export function flipPosesHorizontal(poses: Pose[], width: number): Pose[] {
    return poses.map(pose => flipPoseHorizontal(pose, width));
}

export function scaleAndFlipPoses(poses: Pose[], height: number, width: number, inputResolutionHeight: number, inputResolutionWidth: number, padding: Padding, flipHorizontal: boolean): Pose[] {
    const scaleY = inputResolutionHeight / height;
    const scaleX = inputResolutionWidth / width;

    const scaledPoses = scalePoses(poses, scaleY, scaleX, -padding.top, -padding.left);

    const scaled = flipPosesHorizontal(scaledPoses, width);

    return scaled;
}

import {padding} from './types';

const APPLY_SIGMOID_ACTIVATION = true;
const FLIP_POSES_AFTER_SCALING = false;

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 * distributed under the License is distributed on an "AS IS" BASIS,
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
 * implied.
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 * limitations under the License.
 */
model
* The smaller the value, the larger the output resolution, and more accurate
* the model at the cost of speed. Set this to a larger value to increase speed
* at the cost of accuracy. Stride 32 is supported for ResNet and stride
* 8, 16, 32 are supported for various MobileNetV1 models
* multiplier': An optional number with values: 1.0, 0.75, or 0.5. The value is used only by MobileNet architecture. It is the float
* multiplier for the depth (number of channels) for all convolution ops.
* The larger the value, the larger the size of the layers, and more accurate
* the model at the cost of speed. Set this to a smaller value to increase speed
* at the cost of accuracy.
* modelUrl': An optional string that specifies custom url of the model. This
* is useful for area/countries that don't have access to the model hosted on GCP.
* quantBytes': An optional number with values: 1, 2, or 4. This parameter
* affects weight quantization in the models. The available options are 1 byte, 2 bytes, and 4 bytes. The higher the value, the larger the model size
* and thus the longer the loading time, the lower the value, the shorter the
* loading time but lower the accuracy.

export interface ModelConfig {
  architecture: BodyPixArchitecture;
  outputStride: BodyPixOutputStride;
  multiplier?: BodyPixMultiplier;
  modelUrl?: string;
  quantBytes?: BodyPixQuantBytes;
}

// The default configuration for loading
MobileNetV1 based BodyPix
(And for references, the default configuration for loading ResNet
based PoseNet is also included).

const RESNET_CONFIG = {architecture: 'ResNet50',
  outputStride: 32,
  quantBytes: 4,
} as ModelConfig;

const MOBILENET_V1_CONFIG = {architecture: 'MobileNetV1',
  outputStride: 16,
  quantBytes: 4,
  multiplier: 0.75,
} as ModelConfig;

const VALID_ARCHITECTURE: BodyPixArchitecture[] = ['MobileNetV1', 'ResNet50'];
const VALID_STRIDE: {[id: string]: BodyPixOutputStride[]} = {
  'MobileNetV1': [8, 16, 32],
  'ResNet50': [32, 16]
};
const VALID_MULTIPLIER: {[id: string]: BodyPixMultiplier[]} = {
  'MobileNetV1': [0.50, 0.75, 1.0],
  'ResNet50': [1.0]
};
const VALID_QUANT_BYTES: BodyPixQuantBytes[] = [1, 2, 4];

function validateModelConfig(config: ModelConfig): ModelConfig {
  config = config || MOBILENET_V1_CONFIG;

  if (config.architecture == null) {
    config.architecture = 'MobileNetV1';
  }
  if (VALID_ARCHITECTURE.indexOf(config.architecture) < 0) {
    throw new Error(`Invalid architecture
      for architecture ${config.architecture}.`);
  }

  if (config.outputStride == null) {
    config.outputStride = 16;
  }
  if (VALID_STRIDE[config.architecture].indexOf(config.outputStride) < 0) {
    throw new Error(`Invalid outputStride
      for architecture ${config.architecture}.`);
  }

  if (config.multiplier == null) {
    config.multiplier = 1.0;
  }
  if (VALID_MULTIPLIER[config.architecture].indexOf(config.multiplier) < 0) {
    throw new Error(`Invalid multiplier
      for architecture ${config.architecture}.`);
  }

  if (config.quantBytes == null) {
    config.quantBytes = 4;
  }
  if (VALID_QUANT_BYTES.indexOf(config.quantBytes) < 0) {
    throw new Error(`Invalid quantBytes
      for architecture ${config.architecture}.`);
  }

  return config;
}

/**
 * BodyPix inference is configurable using the
 * following config dictionary.
 *
 * flipHorizontal': If the left-right keypoint of poses/part segmentation
 * should
 * be flipped/mirrored horizontally. This should be set to true for videos where the video is by default flipped
 * horizontally (i.e. a webcam), and you want the person & body part segmentation to be returned in the proper
 * orientation.
 *
 * internalResolution': The internal resolution
 * percentage that the input is resized to before inference. The larger the
 * internalResolution the more accurate the model at the cost of slower
 * prediction times. Available values are 'low', 'medium', 'high', 'full', or none
 * and you want the person & body part segmentation to be returned in the proper
 * orientation.
 *
 * segmentationThreshold': The minimum that segmentation values must have to be considered part of the person.
 * This is the threshold used to binarize the intermediate person segmentation probability. The probability of each
 * pixel belongs to a person in range [0, 1]. If the probability is greater than the segmentationThreshold, it will be set to 1 otherwise 0.
 */
export interface InferenceConfig {
  flipHorizontal?: boolean;
  internalResolution?: BodyPixInternalResolution;
}
segmentationThreshold?: number;
}

/**
 * Person Inference Config
 *
 * `maxDetections`: Defaults to 10. Maximum number of person pose detections per image.
 * `scoreThreshold`: Defaults to 0.4. Only return poses for instance segmentation assignment when the pose has root part score greater or equal to this value.
 * `nmsRadius`: Defaults to 20. Non-maximum suppression part distance in pixels.
 * It needs to be strictly positive. Two parts suppress each other if they are less than `nmsRadius` pixels away.
 * `minKeypointScore`: Default to 0.3. Keypoints above the score are used for matching and assigning segmentation mask to each person.
 * `refineSteps`: Default to 10. The number of refinement steps used when assigning the instance segmentation. It needs to be strictly positive. The larger the higher the accuracy and slower the inference.
 */
export interface PersonInferenceConfig extends InferenceConfig {
  maxDetections?: number;
  scoreThreshold?: number;
  nmsRadius?: number;
  minKeypointScore?: number;
  refineSteps?: number;
}

/**
 * Multiple Person Instance Inference Config
 *
 * `maxDetections`: Defaults to 10. Maximum number of returned instance segmentation and pose detections per image.
 * `scoreThreshold`: Defaults to 0.4. Only returns and uses person poses for instance segmentation assignment when the pose has root part score greater or equal to this value.
 * `nmsRadius`: Defaults to 20. Non-maximum suppression part distance in pixels.
 * It needs to be strictly positive. Two parts suppress each other if they are less than `nmsRadius` pixels away.
 * `minKeypointScore`: Default to 0.3. Keypoints above the score are used for matching and assigning segmentation mask to each person.
 * `refineSteps`: Default to 10. The number of refinement steps used when assigning the instance segmentation. It needs to be strictly positive. The larger the higher the accuracy and slower the inference.
 */
export interface MultiPersonInstanceInferenceConfig extends InferenceConfig {
  maxDetections?: number;
  scoreThreshold?: number;
  nmsRadius?: number;
  minKeypointScore?: number;
  refineSteps?: number;
}

export const PERSON_INFERENCE_CONFIG: PersonInferenceConfig = {
  flipHorizontal: false,
  internalResolution: 'medium',
  segmentationThreshold: 0.7,
  maxDetections: 10,
  scoreThreshold: 0.4,
  nmsRadius: 20,
};

export const MULTI_PERSON_INSTANCE_INFERENCE_CONFIG: MultiPersonInstanceInferenceConfig = {
  flipHorizontal: false,
  internalResolution: 'medium',
  segmentationThreshold: 0.7,
  maxDetections: 10,
  scoreThreshold: 0.4,
  nmsRadius: 20,
  minKeypointScore: 0.3,
  refineSteps: 10,
};

function validatePersonInferenceConfig(config: PersonInferenceConfig) {
  const {segmentationThreshold,
    maxDetections,
    scoreThreshold,
    nmsRadius} = config;
  if (segmentationThreshold < 0.0 ||
    segmentationThreshold > 1.0) {
    throw new Error(`segmentationThreshold ${segmentationThreshold}. ` +
      `Should be in range [0.0, 1.0]`);
  }

  if (maxDetections <= 0) {
    throw new Error(`Invalid maxDetections ${maxDetections}. ` +
      `Should be > 0`);
  }

  if (scoreThreshold < 0.0 || scoreThreshold > 1.0) {
    throw new Error(`Invalid scoreThreshold ${scoreThreshold}. ` +
      `Should be in range [0.0, 1.0]`);
  }

  if (nmsRadius <= 0) {
    throw new Error(`Invalid nmsRadius ${nmsRadius}.`);
  }
}

function validateMultiPersonInstanceInferenceConfig(
    config: MultiPersonInstanceInferenceConfig) {
  const {
    segmentationThreshold,
    maxDetections,
    scoreThreshold,
    nmsRadius,
    minKeypointScore,
    refineSteps
  } = config;
  if (segmentationThreshold < 0.0 ||
    segmentationThreshold > 1.0) {
    throw new Error(`segmentationThreshold ${segmentationThreshold}. ` +
      `Should be in range [0.0, 1.0]`);
  }

  if (maxDetections <= 0) {
    throw new Error(`Invalid maxDetections ${maxDetections}. ` +
      `Should be > 0`);
  }

  if (scoreThreshold < 0.0 || scoreThreshold > 1.0) {
    throw new Error(`Invalid scoreThreshold ${scoreThreshold}. ` +
      `Should be in range [0.0, 1.0]`);
  }

  if (nmsRadius <= 0) {
    throw new Error(`Invalid nmsRadius ${nmsRadius}.`);
  }

  if (minKeypointScore < 0 ||
    minKeypointScore > 1) {
    throw new Error(`Invalid minKeypointScore ${minKeypointScore}.` +
      `Should be in range [0.0, 1.0]`);
  }

  if (refineSteps <= 0 ||
    refineSteps > 20) {
    throw new Error(`Invalid refineSteps ${refineSteps}.` +
      `Should be in range [1, 20]`);
  }
}

export class BodyPix {
  baseModel: BaseModel;

  constructor(net: BaseModel) {
    this.baseModel = net;
  }

  private predictForPersonSegmentation(input: tf.Tensor3D): {
    segmentLogits: tf.Tensor3D,
    heatmapScores:
    tf.Tensor3D,
    offsets: tf.Tensor3D,
    displacementFwd: tf.Tensor3D,
    displacementBwd: tf.Tensor3D
  } {
    const {
      segmentation,
      heatmapScores,
      offsets,
      displacementFwd,
      displacementBwd
    } = this.baseModel.predict(input);
    return {
      segmentLogits: segmentation,
      heatmapScores,
      offsets,
      displacementFwd,
      displacementBwd
    };
  }

  private predictForPersonSegmentationAndPart(input: tf.Tensor3D): {
    segmentLogits: tf.Tensor3D,
    partHeatmapScores:
    tf.Tensor3D,
    offsets: tf.Tensor3D,
    displacementFwd:
tf.Tensor3D;
    displacementBwd: tf.Tensor3D;
  } {
    const {
      segmentation,
      partHeatmaps,
      heatmapScores,
      offsets,
    } = this.baseModel.predict(input);

    return {
      segmentLogits: segmentation,
      partHeatmapLogits: partHeatmaps,
      heatmapScores,
      offsets,
    };
  }

  private predictForMultiPersonInstanceSegmentationAndPart(input: tf.Tensor3D):
    {
      segmentLogits:
      longOffsets: tf.Tensor3D,
      heatmapScores: tf.Tensor3D,
      offsets: tf.Tensor3D,
    } {
      const {
        segmentation,
        longOffsets,
        heatmapScores,
        offsets,
      } = this.baseModel.predict(input);

      return {
        segmentLogits:
        longOffsets,
        heatmapScores,
        offsets,
      };
    }

    private predictForMultiPersonInstanceSegmentationAndPart(input: tf.Tensor3D):
      {
        segmentLogits:
        longOffsets: tf.Tensor3D,
        heatmapScores: tf.Tensor3D,
        offsets: tf.Tensor3D,
      } {
        const {
          segmentation,
          longOffsets,
          heatmapScores,
          offsets,
        } = this.baseModel.predict(input);

        return {
          segmentLogits:
          longOffsets,
          heatmapScores,
          offsets,
        };
      }

    /**
     * Given an image with many people, returns a dictionary of all intermediate
     * tensors including: 1) a binary array with 1 for the pixels that are part of
     * the person, and 0 otherwise, 2) heatmapScores, 3) offsets, and 4) paddings.
     * @param input
     * @return A dictionary containing `segmentation`, `heatmapScores`, `offsets`,
     * and `paddings`: A 2d Tensor with 1 for the
     * pixels that are part of the
     * person, and 0 otherwise. The width and height correspond to the same
     * dimensions of the input image.
     */
  segmentPersonActivation(
      input: BodyPixInput, internalResolution:
      BodyPixInternalResolution,
      segmentationThreshold = 0.5): {
    segmentation: tf.Tensor2D,
    heatmapScores: tf.Tensor3D,
    offsets: tf.Tensor3D,
    displacementFwd: tf.Tensor3D,
    displacementBwd: tf.Tensor3D,
    padding: Padding,
    internalResolutionHeightAndWidth: [number, number]
  } {
    const [height, width] = getInputSize(input);
    const internalResolutionHeightAndWidth =
      toInputResolutionHeightAndWidth(
        internalResolution, this.baseModel.outputStride,
        [height, width]);

    const [resized, padding] =
      padAndResizeTo(input, internalResolutionHeightAndWidth);

    const {
      segmentation,
      heatmapScores,
      offsets,
      displacementFwd,
      displacementBwd
    } = tf.tidy(() =>
      {
        const {
          segmentLogits,
          heatmapScores,
          offsets,
          displacementFwd,
          displacementBwd
        } = this.predictForPersonSegmentation(resized);

        const [resizedHeight, resizedWidth] =
          resized.shape;

        const scaledSegmentScores =
          scaleAndCropToInputTensorShape(
            segmentLogits,
            [height, width],
            [resizedHeight, resizedWidth],
            [[padding.top, padding.bottom],
             [padding.left,
              padding.right]],
            APPLY_SIGMOID_ACTIVATION);

        return {
          segmentation: toMaskTensor(
            tf.squeeze(scaledSegmentScores), segmentationThreshold),
          heatmapScores,
          offsets,
          displacementFwd,
          displacementBwd
        };
      });

    const [resized, dispose]:
      tf.tidy(() =>
        {
          const [
            segmentation,
            heatmapScores,
            offsets,
            displacementFwd,
            displacementBwd
          ] =
            tf.tidy(() =>
              {
                const [
                  segmentation,
                  heatmapScores,
                  offsets,
                  displacementFwd,
                  displacementBwd
                ] =
                  this.predictForPersonSegmentation(resized);

                return {
                  segmentation,
                  heatmapScores,
                  offsets,
                  displacementFwd,
                  displacementBwd,
                  padding,
                  internalResolutionHeightAndWidth
                };
              })
          .then((result) =>
            {
              const {
                segmentation,
                heatmapScores,
                offsets,
                displacementFwd,
                displacementBwd
              } = result;

              return {
                segmentation,
                heatmapScores,
                offsets,
                displacementFwd,
                displacementBwd,
                padding,
                internalResolutionHeightAndWidth
              };
            })
          ;

          return {
            segmentation,
            heatmapScores,
            offsets,
            displacementFwd,
            displacementBwd
          };
        };
    });

    return {
      segmentation,
      heatmapScores,
      offsets,
      displacementFwd,
      displacementBwd
    };
  }
ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement)
   * The input image to feed through the network.
   *
   * @param config PersonInferenceConfig object that contains
   * parameters for the BodyPix inference using person decoding.
   *
   * @return A SemanticPersonSegmentation dictionary that
   * contains height, width, the flattened binary segmentation mask and the poses for all people.
   *
   * @width The width and height correspond to the same dimensions of the input image.
   *
   * - `height`: The height of the segmentation data in pixel unit.
   *
   * - `width`: The width of the segmentation data in pixel unit.
   *
   * - `data`: The flattened Uint8Array of segmentation data. 1 means the pixel
   * belongs to a person and 0 means the pixel doesn't belong to a person.
   * The size of the array is equal to `height` x `width` in row-major order.
   *
   * - `allPoses`: The 2d poses of all people.
   *
   * @async segmentPerson(
   * input: BodyPixInput, config: PersonInferenceConfig = PERSON_INFERENCE_CONFIG): Promise<SemanticPersonSegmentation> {
      *
      * const segmentation, heatmapScores, offsets, displacementFwd, displacementBwd, padding, internalResolutionHeightAndWidth =
      *
      * this.segmentPersonActivation(input, config.internalResolution, config.segmentationThreshold);
      *
      * const [height, width] = segmentation.shape;
      *
      * const result = await segmentation.data() as Uint8Array;
      *
      * segmentation.dispose();
      *
      * const tensorBuffers = await toTensorBuffers3D([heatmapScores, offsets, displacementFwd, displacementBwd]);
      *
      * const [scoresBuf, offsetsBuf, displacementFwdBuf, displacementBwdBuf] = tensorBuffers;
      *
      * let poses = decodeMultiplePoses(scoresBuf, offsetsBuf, displacementFwdBuf, displacementBwdBuf, this.baseModel.outputStride, config.maxDetections, config.nmsRadius);
      *
      * poses = scaleAndFlipPoses(poses, [height, width], internalResolutionHeightAndWidth, padding, flipPosesAfterScaling);
      *
      * heatmapScores.dispose();
      *
      * offsets.dispose();
      *
      * displacementFwd.dispose();
      *
      * displacementBwd.dispose();
      *
      * return [height, width, data: result, allPoses: poses];
      *
      *
      * Given an image with multiple people, returns an *array* of PersonSegmentation
      * object. Each element in the array corresponding to one * person in the image. In other words, it predicts
      * instance-level multiple person segmentation & pose for each person.
      *
      * The model does standard ImageNet pre-processing before inferring through
      * the model. The image pixels should have values [0-255].
      *
      * @param input
      * ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement)
      *
      * The input
      * image to feed through the network.
      *
      * @param config MultiPersonInstanceInferenceConfig object
      * that contains parameters for the BodyPix inference using multi-person decoding.
      *
      * @return An array of PersonSegmentation object, each containing a width, height, a binary array (1 for the pixels that are part
      * of the person, and 0 otherwise) and 2D pose. The array size corresponds to the
      * number of pixels in the image. The width and height correspond to the
      * dimensions of the image the binary array is shaped to, which are
      * the same * dimensions of the input image. The input
      * @async segmentMultiPerson(
      * input: BodyPixInput, config: MultiPersonInstanceInferenceConfig = MULTI_PERSON_INSTANCE_INFERENCE_CONFIG): Promise<PersonSegmentation[]> {
      *
      * config = {...MULTI_PERSON_INSTANCE_INFERENCE_CONFIG, ...
      * config};
      *
      * validateMultiPersonInstanceInferenceConfig(config);
      *
      * const [height, width] =
      *
      * getInputStreamSize(input);
      *
      * const internalResolutionHeightAndWidth = toInputResolutionHeightAndWidth(config.internalResolution, this.baseModel.outputStride,
      *
      * [height, width]);
      *
      * const [resized, padding] =
      *
      * padAndResizeTo(input, internalResolutionHeightAndWidth);
      *
      * const [segmentation, longOffsets, heatmapScoresRaw, offsetsRaw, displacementFwdRaw, displacementBwdRaw, ] =
      *
      * tf.tidy(() => {
      *
      * const [segmentLogits, longOffsets, heatmapScores, offsets, displacementFwd, displacementBwd, ]
      *
      * this.predictForMultiPersonInstanceSegmentationAndPart(resized);
      *
      * const scaledSegmentScores =
      *
      * scaleAndCropToInputTensorShape(segmentLogits, [height, width], internalResolutionHeightAndWidth,
      *
      * [[padding.top, padding.bottom], [padding.left, padding.right]]);_
      *
      * APPLY_SIGMOID_ACTIVATION;
      *
      * const longOffsetsResized = false;
      *
      * let scaledLongOffsets =
      *
      * if (longOffsetsResized) {
      *
      * scaledLongOffsets = scaleAndCropToInputTensorShape(longOffsets, [height, width],
      *
      * internalResolutionHeightAndWidth, [[padding.top, padding.bottom], [padding.left, padding.right]];
      *
      * APPLY_SIGMOID_ACTIVATION;
      *
      * const scaledLongOffsets =
      *
      * scaleAndCropToInputTensorShape(scaledLongOffsets, [height, width],
      *
      * 
      * internalResolutionHeightAndWidth, [[padding.top, padding.bottom], [padding.left, padding.right]];
      *
      * APPLY_SIGMOID_ACTIVATION;
      *
      * const scaledLongOffsets =
      *
      * scaleAndCropToInputTensorShape(scaledLongOffsets, [height, width],
      *
      * internalResolutionHeightAndWidth, [[padding.top, padding.bottom], [padding.left, padding.right]];
      *
      * APPLY_SIGMOID_ACTIVATION;
      *
      * const scaledLongOffsets =
      *
      * scaleAndCropToInputTensorShape(scaledLongOffsets, [height, width],
      *
      * internalResolutionHeightAndWidth, [[padding.top, padding.bottom], [padding.left, padding.right]];
      *
      * APPLY_SIGMOID_ACTIVATION;
      *
      * const scaledLongOffsets =
      *
      * scaleAndCropToInputTensorShape(scaledLongOffsets, [height, width],
      *
      * internalResolutionHeightAndWidth, [[padding.top, padding.bottom], [padding.left, padding.right]];
      *
      * APPLY_SIGMOID_ACTIVATION;
      *
      * const scaledLongOffsets =
      *
      * scaleAndCropToInputTensorShape(scaledLongOffsets, [height, width],
      *
      * internalResolutionHeightAndWidth, [[padding.top, padding.bottom], [padding.left, padding.right]];
      *
      * APPLY_SIGMOID_ACTIVATION;
      *
      * const scaledLongOffsets =
      *
      * scaleAndCropToInputTensorShape(scaledLongOffsets, [height, width],
      *
      * internalResolutionHeightAndWidth, [[padding.top, padding.bottom], [padding.left, padding.right]];
      *
      * APPLY_SIGMOID_ACTIVATION;
      *
      * const scaledLongOffsets =
      *
      * scaleAndCropToInputTensorShape(scaledLongOffsets, [height, width],
      *
      * internalResolutionHeightAndWidth, [[padding.top, padding.bottom], [padding.left, padding.right]];
      *
      * APPLY_SIGMOID_ACTIVATION;
      *
      * const scaledLongOffsets =
      *
      * scaleAndCropToInputTensorShape(scaledLongOffsets, [height, width],
      *
      * internalResolutionHeightAndWidth, [[padding.top, padding.bottom], [padding.left, padding.right]];
      *
      * APPLY_SIGMOID_ACTIVATION;
Given an image with many people, returns a dictionary containing: height, width, a tensor with a part id from 0-24 for the pixels that are part of a corresponding body part, and -1 otherwise. This does standard ImageNet pre-processing before inferring through the model. The image should have values [0-255].

@return A dictionary containing `partSegmentation`, `heatmapScores`, `offsets`, and `padding`: `partSegmentation`: A 2d Tensor with a part id from 0-24 for the pixels that are part of a corresponding body part and -1 otherwise. `heatmapScores`: A 3d Tensor of the keypoint heatmaps used by a single-person pose estimation decoding. `offsets`: A 3d Tensor of the keypoint offsets used by single-person pose estimation decoding. `displacementFwd`: A 3d Tensor of the keypoint forward displacement used by pose estimation decoding. `displacementBwd`: A 3d Tensor of the keypoint backward displacement used by pose estimation decoding. `padding`: The padding (unit pixels) being applied to the input image before it is fed into the model.
toMaskTensor(tf.squeeze(scaledSegmentScores), segmentationThreshold); return {
  partSegmentation: 
  decodePartSegmentation(segmentation, scaledPartHeatmapScore),
  heatmapScores,
  offsets,
  displacementFwd,
  displacementBwd,
};

resized.dispose(); return {
  partSegmentation,
  heatmapScores,
  offsets,
  displacementFwd,
  displacementBwd,
  padding,
  internalResolutionHeightAndWidth
};

/**
 * Given an image with many people, returns a PartSegmentation dictionary that
 * contains the body part segmentation mask for all people and a single
 * pose. * Note: The body part segmentation mask returned by this method covers all
 * people but the pose works well when there is one person. If you want to
 * estimate instance-level multiple person body part segmentation & pose for
 * each person, use `segmentMultiPersonParts` instead.
 * @param input ImageData, HTMLImageElement, HTMLCanvasElement, HTMLVideoElement
 * The input image to feed through the network.
 * * @param config PersonInferenceConfig object that contains
 * parameters for the BodyPix inference using single person decoding.
 * * @return A SemanticPartSegmentation dictionary that contains height, width,
 * the flattened binary segmentation mask and the pose for the person. The width and
 * height correspond to the same dimensions of the input image.
 * - `height`: The height of the person part segmentation data in pixel unit.
 * - `width`: The width of the person part segmentation data in pixel unit.
 * - `data`: The flattened Int32Array of person part segmentation data with a
 * part id from 0-24 for the pixels that are part of a corresponding body
 * part, and -1 otherwise. The size of the array is equal to `height` x `width` in
 * row-major order.
 * - `allPoses`: The 2d poses of all people.
 * @return
 * @return
 * @return
 */

async segmentPersonParts(
    input: BodyPixInput,
    config: PersonInferenceConfig = PERSON_INFERENCE_CONFIG): Promise<SemanticPartSegmentation> {
    config = {...PERSON_INFERENCE_CONFIG, ...config};

    validatePersonInferenceConfig(config);
    const {
      partSegmentation,
      heatmapScores,
      offsets,
      displacementFwd,
      displacementBwd,
      padding,
      internalResolutionHeightAndWidth
    } =
    this.segmentPersonPartsActivation(
            input, config.internalResolution, config.segmentationThreshold);

    const [height, width] = partSegmentation.shape;
    const data = await partSegmentation.data() as Int32Array;
    partSegmentation.dispose();

    const tensorBuffers = await toTensorBuffers3D(
        [heatmapScores, offsets, displacementFwd, displacementBwd]);
    const [scoresBuf, offsetsBuf, displacementsFwdBuf, displacementsBwdBuf] =
        tensorBuffers;
    let poses = decodeMultiplePoses(
        scoresBuf, offsetsBuf,
        displacementsFwdBuf, displacementsBwdBuf,
        this.baseModel.outputStride, config.maxDetections,
        config.scoreThreshold, config.nmsRadius);

    poses = scaleAndFlipPoses(
        poses, [height, width],
        internalResolutionHeightAndWidth, padding,
        FLIP_POSES_AFTER_SCALING);

    heatmapScores.dispose();
    offsets.dispose();
    displacementFwd.dispose();
    displacementBwd.dispose();
    return {height, width, data, allPoses: poses};
}

/**
 * Given an image with multiple people, returns an
 * array of PartSegmentation
 * object. Each element in the array corresponding to one
 * person in the input image. In other words, it predicts
 * instance-level multiple person body part segmentation & pose for
 * each person. * This does standard ImageNet pre-processing before inferring through
 * the model.
 * The image pixels should have values [0-255].
 */

async segmentMultiPersonParts(
    input: BodyPixInput,
    config: MultiPersonInstanceInferenceConfig =
    MULTI_PERSON_INSTANCE_INFERENCE_CONFIG): Promise<PartSegmentation[]> {
    config = {...MULTI_PERSON_INSTANCE_INFERENCE_CONFIG, ...config};

    validateMultiPersonInstanceInferenceConfig(config);
    const [height, width] = getInputSize(input);
    const internalResolutionHeightAndWidth = toInputResolutionHeightAndWidth(input, config.internalResolution,
    this.baseModel.outputStride, [height, width]);
    return MultiPersonInstanceSegmentationConfig =
    MULTI_PERSON_INSTANCE_INFERENCE_CONFIG;
internalResolutionHeightAndWidth);
    const {
      segmentation,
      longOffsets,
      heatmapScoresRaw,
      offsetsRaw,
      displacementFwdRaw,
      displacementBwdRaw,
      partSegmentation,
    } = tf.tidy(() => {
      const {
        segmentLogits,
        longOffsets,
        heatmapScores,
        offsets,
        displacementFwd,
        displacementBwd,
        partHeatmaps
      } = this.predictForMultiPersonInstanceSegmentationAndPart(resized);
    // decoding with scaling
    const scaledSegmentScores = scaleAndCropToInputTensorShape(
        segmentLogits, [height, width],
        internalResolutionHeightAndWidth,
        [padding.top, padding.bottom], [padding.left, padding.right]);
    // decoding with scaling
    const scaledPartSegmentationScores = scaleAndCropToInputTensorShape(
        partHeatmaps, [height, width], internalResolutionHeightAndWidth,
        [padding.top, padding.bottom], [padding.left, padding.right]);
    const constLongOffsets = longOffsets;
    const segmentation = toMaskTensor(
        tf.squeeze(scaledSegmentScores), config.segmentationThreshold);
    const partSegmentation =
    decodeOnlyPartSegmentation(scaledPartSegmentationScores);
    return {
      segmentation,
      longOffsets: constLongOffsets,
      heatmapScoresRaw: heatmapScores,
      offsetsRaw: offsets,
      displacementFwdRaw: displacementFwd,
      displacementBwdRaw: displacementBwd,
      partSegmentation
    };
    });

    const tensorBuffers = await toTensorBuffers3D(
        [heatmapScoresRaw,
          offsetsRaw, displacementFwd, displacementBwd]);
    const [scoresBuf, offsetsBuf,
      displacementsFwdBuf, displacementsBwdBuf] =
        tensorBuffers;
    let poses = decodeMultiplePoses(
        scoresBuf, offsetsBuf, displacementsFwdBuf, displacementsBwdBuf,
        this.baseModel.outputStride,
        config.maxDetections,
        config.scoreThreshold, config.nmsRadius);
    poses = scaleAndFlipPoses(
        poses, [height, width], internalResolutionHeightAndWidth, padding,
        FLIP_POSES_AFTER_SCALING);

    const instanceMasks = await decodePersonInstancePartMasks(
        segmentation, longOffsets, partSegmentation,
        poses, height, width,
        this.baseModel.outputStride, internalResolutionHeightAndWidth, padding,
        config.scoreThreshold, config.refineSteps, config.minKeypointScore,
        config.maxDetections);

    resized.dispose();
    segmentation.dispose();
    longOffsets.dispose();
    heatmapScoresRaw.dispose();
    offsetsRaw.dispose();
    displacementFwdRaw.dispose();
    displacementBwdRaw.dispose();
    partSegmentation.dispose();
    return instanceMasks;
  }

  public dispose() {
    this.baseModel.dispose();
  }
}

/**
 * Loads the MobileNet BodyPix model.
 */
async function loadMobileNet(config: ModelConfig):
    Promise<BodyPix> {
  const outputStride = config.outputStride;
  const quantBytes = config.quantBytes;
  const multiplier = config.multiplier;
  if (tf == null) {
    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
    model.`);
  }

  const url = mobileNetSavedModel(outputStride, multiplier, quantBytes);
  const graphModel = await
    tfconv.loadGraphModel(config.modelUrl || url);
  const mobilenet = new MobileNet(graphModel, outputStride);
  return new BodyPix(mobilenet);
}

/**
 * Loads the ResNet BodyPix model.
 */
async function loadResNet(config: ModelConfig): Promise<BodyPix> {
  const outputStride = config.outputStride;
  const quantBytes = config.quantBytes;
  if (tf == null) {
    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
    model.`);
  }

  const url = resNet50SavedModel(outputStride, quantBytes);
  const graphModel = await
    tfconv.loadGraphModel(config.modelUrl || url);
  const resnet = new ResNet(graphModel, outputStride);
  return new BodyPix(resnet);
}

/**
 * Loads the BodyPix model instance from a checkpoint, with the ResNet
 * or MobileNet architecture. The model to be loaded is configurable using the
 * config dictionary ModelConfig. Please
 * find more details in the documentation of the ModelConfig.
 * @param config ModelConfig dictionary that
 * contains parameters for the BodyPix loading process. Please find more details of each parameters
 * in the documentation of the ModelConfig interface. The predefined
 * 'MOBILENET_V1_CONFIG' and
 * 'RESNET_CONFIG' can also be used as references for defining your customized config.
 * @export
 * @async
 * @function load
 */
export async function load(config = MOBILENET_V1_CONFIG):
    Promise<BodyPix> {
  const model = validateModelConfig(config);
  if (config.architecture === 'ResNet50') {
    return loadResNet(config);
  } else if (config.architecture === 'MobileNetV1') {
    return loadMobileNet(config);
  } else {
    return null;
  }
Open Source Used in Cisco Meeting Server (formerly Acano Server) 3.4

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=============================================================================

// method copied from bGlur in https://codepen.io/zhaojun/pen/zZmRQu.js
export function cpuBlur(canvas: HTMLCanvasElement|OffscreenCanvas, image: HTMLImageElement|HTMLVideoElement|HTMLCanvasElement|OffscreenCanvas, blur: number) {
  const ctx = canvas.getContext('2d');
  let sum = 0;
  const delta = 5;
  const alphaLeft = 1 / (2 * Math.PI * delta * delta);
  const step = blur < 3 ? 1 : 2;
  for (let y = -blur; y <= blur; y += step) {
    for (let x = -blur; x <= blur; x += step) {
      const weight = alphaLeft * Math.exp(-(x * x + y * y) / (2 * delta * delta));
      sum += weight;
    }
  }
  for (let y = -blur; y <= blur; y += step) {
    for (let x = -blur; x <= blur; x += step) {
      ctx.globalAlpha = alphaLeft * Math.exp(-(x * x + y * y) / (2 * delta * delta)) / sum * blur;
      ctx.drawImage(image, x, y);
    }
  }
  ctx.globalAlpha = 1;
}

=============================================================================

import {cpuBlur} from './blur';
import {Color, PartSegmentation, PersonSegmentation} from './types';
import {SemanticPartSegmentation, SemanticPersonSegmentation} from './types';
import {getInputSize} from './util';

export type Canvas = HTMLCanvasElement | OffscreenCanvas;

const offScreenCanvases: {[name: string]: Canvas} = {};

function isSafari() {
  return (/^((?!chrome|android).)*safari/i.test(navigator.userAgent));
}

function assertSameDimensions({width: widthA, height: heightA}: HasDimensions,
  {width: widthB, height: heightB}: HasDimensions, nameA: string,
  nameB: string) {
  if (widthA !== widthB || heightA !== heightB) {
    throw new Error(`error: dimensions must match. ${nameA} has dimensions ${widthA}x${heightA}, ${nameB} has dimensions ${widthB}x${heightB}`);
  }
}

function flipCanvasHorizontal(canvas: Canvas) {
  const ctx = canvas.getContext('2d');
  ctx.scale(-1, 1);
  ctx.translate(-canvas.width, 0);
}

function drawWithCompositing(ctx: CanvasRenderingContext2D|OffscreenCanvasRenderingContext2D, image: Canvas|ImageType, compositeOperation: string) {
  ctx.globalCompositeOperation = compositeOperation;
  ctx.drawImage(image, 0, 0, image.width, image.height);
}

function createOffScreenCanvas(): Canvas {
  return document.createElement('canvas');
}

function ensureOffscreenCanvasCreated(id: string): Canvas {
  if (!offScreenCanvases[id]) {
    offScreenCanvases[id] = createOffScreenCanvas();
  }
  return offScreenCanvases[id];
}

function drawAndBlurImageOnCanvas(image: Canvas|ImageType, blurAmount: number, canvas: Canvas) {
  const ctx = canvas.getContext('2d');
  ctx.drawImage(image, 0, 0, image.width, image.height);
  ctx.drawImage(image, 0, 0, image.width, image.height);
  ctx.drawImage(image, 0, 0, image.width, image.height);
  if (isSafari()) {
    cpuBlur(canvas, image, blurAmount);
  } else {
    ctx秅learRect(0, 0, width, height);
    ctx.save();
    ctx秅learRect(0, 0, width, height);
    ctx秅learRect(0, 0, width, height);
    ctx秅learRect(0, 0, width, height);
    ctx秅learRect(0, 0, width, height);
  }
}

function drawAndBlurImageOnOffScreenCanvas(image: Canvas|ImageType, blurAmount: number, offscreenCanvasName: string) {
  const canvas = ensureOffScreenCanvasCreated(offscreenCanvasName);
  if (blurAmount === 0) {


renderImageToCanvas(image, canvas);
} else {
  drawAndBlurImageOnCanvas(image, blurAmount, canvas);
}

function renderImageToCanvas(image: ImageType, canvas: Canvas) {
  const {width, height} = image;
  canvas.width = width;
  canvas.height = height;
  const ctx = canvas.getContext('2d');

  ctx.drawImage(image, 0, 0, width, height);
}

function renderImageDataToCanvas(imageData: ImageData, canvas: Canvas) {
  const {width, height} = canvas;
  canvas.width = width;
  canvas.height = image.height;
  const ctx = canvas.getContext('2d');

  ctx.putImageData(imageData, 0, 0);
}

/**
 * Render an image to a canvas
 */
function renderImageDataToOffScreenCanvas(imageData: ImageData, canvasName: string): Canvas {
  const canvas = ensureOffscreenCanvasCreated(canvasName);
  renderImageDataToCanvas(imageData, canvas);

  return canvas;
}

/**
 * Given the output from estimating multi-person segmentation, generates an image with
 * foreground and background color at each pixel determined by the corresponding binary segmentation value
 * at the pixel from the output. In other words, pixels where there is a person will be colored with foreground color
 * and where there is not a person will be colored with background color.
 */

personOrPartSegmentation: SemanticPersonSegmentation | SemanticPartSegmentation | PersonSegmentation | PartSegmentation,
  foreground: Color = {r: 0, g: 0, b: 0, a: 0},
  background: Color = {r: 0, g: 0, b: 0, a: 255},
  drawContour = false,
  foregroundIds: number[] = [1],
  radius = 1,
  segmentBoundary: boolean = true,
  segmentationData: Uint8Array | Int32Array,
  row: number,
  column: number,
  numberOfBackgroundPixels: number = 0,
  for (let i = -radius; i <= radius; i++) {
    for (let j = -radius; j <= radius; j++) {
      const n = (column + j) * width + (i + j);
      if (segmentationData[n] === 255) {
        numberOfBackgroundPixels += 1;
      }
    }
  }
}

multiPersonOrPartSegmentation: SemanticPersonSegmentation | SemanticPartSegmentation | PersonSegmentation | PartSegmentation,
  foreground: Color = {r: 0, g: 0, b: 0, a: 0},
  background: Color = {r: 0, g: 0, b: 0, a: 255},
  drawContour = false,
  foregroundIds: number[] = [1],
  radius = 1,
  segmentBoundary: boolean = true,
  segmentationData: Uint8Array | Int32Array,
  row: number,
  column: number,
  numberOfBackgroundPixels: number = 0,
  for (let i = -radius; i <= radius; i++) {
    for (let j = -radius; j <= radius; j++) {
      const n = (column + j) * width + (i + j);
      if (segmentationData[n] === 255) {
        numberOfBackgroundPixels += 1;
      }
    }
  }
}

multiPersonOrPartSegmentation: SemanticPersonSegmentation | SemanticPartSegmentation | PersonSegmentation | PartSegmentation,
  foreground: Color = {r: 0, g: 0, b: 0, a: 0},
  background: Color = {r: 0, g: 0, b: 0, a: 255},
  drawContour = false,
  foregroundIds: number[] = [1],
  radius = 1,
  segmentBoundary: boolean = true,
  segmentationData: Uint8Array | Int32Array,
  row: number,
  column: number,
  numberOfBackgroundPixels: number = 0,
  for (let i = -radius; i <= radius; i++) {
    for (let j = -radius; j <= radius; j++) {
      const n = (column + j) * width + (i + j);
      if (segmentationData[n] === 255) {
        numberOfBackgroundPixels += 1;
      }
    }
  }
}

multiPersonOrPartSegmentation: SemanticPersonSegmentation | SemanticPartSegmentation | PersonSegmentation | PartSegmentation,
  foreground: Color = {r: 0, g: 0, b: 0, a: 0},
  background: Color = {r: 0, g: 0, b: 0, a: 255},
  drawContour = false,
isBoundary = isSegmentationBoundary(
    multiPersonOrPartSegmentation[k].data, i, j, width,
    foregroundIds);  

if (drawContour && i - 1 >= 0 && i + 1 < height && j - 1 >= 0 &&
    j + 1 < width &&
    &isBoundary) {
  drawStroke(bytes, i, j, width, 1);
}

}  

return new ImageData(bytes, width, height);
}

const RAINBOW_PART_COLORS: Array<number, number, number> = [
  [110, 64, 170],[143, 61, 178],[178, 60, 178],[210, 62, 167],[238, 67, 149],[255, 78, 125],[255, 94, 99],
  [255, 115, 75],[255, 140, 56],[239, 167, 47],[217, 194, 49],[194, 219, 64],[175, 240, 91],[135, 245, 87],
  [96, 247, 96],[64, 243, 115],[40, 234, 141],[28, 219, 169],[26, 199, 194],[33, 176, 213],[45, 150, 224],[65,
  125, 224],[84, 101, 214],[99, 81, 195]);

/**
 * Given the output from person body part segmentation (or
 * multi-person instance body part segmentation) and an array of colors indexed by part id, *
 * generates an image with the corresponding color for each part at each pixel. *
 * and white pixels where there is no part. *
 *
 * @returns An ImageData with the same width and height of all the element in *
 * multiPersonPartSegmentation, with the corresponding color for each part at each pixel, and black pixels where there is no part. *
 *
 * @param partSegmentation The output from segmentPersonParts or segmentMultiPersonParts. The former is a *
 * SemanticPartSegmentation object and later is an array of PartSegmentation object. *
 * @param partColors A multi-dimensional array of rgb colors indexed by part id. Must have 24 colors, one for every part. *
 * @returns An ImageData with the same width and height of all the element in *
 * multiPersonPartSegmentation, with the corresponding color for each part at each pixel, and black pixels where there is no part. *
 */
export function toColoredPartMask(
    partSegmentation: SemanticPartSegmentation|PartSegmentation[],
    partColors: Array<number, number, number> = RAINBOW_PART_COLORS): ImageData {
  if (Array.isArray(partSegmentation) && partSegmentation.length === 0) {
    return null;
  }

  let multiPersonPartSegmentation;  
  if (!Array.isArray(partSegmentation)) {
    multiPersonPartSegmentation = [partSegmentation];
  } else {
    multiPersonPartSegmentation = partSegmentation;
  }
  const {width, height} = multiPersonPartSegmentation[0];
  const bytes = new Uint8ClampedArray(width * height * 4);

  for (let i = 0; i < height * width; ++i) {
    // invert mask. Invert the segmentation mask.
    const j = i * 4;
    bytes[j + 0] = 255;
    bytes[j + 1] = 255;
    bytes[j + 2] = 255;
    bytes[j + 3] = 255;
    for (let k = 0; k < multiPersonPartSegmentation.length; k++) {
      const partId = multiPersonPartSegmentation[k].data[i];
      if (partId !== -1) {
        const color = partColors[partId];
        if (!color) {
          throw new Error(`No color could be found for part id ${partId}`);
        }
        bytes[j + 0] = color[0];
        bytes[j + 1] = color[1];
        bytes[j + 2] = color[2];
        bytes[j + 3] = 255;
      }
    }
  }
  return new ImageData(bytes, width, height);
}

const CANVAS_NAMES = {
  blurred: 'blurred',
  blurredMask: 'blurred-mask',
  mask: 'mask',
  lowresPartMask: 'lowres-part-mask',
};

/**
 * Given an image and a maskImage of type ImageData, draws the image with the *
 * pixelated mask on top of it onto a canvas. *
 *
 * @param canvas The canvas to be drawn onto. *
 * @param maskImage An ImageData containing the mask. Ideally this should be *
 * generated by toMask or toColoredPartMask. *
 * @param maskOpacity The opacity of the mask when drawing it on top of the *
 * image. Defaults to 0.7. Should be a float between 0 and 1. *
 * @param maskBlurAmount How many pixels to blur the mask by. Defaults to 0. *
 * Should be an integer between 0 and 20. *
 */
export function drawMask(
    canvas: Canvas, image: ImageType, maskImage: ImageData|null,
    maskOpacity = 0.7, maskBlurAmount = 0, flipHorizontal = false) {
  const {height, width} = getInputSize(image);
  canvas.width = width;
  canvas.height = height;
  const ctx = canvas.getContext('2d');
  ctx.save();
  if (flipHorizontal) {
    flipCanvasHorizontal(canvas);
  }
  ctx.drawImage(image, 0, 0);

  ctx.globalAlpha = maskOpacity;
  if (maskImage) {
    assertSameDimensions({width, height}, maskImage, 'image', 'mask');

    const blurredImage = drawAndBlurImageOnOffScreenCanvas
        (maskImage, CANVAS_NAMES.blurredMask);
    ctx.drawImage(blurredImage, 0, 0, width, height);
  }
  ctx.restore();
}
blur the mask by. Defaults to 0.* Should be an integer between 0 and 20.* @param flipHorizontal If the result should be flipped horizontally. Defaults to false.* @param pixelCellWidth The width of each pixel cell. Default to 10 px.* @export function drawPixelatedMask canvas: Canvas, image: ImageType, maskImage: ImageData, maskOpacity = 0.7, maskBlurAmount = 0, flipHorizontal = false, pixelCellWidth = 10.0 { const [height, width] = getInputSize(image); assertSameDimensions((width, height), maskImage, 'image', 'mask'); const mask = renderImageToOffScreenCanvas(maskImage, CANVAS_NAMES.mask); const blurredMask = drawAndBlurImageOnOffScreenCanvas(canvas, mask, maskBlurAmount, CANVAS_NAMES.blurredMask); canvas.width = blurredMask.width; canvas.height = blurredMask.height; const ctx = canvas.getContext('2d'); ctx.save(); if (flipHorizontal) { flipCanvasHorizontal(canvas); } console.log(canvas); }

const offsetCanvas = ensureOffscreenCanvasCreated(CANVAS_NAMES.lowresPartMask); const offsetCanvasCtx = offsetCanvas.getContext('2d'); offsetCanvas.width = blurredMask.width * (1.0 / pixelCellWidth); offsetCanvas.height = blurredMask.height * (1.0 / pixelCellWidth); offsetCanvasCtx.drawImage(blurredMask, 0, 0, blurredMask.width, blurredMask.height, 0, 0, offsetCanvas.width, offsetCanvas.height, 0, 0, canvas.width, canvas.height); // Draws vertical grid lines that are `pixelCellWidth` apart from each other. for (let i = 0; i < offsetCanvas.width; i++) { ctx.beginPath(); ctx.strokeStyle = '#ffffff'; ctx.moveTo(pixelCellWidth * i, 0); ctx.lineTo(pixelCellWidth * i, canvas.height); ctx.stroke(); }

// Draws horizontal grid lines that are `pixelCellWidth` apart from each other. for (let i = 0; i < offsetCanvas.height; i++) { ctx.beginPath(); ctx.strokeStyle = '#ffffff'; ctx.moveTo(0, pixelCellWidth * i); ctx.lineTo(canvas.width, pixelCellWidth * i); ctx.stroke(); }

ctx.globalAlpha = 1.0 - maskOpacity; ctx.drawImage(image, 0, 0, blurredMask.width, blurredMask.height); ctx.restore();}

drawWithCompositing(ctx, personMask, 'destination-in');

// "destination-over" - "The existing canvas content is
// opaque and will be blended with new content."
// crop what's not the person using the mask from the original image
console.log(canvas); drawWithCompositing(canvas, canvas, ImageType, multiPersonSegmentation, new PersonSegmentation([[]], backgroundBlurAmount: number)); Canvas { const backgroundMaskImage = toMask(personSegmentation, {r: 0, g: 0, b: 0, a: 255}, {r: 0, g: 0, b: 0, a: 0}); const backgroundMask = renderImageToOffScreenCanvas(backgroundMaskImage, CANVAS_NAMES.mask); if (edgeBlurAmount === 0) { return backgroundMask; }

else { return drawAndBlurImageOnOffScreenCanvas(canvas, backgroundMask, edgeBlurAmount, CANVAS_NAMES.blurredMask); }

}

* Given a personSegmentation and an image, draws the image
with its background blurred onto the canvas. * @param params The
canvas to draw the background-blurred image onto. * @param
image The image to blur the background of and draw. * @param
canvas The canvas to draw the background-blurred
image onto. * @param params The canvas to draw the background-blurred
image onto. * @param params The canvas to draw the background-blurred
image onto.
kept where both the new shape and existing canvas content overlap. Everything else is made transparent.

// draw the blurred background on top of the original image where it doesn't overlap.

drawWithCompositing(ctx, blurredImage, 'destination-over');
ctx.restore();

/**
 * Given a personSegmentation and an image, draws the image with its background blurred onto the canvas. The canvas to draw the background-blurred image onto.
 *
 * @param param Canvas
 * @param image The image to blur the background of and draw.
 * @returns the blurred background on the canvas
 */
export function blurBodyPart(canvas, image, partSegmentation, bodyPartIdsToBlur = [0, 1], backgroundBlurAmount = 3, edgeBlurAmount = 3, flipHorizontal = false) {
  const blurredImage = drawAndBlurImageOnOffScreenCanvas(image, backgroundBlurAmount, CANVAS_NAMES.blurred);
  canvas.width = blurredImage.width;
  canvas.height = blurredImage.height;
  const ctx = canvas.getContext('2d');

  if (Array.isArray(partSegmentation) && partSegmentation.length === 0) {
    ctx.drawImage(blurredImage, 0, 0);
    return;
  }
  const bodyPartMask = createBodyPartMask(partSegmentation, bodyPartIdsToBlur, edgeBlurAmount);

  ctx.save();
  if (flipHorizontal) {
    flipCanvasHorizontal(canvas);
  }
  // draw the original image on the final canvas
  const \[height, width\] = getInputSize(image);
  ctx.drawImage(image, 0, 0, width, height);
  // "destination-in" - "The existing canvas content is kept where both the new shape and existing canvas content overlap. Everything else is made transparent."
  // crop what's not the person using the mask from the original image
  drawWithCompositing(ctx, bodyPartMask, 'destination-in');
  // "destination-over" - "The existing canvas content is kept where both the new shape and existing canvas content overlap. Everything else is made transparent."
  // draw the blurred background on top of the original image where it doesn't overlap.
  drawWithCompositing(ctx, blurredImage, 'destination-over');
  ctx.restore();
}

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const version = '2.2.0';
export {version};

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`export {BodyPix, load} from './body_pix_model';
export {blurBodyPart, drawBokehEffect, drawMask, drawPixelatedMask, toColoredPartMask, toMask} from './output_rendering_util';
export {PART_CHANNELS} from './part_channels';
export {PartSegmentation, PersonSegmentation, SemanticPartSegmentation, SemanticPersonSegmentation} from './types';
export {flipPoseHorizontal, resizeAndPadTo, scaleAndCropToInputTensorShape} from './util';

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* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/multi_person/decode_multiple_masks_webgl.d.ts

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Q, gBAagB, EA, CA, CA, CA, CA, GA, EA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA, QA,QA
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import {Backend, DataId} from '../tensor';
import {BackendValues, DataType} from '../types';

export const EPSILON_FLOAT32 = 1e-7;
export const EPSILON_FLOAT16 = 1e-4;

// Required information for all
export interface BackendTimingInfo {
  kernelMs: number|{error: string};
  getExtraProfileInfo?():
                                   // a field for additional timing information
                                   // e.g. packing / unpacking for WebGL
                                   // backend
                                  string;
}

export interface TensorStorage {
  read(dataId: DataId): Promise<BackendValues>;
  readSync(dataId: DataId): BackendValues;
  disposeData(dataId: DataId, force?: boolean): boolean;
  memory(): {unreliable:
                                  boolean;};  // Backend-specific information.
  /** Returns number of data ids currently in the storage. */
  numDataIds(): number;
  refCount(dataId: DataId): number;
}

/** Convenient class for storing tensor-related data. */
export class DataStorage<T> {
  private data = new WeakMap<DataId, T>();
  private dataIdsCount = 0;

  constructor(private backend: KernelBackend, private dataMover: DataMover) {}

  get(dataId: DataId) {
    if (!this.data.has(dataId)) {
      this.dataMover.moveData(this.backend, dataId);
    }
    return...
this.data.get(dataId);
}

set(dataId: DataId, value: T): void {
  this.data.set(dataId, value);
}

has(dataId: DataId): boolean {
  return this.data.has(dataId);
}

delete(dataId: DataId): void {
  this.data.delete(dataId);
}

numDataIds(): number {
  return this.data.size;
}

export interface DataMover {
  /**
   * To be called by backends whenever they see a dataId that they don't own.
   * Upon calling this method, the mover will fetch the tensor from another backend and register it with the current active backend.
   */
  moveData(backend: KernelBackend, dataId: DataId): number;
}

export interface BackendTimer {
  // check if backend timer is available
  timerAvailable(): boolean;
  time(f: () => void): Promise<BackendTimingInfo>;
}

/**
 * The interface that defines the kernels that should be implemented when adding a new backend. New backends don't need to implement every one of the * methods, this can be done gradually (throw an error for unimplemented * methods).
 */
export class KernelBackend implements TensorStorage, Backend, BackendTimer {
  refCount(dataId: DataId): number {
    return notYetImplemented('refCount');
  }
  incRef(dataId: DataId): void {
    return notYetImplemented('incRef');
  }
  timerAvailable(): boolean {
    return true;
  }
  time(f: () => void): Promise<BackendTimingInfo> {
    return notYetImplemented('time');
  }
  read(dataId: object): Promise<BackendValues> {
    return notYetImplemented('read');
  }
  readSync(dataId: object): BackendValues {
    return notYetImplemented('readSync');
  }
  disposeData(dataId: object, force?: boolean): boolean {
    return notYetImplemented('disposeData');
  }
  write(values: BackendValues, shape: number[], dtype: DataType): DataId {
    return notYetImplemented('write');
  }
  move(
      dataId: DataId, values: BackendValues, shape: number[], dtype: DataType,
      refCount: number): void {
    return notYetImplemented('move');
  }
  memory(): {unreliable: boolean; reasons?: string[]} {
    return notYetImplemented('memory');
  }
  floatPrecision(): number {
    return notYetImplemented('floatPrecision');
  }
  epsilon(): number {
    return this.floatPrecision() === 32 ? EPSILON_FLOAT32 : EPSILON_FLOAT16;
  }
  dispose(): void {
    return notYetImplemented('dispose');
  }
}

function notYetImplemented(kernelName: string): never {
  throw new Error(`The '${kernelName}' kernel is not yet implemented or not found in the registry.`);
}

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```js
const randomTen = (number) => {
  const width = Math.ceil(Math.sqrt(size));
  return [width, Math.ceil(size / width)];
}

/**
 * x);
    return (e2x - 1) / (e2x + 1);
  }
}

export function sizeToSquarishShape(size: number): [number, number] {
  if (x === Infinity) {
    return 1;
  } else if (x === -Infinity) {
    return -1;
  } else {
    const e2x = Math.exp(2 * x);
    return (e2x - 1) / (e2x + 1);
  }
}

export function tanh(x: number): number {
  // tslint:disable-next-line:no-any
  return (Math as any).tanh(x);
}

export function isInt(a: number): boolean {
  return a % 1 === 0;
}

export function tanh(x: number): number {
  // tslint:disable-next-line:no-any
  return (Math as any).tanh(x);
}

export function arraysEqual(n1, n2) {
  if (n1 === n2) {
    return true;
  }
  if (n1 == null || n2
```
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```typescript
export function checkConversionForErrors<D extends DataType>(
    vals: Array<'string'>(size);
) => {
  if (shape.length === 0) {
    throw Error(`Shape cannot be empty`);
  }
  if (shape.some(dim => dim < 0)) {
    throw Error(`Shape contains negative dimension`);
  }
  if (shape.some(dim => !Number.isInteger(dim))) {
    throw Error(`Shape contains non-integer dimension`);
  }
  // Perform shape validation
  let result: number[] = shape.map(dim => dim > 0 ? dim : 1);
  if (result.some(dim => dim <= 0)) {
    throw Error(`Shape contains non-positive dimension`);
  }
  // Ensure shape and size are compatible
  if (size % result.reduce((acc, curr) => acc * curr, 1) !== 0) {
    throw Error(`Size not divisible by shape`);
  }
  // Check for all dimensions
  for (let i = 0; i < shape.length; i++) {
    if (shape[i] === -1) {
      result[i] = size / result.reduce((acc, curr) => acc * curr, 1);
    }
  }
  // Return the validated shape
  return result;
}

// Example usage
const size = 24;
const shape = [2, 3, 4];
const validatedShape = checkConversionForErrors(shape, size);
console.log(validatedShape); // Output: [2, 3, 4]
```

---

The provided code snippet is a TypeScript function that checks if the shape of an array is compatible with a given size. It validates the shape dimensions, ensuring they are non-negative integers and can be evenly divided by the size. If any of these conditions are not met, it throws an error. The function is used to validate the shape of an array before further processing. This is important in scenarios where the shape of an array is not known at compile time, such as in applications that dynamically receive data, ensuring data integrity and preventing errors during runtime.
{\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
export function assertNonNegativeIntegerDimensions(shape: number[]) {\n  shape.forEach(dimSize => {\n    assert(Number.isInteger(dimSize) && dimSize >= 0, () => {\n      Tensor must have a shape comprised of positive integers but got `+in\n      shape ${shape}.`);\n    }\n  });\n}\n
/**\n * Computes flat index for a given location (multidimensional 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 * \n * @export function locToIndex(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 * Computes the location (multidimensional index) in a \n * tensor/multidimensional 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 * \n * @export function indexToLoc(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}
Promise<FlagValue> {
  if (flagName in this.flags) {
    return this.flags[flagName];
  }
}

this.flags[flagName] = await this.evaluateFlag(flagName);
return this.flags[flagName];

get(flagName: string): FlagValue {
  if (flagName in this.flags) {
    return this.flags[flagName];
  }
}

const flagValue = this.evaluateFlag(flagName);
if (isPromise(flagValue)) {
  throw new Error(`Flag ${flagName} cannot be synchronously evaluated. ` +
                   `Please use getAsync() instead.`);
}

this.flags[flagName] = flagValue as number || boolean;
return this.flags[flagName];

getNumber(flagName: string): number {
  return this.get(flagName) as number;
}

getAll(flagName: string): Flags {
  return this.flags;
}

// For backwards compatibility
get features(): Flags {
  return this.flags;
}

set(flagName: string, value, FlagValue: FlagValue): void {
  if (this.flagRegistry[flagName] == null) {
    throw new Error(`Cannot set flag '${flagName}' as it has not been registered.`);
  }
  if (this.flags[flagName] == value) {
    if (this.flagRegistry[flagName].setHook != null) {
      this.flagRegistry[flagName].setHook(value);
    }
  } else {
    try {
        private evaluateFlag(flagName: string): FlagValue {
          if (this.flagRegistry[flagName] == null) {
            throw new Error(`Cannot evaluate flag '${flagName}': no evaluation function found.`);
          }
          return this.flagRegistry[flagName].evaluationFn();
        }
      } catch (e) {
        cachedSetTimeout = setTimeout;
        try {
          if (typeof clearTimeout === 'function') {
            cachedClearTimeout = clearTimeout;
          } else {
            cachedSetTimeout = defaultSetTimeout;
          }
        }
        try {
          if (!cachedSetTimeout) && setTimeout) {
            cachedSetTimeout = setTimeout;
            return setTimeout(fun, 0);
          }
        }
        // when when somebody has screwed with setTimeout but no I.E. madness
        return cachedSetTimeout(fun, 0);
      }
    }
  }
}

function runTimeout(fun) {
    if (typeof global === 'undefined') {
        throw new Error('setTimeout has not been defined.');
    }
    if (typeof global.setTimeout === 'function') {
        return setTimeout(fun, 0);
    }
    // if setTimeout wasn't available but was latter defined
    if ((cachedSetTimeout === null)) {
        cachedSetTimeout = defaultSetTimeout;
    }
    try {
        cachedClearTimeout = clearTimeout;
    } catch (e) {
        cachedClearTimeout = clearTimeout;
    }
}

function defaultClearTimeout () {
    throw new Error('clearTimeout has not been defined');
}

function defaultSetTimout() {
    throw new Error('setTimeout has not been defined');
}

return cachedSetTimeout.call(null, fun, 0);

}
```javascript
function runClearTimeout(marker) {
    if (cachedClearTimeout === clearTimeout) {
        // normal environments in sane situations
        return clearTimeout(marker);
    }
    if (cachedClearTimeout === defaultClearTimeout && clearTimeout) {
        cachedClearTimeout = clearTimeout;
    }
    var timeout = runTimeout(cleanUpNextTick);
    draining = true;
    var len = queue.length;
    while(len) {
        currentQueue = queue;
        queue = [];  
        while (++queueIndex < len) {
            if (currentQueue) {
                currentQueue[queueIndex].run();
            }
        }
    }
    currentQueue = null;
    draining = false;
    runClearTimeout(timeout);
}

function Item(fun, array) {
    this.fun = fun;
    this.array = array;
}
Item.prototype.run = function () {
    this.fun.apply(null, this.array);
};
```

---

```javascript
let globalNameSpace: {
    _tfGlobals: Map<string, any>;
};
export function getGlobalNamespace(): {
    _tfGlobals: Map<string, any>;
} {
    if (globalNameSpace == null) {
        let ns: any;
        if (typeof (window) !== 'undefined') {
            ns = window;
        } else if (typeof (global) !== 'undefined') {
            ns = global;
        } else if (typeof (process) !== 'undefined') {
            ns = process;
        } else if (typeof (self) !== 'undefined') {
            throw new Error('Could not find a global object.');
        }
        globalNameSpace = ns;
    }
    return globalNameSpace;
}
```

---

```javascript
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you may not use this file except in compliance with the License. You may obtain a copy of the License at http://www.apache.org/licenses/LICENSE-2.0 * Unless required by applicable law or agreed to in writing, software distributed under the License is distributed on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied. * See the License for the specific language governing permissions and limitations under the License.
```
ns._tfGlobals = new Map();
return ns._tfGlobals;

/**
 * Returns a globally accessible 'singleton'
 * object.
 * @param key the name of the object
 * @param init a function to initialize
 * the first time it is fetched.
 */
export function getGlobal<T>(key: string, init: () => T): T {
  const globalMap = getGlobalMap();
  if (globalMap.has(key)) {
    return globalMap.get(key);
  } else {
    const singleton = init();
    globalMap.set(key, singleton);
    return globalMap.get(key);
  }
}

/**
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 */

Allow UpperCamelCase variable names

// tslint:disable: variable-name
// Unfortunately just enabling PascalCase
// per file (tslint:enable: true) doesn't work.

import {NamedTensorInfoMap, TensorInfo} from
'./kernel_registry';
import {ExplicitPadding} from './ops/conv_util';
import {DataType, PixelData} from './types';
import {Activation} from './ops/fused_types';
import {BinaryInput} from './ops/conv_util';
import {UnaryInput} from './ops/fused_types';
import {ExplicitPadding} from './ops/conv_util';
Pick<NamedTensorInfoMap, 'input'>;

export const Reciprocal = 'Reciprocal';
export type ReciprocalInputs = UnaryInputs;

export const Relu = 'Relu';
export const Relu6Inputs = Pick<NamedTensorInfoMap, 'x'>;

export const Reshape = 'Reshape';
export type ReshapeInputs = Pick<NamedTensorInfoMap, 'x'>;

export const ReshapeAttrs = { shape: number[]};

export type ReshapeNearestNeighborInputs = Pick<NamedTensorInfoMap, 'images'>;

export const ReshapeNearestNeighbor = 'ReshapeNearestNeighbor';
export type ReshapeNearestNeighborInputs = number[];

export const ReshapeNearestNeighborGrad = 'ReshapeNearestNeighborGrad';
export type ReshapeNearestNeighborGradInputs = Pick<NamedTensorInfoMap, 'dy'>;

export const ReshapeNearestNeighborGradAttrs = Pick<NamedTensorInfoMap, 'images'>;

export const ReshapeBilinear = 'ReshapeBilinear';
export type ReshapeBilinearInputs = Pick<NamedTensorInfoMap, 'images'>;

export const ReshapeBilinearGrad = 'ReshapeBilinearGrad';

export const Relu6 = 'Relu6';
export type Relu6Inputs = Pick<NamedTensorInfoMap, 'x'>;

export const Reverse = 'Reverse';
export const ReverseInputs = Pick<NamedTensorInfoMap, 'x'>;

export const Round = 'Round';
export type RoundInputs = UnaryInputs;

export const Rsqrt = 'Rsqrt';
export type RsqrtInputs = UnaryInputs;

export const ScatterNd = 'ScatterNd';
export type ScatterNdInputs = Pick<NamedTensorInfoMap, 'indices'|'updates'>;

export const Select = 'Select';
export const SelectInputs = Pick<NamedTensorInfoMap, 'condition'|'t'|'e'>;

export const Selu = 'Selu';
export const SeluInputs = Pick<NamedTensorInfoMap, 'x'>;

export const Slice = 'Slice';
export const SliceInputs = Pick<NamedTensorInfoMap, 'x'>;

export const Sigmoid = 'Sigmoid';
export type SigmoidInputs = UnaryInputs;

export const Softmax = 'Softmax';
export const SoftmaxInputs = Pick<NamedTensorInfoMap, 'logits'>;

export const SpaceToBatchND = 'SpaceToBatchND';
export type SpaceToBatchNDInputs = Pick<NamedTensorInfoMap, 'x'>;

export const SplitV = 'SplitV';
export type SplitVInputs = Pick<NamedTensorInfoMap, 'x'>;

export const Sqrt = 'Sqrt';
export type SqrtInputs = UnaryInputs;

export const Square = 'Square';
export const SquareInputs = Pick<NamedTensorInfoMap, 'x'>;

export const Sub = 'Sub';
export type SubInputs = BinaryInputs;

export const SparseToDense = 'SparseToDense';
export type SparseToDenseInputs = Pick<NamedTensorInfoMap, 'sparseIndices'|'sparseValues'|'defaultValue'>;

export const StridedSlice = 'StridedSlice';
export type StridedSliceInputs = Pick<NamedTensorInfoMap, 'x'>;

export const Transpose = 'Transpose';
export type TransposeInputs = Pick<NamedTensorInfoMap, 'x'>;

export const Unique = 'Unique';
export type UniqueInputs = Pick<NamedTensorInfoMap, 'x'>;

Pick<NamedTensorInfoMap, 'images'>;
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---

The code snippet contains definitions for various TensorFlow.js kernels, including:

- `Unpack` which appears to be a function for unpacking values from a tensor
- `UnsortedSegmentSum` which could be used for summing over segments
- `ZerosLike` which might be used to create tensors filled with zeros
- `Step` which could be a function for creating a step function
- `FromPixels` which might be used for creating tensors from pixel data
- `RotateWithOffset` which could be for rotating images with offset
- `FusedMatMul` which is a fused matrix multiplication
- `FusedConv2D` and `FusedDepthwiseConv2D` which are fused 2D convolution kernels

The code also includes imports and definitions for various TensorFlow.js utilities and types such as `KernelConfig`, `NamedAttrMap`, `KernelFunc`, and `NamedTensorInfoMap`

---

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The code is part of the TensorFlow.js library, which is used for training and inference in machine learning workflows, particularly in the context of deep learning and computer vision applications.
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```typescript
// When saveAllInputs is true, all inputs will be saved. Only use this flag // if inputs is an array of Tensors.
saveAllInputs?: boolean;
outputsToSave?: boolean[];
gradFunc: GradFunc;

// Holds metadata for a given tensor.

export interface GradConfig {
  kernelName: string;
  inputsToSave?: string[];
  // When saveAllInputs is true, all inputs will be saved. Only use this flag // if inputs is an array of Tensors.
  saveAllInputs?: boolean;
  outputsToSave?: boolean[];
  gradFunc: GradFunc;
}

/** Holds metadata for a given tensor. */
export interface TensorInfo {
  dataId: DataId;
  shape: number[];
  dtype: DataType;
}

export interface NamedTensorInfoMap {
  [name: string]: TensorInfo;
}

export interface NamedAttrMap {
  [name: string]: Attribute;
}

/**
 * Returns the kernel function (code) associated with the provided names.
 */
export function getKernel(kernelName: string, backendName: string): KernelConfig {
  const key = makeKey(kernelName, backendName);
  return kernelRegistry.get(key);
}

/**
 * Returns the registered gradient info associated with the provided kernel.
 */
export function getGradient(kernelName: string): GradConfig {
  return gradRegistry.get(kernelName);
}

export function getKernelsForBackend(backendName: string): KernelConfig[] {
  const it = kernelRegistry.entries();
  const result: KernelConfig[] = [];

  while (true) {
    const {done, value} = it.next();
    if (done) {
      break;
    }
    const [key, config] = value;
    const [backend, kernelName] = key.split('_');
    if (backend === backendName) {
      result.push(config);
    }
  }
  return result;
}

/**
 * Registers the function (forward pass) for the kernel in a global registry.
 */
export function registerKernel(config: KernelConfig) {
  const {kernelName, backendName} = config;
  const key = makeKey(kernelName, backendName);
  if (kernelRegistry.has(key)) {
    console.warn(`The kernel '${kernelName}' for backend ` +
      `'${backendName}' is already registered`);
  }
  kernelRegistry.set(key, config);
}

/**
 * Registers a gradient function for a given kernel in the global registry.
 */
export function registerGradient(config: GradConfig) {
  const {kernelName} = config;
  if (gradRegistry.has(kernelName)) {
    // TODO (yassogba) after 3.0 assess whether we need to keep this gated
    if (env().getBool('DEBUG')) {
      console.warn(`Overriding the gradient for '${kernelName}'`);
    }
  }
  gradRegistry.set(kernelName, config);
}

/**
 * Removes the kernel function from the registry.
 */
export function unregisterKernel(kernelName: string, backendName: string): void {
  const key = makeKey(kernelName, backendName);
  if (kernelRegistry.has(key)) {
    kernelRegistry.delete(key);
  }
}

/**
 * Removes the registered gradient from the global registry.
 */
export function unregisterGradient(kernelName: string): void {
  if (gradRegistry.has(kernelName)) {
    gradRegistry.delete(kernelName);
  }
}

/**
 * Finds kernels that have already been registered to a backend and re-registers
 * them for a new backend. Useful for registering custom backends.
 */
export function copyRegisteredKernels(registeredBackendName: string, newBackendName: string): void {
  const kernels = getKernelsForBackend(registeredBackendName);
  kernels.forEach(kernelConfig => {
    const newKernelConfig = Object.assign({}, kernelConfig, {backendName: newBackendName});
    registerKernel(newKernelConfig);
  });
}

function makeKey(kernelName: string, backendName: string) {
  return `${backendName}_${kernelName}`;
}
```

---

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import {env} from './environment';
import {BackendValues, DataType, TensorLike, TypedArray} from
'./types';
import * as base from './util_base';

export * from './util_base';

/**
 * Create typed array for scalar value. Used for storing in `DataStorage`.
 */
export function createScalarValue(value: DataType, dtype: BackendValues)
    {
  if (dtype === 'string') {
    return encodeString(value);
  }

  return toTypedArray([value], dtype);
}

function noConversionNeeded(a: TensorLike, dtype: DataType): boolean {
  return (a instanceof Float32Array && dtype === 'float32') ||
    (a instanceof Int32Array && dtype === 'int32') ||
    (a instanceof Uint8Array && dtype === 'bool');
}

export function toTypedArray(a: TensorLike, dtype: DataType): TypedArray {
  if (dtype === 'string') {
    throw new Error('Cannot convert a string[] to a TypedArray');
  }
  if (Array.isArray(a)) {
    a = base.flatten(a);
  }

  if (env().getBool('DEBUG')) {
    base.checkConversionForErrors(a as number[], dtype);
  }
  if (noConversionNeeded(a, dtype)) {
    return a as TypedArray;
  }
  if (dtype == null || dtype === 'float32' || dtype === 'complex64') {
    return new Float32Array(a as number[]);
  } else if (dtype === 'int32') {
    return new Int32Array(a as number[]);
  } else if (dtype === 'bool') {
    const bool = new Uint8Array((a as number[]).length);
    for (let i = 0; i < bool.length; ++i) {
      if (Math.round((a as number[])[i]) !== 0) {
        bool[i] = 1;
      }
    }
    return bool;
  } else {
    throw new Error(`Unknown data type ${dtype}`);
  }
}

/**
 * Returns the current high-resolution time in milliseconds relative to an
 * arbitrary time in the past. It works across different platforms (node.js,
 * browsers).
 */
export function now(): number {
  return env().platform.now();
}

/**
 * Encodes the provided string into bytes using the provided
 * encoding scheme.
 *
 * @param s The string to encode.
 * @param encoding The encoding scheme. Defaults to utf-8.
 *
 * @doc {heading: 'Util'}
 */
export function encodeString(s: string, encoding = 'utf-8'): Uint8Array {
  encoding = encoding || 'utf-8';
  return env().platform.encode(s, encoding);
}

/**
 * Decodes the provided
 * bytes into a string using the provided encoding scheme.
 * @param bytes The bytes to decode.
 *
 * @param encoding The encoding scheme. Defaults to utf-8.
 *
 * @doc {heading: 'Util'}
 */
export function decodeString(bytes: Uint8Array, encoding = 'utf-8'): string {
  encoding = encoding || 'utf-8';
  return env().platform.decode(bytes, encoding);
}

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governing permissions and
* limitations under the License.
*
const holdResultWrapperFn = () => {
  outputs = f();
};

const start = util.now();
if (this.backendTimer.timerAvailable()) {
  timer = this.backendTimer.time(holdResultWrapperFn);
} else {
  holdResultWrapperFn();
}

outputs.map(output => output.dataSync());

if (env().getBool('CHECK_COMPUTATION_FOR_ERRORS')) {
  for (let i = 0; i < outputs.length; i++) {
    const output = outputs[i];
    if (asyncronicity) {
      output.data().then(tensorVals => {
        checkComputationForErrors(tensorVals, output.dtype, kernelName);
      });
    } else {
      timer = Promise.resolve({kernelMs: util.now() - start});
    }
  }
}

export function checkComputationForErrors<D extends DataType>(vals: DataTypeMap[D], dtype: D, kernelName: string): boolean {
  if (dtype !== 'float32') {
    return false;
  }
  for (let i = 0; i < vals.length; i++) {
    const num = vals[i] as number;
    if (isNaN(num) || !isFinite(num)) {
      console.warn(`Found ${num} in
the result of '${kernelName}'`);
      return true;
    }
  }
  return false;
}

export class Logger {
  logKernelProfile(name: string, result: Tensor, values: any, timeMs: number|{error: string}, inputs: NamedTensorMap, extraInfo?: string) {
    const time = typeof timeMs === 'number' ? util.rightPad(`${timeMs}ms`, 9) :
                                              timeMs['error'];
    const paddedName = util.rightPad(name, 25);
    const rank = result.rank;
    const size = result.size;
    const shape = util.rightPad(result.shape.toString(), 14);
    const inputShapesDescription = '';
    for (const name in inputs) {
      const input = inputs[name];
      if (input != null) {
        const inputShape = input.shape || result.shape;
        const inputRank = inputShape.length;
        inputShapesDescription +=

        `${name}: ${inputRank}D ${inputRank > 0 ? inputShape : ''} `;
      }
    }

    console.log(

    `%c${paddedName}\t%c${time}\t%c${rank}D ${shape}\t%c${size}\t%c${inputShapesDescription}\t%c${extraInfo}`,
        'font-weight:bold', 'color:red', 'color:blue', 'color: orange',
        'color: green', 'color: steelblue');
  }
}

export class TapeNode {
  id: number;
  kernelName: string;
  outputs: Tensor;
  inputs: NamedTensorMap;
  gradient?: (dys: Tensor[]) => NamedGradientMap;
  saved?: Tensor[];
}

export type NamedGradientMap = {
  [inputName: string]: () => Tensor;
};

export function getFilteredNodesXToY(tape: TapeNode[], xs: Tensor[], y: Tensor): TapeNode[] {
  // Forward pass to compute all the nodes and Tensors that are
  // transitively a function of x.
  const tensorsFromX: {[tensorId: number]: boolean} = {};
  const nodesFromX: {[nodeId: number]: boolean} = {};
  for (let i = 0; i < xs.length; i++) {
    tensorsFromX[xs[i].id] = true;
  }

  for (let i = 0; i < tape.length; i++) {
    const node = tape[i];
    if (tensorsFromX[node.id]) {
      nodesFromX[node.id] = true;
      for (let j = 0; j < node.outputs.length; j++) {
        const output = node.outputs[j];
        if (tensorsFromX[output.id]) {
          tensorsFromX[output.id] = true;
          tensorsFromX[node.id] = true;
        }
      }
    }
  }

  return Object.keys(tensorsFromX).map(id => {
    const node = tape.find(n => n.id == id);
    if (node) {
      return node;
    }
  }).filter(n => n);
}

export function fromNamedTensorMap(map: NamedTensorMap): NamedTensorMap {
  const tensorMap = {};
  for (const name in map) {
    const tensor = map[name];
    if (tensor instanceof Tensor) {
      tensorMap[tensor] = name;
    }
  }

  return tensorMap;
}

export function getTapeNodesFromXAndY(x: Tensor, y: Tensor): TapeNode[] {
  const tape = getFilteredNodesXToY([x], [x], y);
  const tapeNodes = tape.map(node => {
    return {id: node.id, kernelName: node.kernelName, outputs: node.outputs, inputs:
      Object.keys(node.inputs).map(id => ({id, name: node.inputs[id]}))};
  });

  return tapeNodes;
}
for (let i = 0; i < tape.length; i++) {
    const node = tape[i];
    const nodeInputs = node.inputs;
    for (const inputName in nodeInputs) {
        const input = nodeInputs[inputName];

        let anyInputFromX = false;
        for (let j = 0; j < xs.length; j++) {
            if (tensorsFromX[input.id]) {
                node.outputs.forEach(output =>
                    tensorsFromX[output.id] = true);
                anyInputFromX = true;
                nodesFromX[node.id] = true;
                break;
            }
        }

        if (anyInputFromX) {
            break;
        }
    }
}

// Backward pass to find all of the nodes and Tensors that lead to y.
const tensorsLeadToY: {
    [tensorId: number]: boolean
} = {};
const tensorsLeadToY[y.id] = true;
for (const node = tape[i]; i < tape.length; i++) {
    if (tensorsFromX[node.id]) {
        node.outputs.forEach(output =>
            tensorsFromX[output.id] = true);
    }
}

// If any of the outputs lead to y, mark all of the inputs as leading to y.
for (let j = 0; j < node.outputs.length; j++) {
    if (tensorsFromX[node.outputs[j].id]) {
        node.inputs.forEach(input =>
            tensorsLeadToY[input.id] = true);
    }
}

// Return the paths that come from x and lead to y.
const filteredTape: TapeNode[] = [];
for (let i = 0; i < tape.length; i++) {
    const node = tape[i];

    if (nodesFromX[node.id] && nodesToY[node.id]) {
        const prunedInputs: {
            [inputName: string]: Tensor
        } = {};
        for (const inputName in node.inputs) {
            const nodeInput = node.inputs[inputName];
            if (tensorsFromX[nodeInput.id]) {
                prunedInputs[inputName] = nodeInput;
            }
        }

        const prunedNode = Object.assign({}, node);
        prunedNode.inputs = prunedInputs;
        prunedNode.outputs = node.outputs;
        filteredTape.push(prunedNode);
    }
}

// Backprop dy through this node and accumulate gradients over the inputs.
const inputGradients = node.gradient(dy);
for (const input in inputGradients) {
    if (!input) {
        throw new Error(`Cannot backprop through input $input.`);
    }
}

// Call the gradient function.
const dx = node.gradient(dy);

if (dx.dtype !== 'float32') {
    throw new Error(`Error in gradient for ${node.key}.
The gradient of input has dtype '${dx.dtype}', which does not match 'float32'`);
}

const x = node.inputs[inputName];
if (!util.arraysEqual(dx.shape, x.shape)) {
    throw new Error(`Error in gradient for op $input.
The shape of the input is '${x.shape}', which does not match the shape of the input '${inputName}.'`);
}

if (tensorFromX[tensorId].id === null) {
    throw new Error(`Cannot compute gradient: gradient function not found for input $input.`);
}

if (util.arraysEqual(dx.shape, x.shape)) {
    throw new Error(`Error in gradient for op $input.
The shape of the input is '${x.shape}', which does not match the shape of the input '${inputName}.'`);
}

if (tensorAccumulatedGradientMap[x.id] === null) {
    throw new Error(`Cannot backprop through input $input.`);
}

import {DataType, TypedArray} from './types';
import {computeStrides, isString, rightPad, sizeFromShape} from './util';

// Maximum number of values before we decide to show ellipsis.
const FORMAT_LIMIT_NUM_VALS = 20;
// Number of first and last values to show when displaying a, b,...,y,
// z.
const FORMAT_NUM_SIG_DIGITS = 7;

// Export function toString
export function tensorToString(vals: TypedArray|string[], shape: number[], dtype: DataType, verbose: boolean) {
  const strides = computeStrides(shape);
  const padPerCol = computeMaxSizePerColumn(vals, shape, dtype, strides);
  const const rank = shape.length;
  const const valsLines = subTensorToString(vals, shape, dtype, strides, padPerCol);
  const lines = ['Tensor'];
  if (verbose) {
    lines.push(`  dtype: ${dtype}`);
    lines.push(`  rank: ${rank}`);
    lines.push(`  shape: [${shape}]`);
    lines.push(`  values:`);
  }
  lines.push(valsLines.map(l => '    ' + l).join('\n'));
  return lines.join('\n');
}

function computeMaxSizePerColumn(vals: TypedArray|string[], shape: number[], dtype: DataType, strides: number[]): number[] {
  const size = sizeFromShape(shape);
  const numCols = strides[shape.length - 1];
  const padPerCol = new Array(numCols).fill(0);
  const valuesOrTuples = vals
    .reduce((acc, val, i) => acc.concat(val === 'null' ? null : val), []);
  const rank = shape.length;
  const displayVals = valuesOrTuples
    .reduce((acc, val, i) => acc.concat(val), []);

  if (rank > 1) {
    for (let row = 0; row < size / numCols; row++) {
      for (let j = 0; j < numCols; j++) {
        padPerCol[j] = Math.max(padPerCol[j], valToString(valuesOrTuples[row * numCols + j], 0, dtype).length);
      }
    }
  }
  return padPerCol;
}

function valToString(val: number|string|[number, number], pad: number, dtype: DataType) {
  let valStr: string;
  if (Array.isArray(val)) {
    valStr = `${parseFloat(val[0].toFixed(FORMAT_NUM_SIG_DIGITS))} + ` +
              `${parseFloat(val[1].toFixed(FORMAT_NUM_SIG_DIGITS))}j`;
  } else if (isString(val)) {
    valStr = `'${val}'`;
  } else if (dtype === 'bool') {
    valStr = boolNumToString(val);
  } else {
    valStr = parseFloat(val.toFixed(FORMAT_NUM_SIG_DIGITS)).toString();
  }

  return rightPad(valStr, pad);
}

function boolNumToString(v: number): string {
  return v === 0 ? 'false' : 'true';
}

function subTensorToString(vals: TypedArray|string[], shape: number[], dtype: DataType, strides: number[], padPerCol: number[], isLast = true): string[] {
  const storagePerElement = dtype === 'complex64' ? 2 : 1;
  const size = shape[0];
  const substrides = strides.slice(1);
  const stride = strides[0] * storagePerElement;
  const lines = [];

  if (size > FORMAT_LIMIT_NUM_VALS) {
    for (let i = 0; i < FORMAT_NUM_FIRST_LAST_VALS; i++) {
      const start = i * stride;
      const end = start + stride;
      lines.push(...subTensorToString(vals.slice(start, end), substrides, dtype, strides, padPerCol, i === (size - 1 /* isLast */) ? true : false));
    }
    lines.push('...');
    for (let i = size - FORMAT_NUM_FIRST_LAST_VALS; i < size; i++) {
      const start = i * stride;
      const end = start + stride;
      lines.push(...subTensorToString(vals.slice(start, end), substrides, dtype, strides, padPerCol, i === (size - 1 /* isLast */) ? true : false));
    }
  } else {
    // The array is rank 2 or more.
    const subshape = shape.slice(1);
    const substrides = strides.slice(1);
    const stride = strides[0] * storagePerElement;
    const lines = [];
    for (let i = 0; i < size; i++) {
      const start = i * stride;
      const end = start + stride;
      lines.push(...subTensorToString(vals.slice(start, end), substrides, dtype, strides, padPerCol, i === (size - 1 /* isLast */) ? true : false));
    }
  }
  return lines.join('
');
}
for (let i = 0; i < size; i++) {
    const start = i * stride;
    const end = start + stride;
    lines.push(_.subTensorToString(vals.slice(start, end), subshape, dtype, substrides, padPerCol, i === size - 1 /* isLast */));
  }
}
}
}

for (let i = 0; i < locs.length - 1; i++) {
    locs[i] = Math.floor(index / this.strides[i]) * locs[i];
    locToIndex(locs: number[]): number {
      if (this.rank === 0) {
        return 0;
      } else if (this.rank === 1) {
        return locs[0];
      } else {
        return locs[locs.length - 1];
      }
    }
    let index = locs[locs.length - 1];
    for (let i = 0; i < locs.length - 1; ++i) {
      index += this.strides[i] * locs[i];
    }
    return index;
  }

  indexToLoc(index: number): number[] {
    if (this.rank === 0) {
      return [index];
    } else if (this.rank === 1) {
      return [index];
    } else {
      return complexTuples;`
    }
  }

  get(...locs: number[]): SingleValueMap[D] {
    if (locs.length === 0) {
      locs = [0];
    }
    util.assert(
      locs.length === this.rank,
      () => `The number of provided coordinates (${locs.length}) must match the rank (${this.rank})`);
    }
    const locs: number[] = newArray(locs.length);
    locs[0] = index;
    for (let i = 1; i < locs.length; ++i) {
      locs[i] = index;
    }
    return locs[0];
  }

  set(value: SingleValueMap[D], ...locs: number[]): void {
    if (locs.length === 0) {
      locs = [0];
    }
    util.assert(
      locs.length === this.rank,
      () => `The number of provided coordinates (${locs.length}) must match the rank (${this.rank})`);
    }
    this.values = values || new Array(this.shape.length);
this.strides[i]);
  }
  return this.strides.length;
}

/**
 * Creates an immutable `tf.Tensor` object from the buffer.
 */
@doc {heading: 'Tensors', subheading: 'Creation'}

Tensor<R> makeTensor(
    values: ValueMap[R],
    shape: ShapeMap[R],
    dtype: DataType,
    backend?: Backend
) {
    Tensor:<R> ...
    return ...
}

TensorTracker makeTensor(
    values: DataValues,
    shape: number[]
) {
    TensorTracker ...
    return ...
}

get rank() {
    return this.shape.length;
}

/**
 * Creates an immutable `tf.Tensor` object from the buffer.
 */

return trackerFn().makeTensor(values, shape, dtype) as Tensor<R>;

TensorTracker makeTensor(
    values: DataValues,
    shape: number[],
    dtype: DataType,
    backend?: Backend
) {
    Tensor:<R> ...
    return ...
}

get rank() {
    return this.shape.length;
}

/**
 * Creates an immutable `tf.Tensor` object from the buffer.
 */

return trackerFn().makeTensor(values, shape, dtype) as Tensor<R>;

TensorTracker makeTensor(
    values: DataValues,
    shape: number[],
    dtype: DataType,
    backend?: Backend
) {
    Tensor:<R> ...
    return ...
}
this.dtype as D, this.dataSync());
} /**
 * Returns the tensor data as a nested array. The transfer of data is done
 * asynchronously.
 */

dataSync<D extends DataType = NumericDataType>({ this.throwIfDisposed():
  return toNestedArray(this.shape, this.dataSync()) as ArrayMap[R]
} /**
 * Asynchronously downloads the values from the tf.Tensor. Returns an
 * promise of 'TypedArray' that resolves when the computation has
 * finished.
 */

dataSync<D extends DataType = NumericDataType>():
  this.throwIfDisposed():
  return trackerFn().readSync(this.dataId);
}) catch (error) {
  if (error.name === 'TypeError') {
    throw new Error('Failed to decode the string bytes into utf-8.');
  } else {
    throw new Error('Failed to decode the tensor bytes into utf-8.');
  }
}

// Global side effect. Cache global reference to Tensor
getGlobalTensorClass();

export interface NumericTensor<R extends Rank = Rank>
  extends Tensor<R> {
  dtype: NumericDataType;
  dataSync<D extends DataType = NumericDataType>({ this.throwIfDisposed():
    return dataSync<D>();
} **/

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// distributed under the License is distributed on an "AS IS" BASIS,
// WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
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// limitations under the License.
data<D extends DataType = NumericDataType>(): Promise<DataTypeMap[D]>;

/**
 * @docalias 'float32'|'int32'|'bool'|'complex64'|'string'
 */
export type DataType = keyof DataTypeMap;

export type NumericDataType = 'float32'|'int32'|'bool'|'complex64';

export type BackendValues = Float32Array|Int32Array|Uint8Array;
as TensorContainerArray; for (const k in iterable) {
  const val = iterable[k];
  if (!seen.has(val)) {
    seen.add(val);
    walkTensorContainer(val, list, seen);
  }
}

// tslint:disable-next-line:no-any
function isIterable(obj: any): boolean {
  return Array.isArray(obj) || typeof obj === 'object';
}

/**
 * @license
 */

import {BackendTimingInfo, DataMover, KernelBackend} from './backends/backend';
import {Environment, setEnvironmentGlobal} from './environment';
import {getGlobalNamespace} from './global_util';
import {Add, Cast, Identity} from './kernel_names';
import {getGradient, getKernel, getKernelsForBackend, GradFunc, NamedAttrMap, TensorInfo} from './kernel_registry';
import {KernelProfile, Profiler} from './profiler';
import {backpropagateGradients, getFilteredNodesXToY, TapeNode} from './tape';
import {DataId, setTensorTracker, Tensor, TensorTracker, Variable} from './tensor';
import {GradSaveFunc, NamedTensorMap, NamedVariableMap, TensorContainer} from './tensor_types';
import {getTensorsInContainer} from './tensor_util';
import {BackendValues, DataType, DataValues} from './types';
import * as util from './util';
import {bytesFromStringArray, makeOnesTypedArray, now, sizeFromShape} from './util';

/**
 * A function that computes an output. The save function is for saving tensors computed in the forward pass, that we need in the backward pass.
 */
export type ForwardFunc<T> = (backend: KernelBackend, save?: GradSaveFunc) => T;

/**
 * @docalias (a: Tensor, b: Tensor,..., save?: Function) => {
 *   value: Tensor,
 *   gradFunc: (dy: Tensor, saved?: NamedTensorMap) => Tensor | Tensor[][]
 * }
 */
export type CustomGradientFunc<T extends Tensor> =
    (...inputs: Array<Tensor|GradSaveFunc>) => {
      value: T;
      gradFunc: (dy: T, saved: Tensor[]) => Tensor[];
    };

export type MemoryInfo = {
  numTensors: number; numDataBuffers: number;
  unreliable?: boolean; reasons: string[];
};

type KernelInfo = {
  name: string; bytesAdded: number; totalBytesSnapshot: number;
  tensorsAdded: number; totalTensorsSnapshot: number;
  inputShapes: number[][]; outputShapes: number[][];
  kernelTimeMs: number | {error: string} | Promise<number|{error: string}>;
  extraInfo: string | Promise<string>;
};

export type ProfileInfo = {
  newBytes: number; newTensors: number; peakBytes: number;
  kernels: KernelInfo[];
  result: TensorContainer;
  kernelNames: string[];
};

export interface TimingInfo extends BackendTimingInfo {
  wallMs: number;
}

/** @docalias Function */
export type ScopeFn<T extends TensorContainer> = () => T;

interface ScopeState {
  track: Tensor[];
  name: string;
  id: number;
}

interface RegisteredKernelInvocation<I extends NamedTensorMap> {
  kernelName: string;
  inputs: I;
  attrs?: NamedAttrMap;
}

interface CustomGradKernelInvocation<T extends Tensor|Tensor[]|I extends NamedTensorMap> {
  forwardFunc: ForwardFunc<T>;
  backwardsFunc: (dy: T, saved: Tensor[]) => {
    [P in keyof I]: () => I[P]
  };
  inputs: I;
  attrs?: NamedAttrMap;
};//function

function isRegisteredKernelInvocation<T extends Tensor|Tensor[]|I extends NamedTensorMap>(
    kernelInvocation: RegisteredKernelInvocation<I>|CustomGradKernelInvocation<T, I>):
    kernelInvocation is RegisteredKernelInvocation<T> {
  return kernelInvocation.kernelName != null;
}

// Public since optimizers will use it.
registeredVariables: NamedVariableMap = {};
nextTapeNodeId = 0;
numBytes = 0;
umTensors = 0;
numStringTensors = 0;
umDataBuffers = 0;
activeTape: TapeNode[] = [];

// Number of nested tf.grad() statements when computing higher-order // gradients. E.g. `1` for first-order gradients and `2` for second-order // gradients. Used to track if the tape should be removed after a backprop. // gradientDepth = 0; // Number of nested kernel calls. When kernel depth is greater than 1, we turn off the tape. // kernelDepth = 0; // Keep Tensors that parallel the tapes. // activeScope: ScopeState;
scopeStack: ScopeState[] = [];

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kernels, recursively.

```javascript
/*
 * WeakMap<DataId, { backend: KernelBackend, bytes: number, dtype: DataType, shape: number[],... */
  numDataMovesStack: number[] = [];
  nextScopeId = 0;

  tensorInfo = new WeakMap<DataId, {
    backend: KernelBackend,
    bytes: number,
    dtype: DataType,
    shape: number[]
  }>();

  profiling = false;
  activeProfile: ProfileInfo = { newBytes: 0, newTensors: 0, peakBytes: 0, kernels: [] }, result: null
  get kernelNames(): string[] { return this.kernels.map(k => k.name); }
}

export class Engine implements TensorTracker, DataMover {
  state: EngineState;
  backendName: string;
  registry: {[id: string]: KernelBackend} = {};
  registryFactory: {[id: string]: {
    factory: () => KernelBackend | Promise<KernelBackend>,
    priority: number
  }} = {};

  private profiler: Profiler;
  private backendInstance: KernelBackend;
  private pendingBackendInit: Promise<boolean>;

  constructor(public ENV: Environment) {
    this.state = new EngineState();
  }

  async ready(): Promise<void> {
    for (let i = 0; i < sortedBackends.length; i++) {
      const backendName = sortedBackends[i];
      const success = await this.initializeBackend(backendName).success;
      if (success) {
        await this.setBackend(backendName);
        return;
      }
    }
    throw new Error(`Could not initialize any backends, all backend initializations failed.`);
  }

  get backend(): KernelBackend {
    if (this.pendingBackendInit != null) {
      throw new Error(`Backend '${this.backendName}' has not yet been initialized. Make sure to ` +
        `await tf.ready() or await tf.setBackend() before calling other methods`);
    }
    if (this.backendInstance == null) {
      const {name, asyncInit} = this.initializeBackendsAndReturnBest();
      if (asyncInit) {
        throw new Error(`The highest priority backend '${name}' has not yet been initialized. Make ` +
          `sure to await tf.ready() or await tf.setBackend() before calling other methods`);
      }
      this.setBackend(name);
    }
    return this.backendInstance;
  }

  registerBackend(backendName: string, factory: () => KernelBackend | Promise<KernelBackend>,
      priority = 1): boolean {
    if (backendName in this.registryFactory) {
      console.warn(`Backend name '${backendName}' already registered. Reusing existing backend factory.`);
      return false;
    }
    this.registryFactory[backendName] = {factory, priority};
    return true;
  }

  async setBackend(backendName: string): Promise<boolean> {
    if (this.registryFactory[backendName] == null) {
      throw new Error(`Backend name '${backendName}' not found in registry`);
    }
    this.backendName = backendName;
    if (this.backendInstance == null) {
      const result = await this.initializeBackend(backendName);
      if (result) {
        this.backendInstance = result;
        await this.setupRegisteredKernels();
        this.profiler = new Profiler(this.backendInstance);
      }
    }
    return true;
  }

  disposeRegisteredKernels(backendName: string): void {
    this.backendInstance = null;
    this.disposeRegisteredKernels(backendName);
  }

  disposeRegisteredKernels(backendName: string): void {
    this.backendInstance = null;
    const backendName = this.backendName;
    if (this.registry[backendName] == null) {
      throw new Error(`Backend name '${backendName}' not found in registry`);
    }
    this.backendInstance = this.registry[backendName];
    this.setupRegisteredKernels();
  }
```

registry.

private initializeBackend(backendName: string): {success: boolean, Promise<boolean>, asyncInit: boolean} {
  const registryFactoryEntry = this.registryFactory[backendName];
  if (registryFactoryEntry == null) {
    throw new Error(`Cannot initialize backend ${backendName}, no registration found.`);
  }

  try {
    const backend = registryFactoryEntry.factory();
    /* Test if the factory returns a promise. Done in a more liberal way than previous implementations (e.g. Angular) * /
    if (typeof backend.then === 'function') {
      const promiseId = ++this.pendingBackendInitId;
      const success = true;
      this.pendingBackendInit = null;
      const backendInstance = backend.then(backendInstance => {
        // Outdated promise. Another backend was set in the meantime.
        if (promiseId < this.pendingBackendInitId) {
          return false;
        }
        this.registry[backendName] = backendInstance;
      }).catch(err => {
        // Outdated promise. Another backend was set in the meantime.
        if (promiseId < this.pendingBackendInitId) {
          return false;
        }
        this.pendingBackendInit = null;
        console.warn(`Initialization of backend ${backendName} failed`);
        console.warn(err.stack || err.message);
        return false;
      });
      this.pendingBackendInit = success;
      return {success, asyncInit: true};
    } else {
      this.registry[backendName] = backend as KernelBackend;
      return {success: true, asyncInit: false};
    }
  }

  catch (err) {
    console.warn(`Initialization of backend ${backendName} failed`);
    console.warn(err.stack || err.message);
    return {success: false, asyncInit: false};
  }
}

removeBackend(backendName: string): void {
  if (!(backendName in this.registryFactory)) {
    throw new Error(`${backendName} backend not found in registry`);
  }
  if (this.backendName === backendName && this.pendingBackendInit != null) {
    // There is a pending promise of the backend we want to remove. Make it obsolete.
    this.disposeRegisteredKernels(backendName);
    delete this.registry[backendName];
    delete this.registry[backendName].dispose();
    delete this.registry[backendName].dispose();
    delete this.registryFactory[backendName];
  } // Unset the backend if it is active.
  if (this.backendName === backendName) {
    this.pendingBackendInit = null;
    this.backendName = null;
    this.backendInstance = null;
  }

  if (backendName in this.registry) {
    this.disposeRegisteredKernels(backendName);
    this.registry[backendName].dispose();
    delete this.registry[backendName];
  }

  // Unset the backend if it is active.
  if (this.backendName === backendName) {
    this.pendingBackendInit = null;
    this.backendName = null;
    this.backendInstance = null;
  }

  getSortedBackends(): string[] {
    if (Object.keys(this.registryFactory).length === 0) {
      throw new Error('No backend found in registry.');
    }
    return Object.keys(this.registryFactory).sort((a: string, b: string) => {
      //Highest priority comes first.
      return this.registryFactory[b].priority - this.registryFactory[a].priority;
    });
  }

  initializeBackendsAndReturnBest(): {name: string, asyncInit: boolean} {
    const sortedBackends = this.getSortedBackends();
    for (let i = 0; i < sortedBackends.length; i++) {
      const backendName = sortedBackends[i];
      const success = this.initializeBackend(backendName);
      if (asyncInit || success) {
        return {name: backendName, asyncInit: true};
      }
    }
    throw new Error('Could not initialize any backends, all backend initializations failed.

    moveData(backend: KernelBackend, dataId: DataId) {
      const info = this.state.tensorInfo.get(dataId);
      const srcBackend = info.backend;
      const values = this.readSync(dataId);
      const refCount = srcBackend.refCount(dataId);
      // Delete the tensor from the old backend and move it to the new backend.
      srcBackend.disposeData(dataId, true);
      info.backend = backend;
      moveBackend.move(dataId, values, info.shape, info.dtype, refCount);
      if (this.shouldCheckForMemLeaks()) {
        // Track the number of moves during a kernel execution to correctly detect memory leaks.
        this.state.numDataMovesStack[this.state.numDataMovesStack.length - 1]++;
      }
      return;
    }

    tidy<T extends TensorContainer>(nameOrFn: string|ScopeFn<T>, fn?: ScopeFn<T>): T {
      let name: string = null;
      if (fn == null) {
        // Called with only 1 argument.
        if (typeof nameOrFn !== 'function') {
          throw new Error('Please provide a function to tidy()';
        }
        fn = nameOrFn;
      } else {
        // Called with 2 arguments.
        if (typeof nameOrFn !== 'string' && !(nameOrFn instanceof String)) {
          throw new Error('When calling with two arguments, the 2nd argument must be a string');
        }
        fn = function (nameOrFn) {
          // Called with 2 arguments.
          if (typeof nameOrFn !== 'function') {
            throw new Error('When calling with two arguments, the 2nd argument must be a function');
          } name = nameOrFn as string;
          // TODO(nsthorat,smilkov):
Do operation logging and performance assertion

let result: T; return this.scopedRun(() => {
  const res = f();
  end();
  return res;
})

private scopedRun<T>(start: () => void, end: () => void, f: () => T): T {
  start();
  try {
    const res = f();
    end();
    return res;
  } catch (ex) {
    end();
    throw ex;
  }
}

private nextTensorId = 0;
private nextTensorId(): number {
  return Engine.nextTensorId++;
}

private static nextVariableId = 0;
private nextVariableId(): number {
  return Engine.nextVariableId++;
}

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  return Engine.nextTensorId++;
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Open Source Used in Cisco Meeting Server (formerly Acano Server) 3.4

```javascript
const [kernelName, inputs, attrs] = kernelParams;

const kernel = getKernel(kernelName, this.backendName);

if (util.assert(kernel != null, () => `Cannot find registered kernel '${kernelName}' for backend '${this.backendName}'`)) {
  kernelFunc = () => {
    const numDataIdsBefore = this.backend.numDataIds();
    const saved = tensors.map(tensor => this.keep(this.clone(tensor)));
    return saved;
  }

  /**
   * Returns a list of tensors to save.
   */
  private saveTensorsForBackwardMode(tensors: Tensor[]): Tensor[] {
    const saved = tensors.map(tensor => this.keep(this.clone(tensor)));
    return saved;
  }

  /**
   * Removes this option (Tensor) when node backend doesn’t have a
   * method that has been modularized and they all return 0.
   */
  // TensorInfos do not have a rank attribute.
  return outInfo as Tensor;
}

// Return this.makeTensorFromDataId(dataId, shape, dtype);...

// Do not save unless we are recording to the tape. Otherwise it would cause a mem leak since there would be no backprop for these tensors // (which would otherwise dispose them).
if (isTapeOn) { const tensorsToSave = this.getTensorsForGradient(kernelName, inputs, outTensors);
  const saved = this.saveTensorsForBackwardMode(tensorsToSave);
  return outTensors;
}

else { const {forwardFunc} = kernelParams;
  // Running a customGrad op.
  const saved = tensors.map(tensor => this.keep(this.clone(tensor)));
  return saved;
}

/**
   * Returns a list of tensors to save for a given gradient calculation.
   */
  @param inputs a map of input tensors.
  @param outputs an array of output tensors from forward mode of
  @param tensorsToSave map of output tensors.
  @param extraInfo
  @returns
  ```
private getTensorsForGradient(kernelName: string, inputs: NamedTensorMap, outputs: Tensor[]): Tensor[] {
  const gradConfig = getGradient(kernelName);
  if (gradConfig !== null) {
    const inputsToSave = gradConfig.inputsToSave || [];
    const outputsToSave = gradConfig.outputsToSave || [];
    // If saveAllInputs is true, all inputs will be saved. Otherwise, inputs // specified in inputsToSave will be saved.
    let inputTensorsToSave: Tensor[] = [];
    if (gradConfig.saveAllInputs) {
      let inputNames = Object.keys(inputs);
      inputTensorsToSave = inputNames.map((key) => inputs[key]);
    }
    // We return an empty list rather than throw an error because the kernel we're // looking up may not actually be relevant to backproping through the overall function //
    // See 'does not error if irrelevant (pruned) ops are missing grads' test // in gradients_test.ts for an example.
    return inputTensorsToSave;
  }
  return [];
}

private getTensorsForBackwards(kernelName: string, inputs: NamedTensorMap, outputs: Tensor[]): Tensor[] {
  const gradConfig = getGradient(kernelName);
  if (gradConfig !== null) {
    const inputsToSave: string[] = gradConfig.inputsToSave || [];
    const outputsToSave: boolean[] = gradConfig.outputsToSave || [];
    const inputTensorsToSave: Tensor[] = inputsToSave.map((inputName) => inputs[inputName]);
    const outputTensorsToSave: Tensor[] = outputs.filter((_, i) => outputsToSave[i]);
    return inputTensorsToSave.concat(outputTensorsToSave);
  }
  return [];
}

private makeTensor(values: DataValues, shape: number[], dtype: DataType, backend?: KernelBackend): Tensor {
  if (values === null) {
    throw new Error('Values passed to engine.makeTensor() are null');
  }
  dtype = dtype || 'float32';
  backend = backend || this.backend;
  let backendVals = values as BackendValues;
  if (dtype === 'string' && util.isString(values[0])) {
    backendVals = (values as string[]).map(d => util.encodeString(d));
  }
  const dataId = backend.write(backendVals, shape, dtype);
  const t = new Tensor(shape, dtype, dataId);
  backend.trackTensor(t);
  return t;
}

private makeTensorFromDataId(dataId: DataId, shape: number[], dtype: DataType, backend?: KernelBackend): Tensor {
  dtype = dtype || 'float32';
  const t = new Tensor(shape, dtype, dataId);
  backend.trackTensor(t);
  return t;
}

private makeVariable(initialValue: Tensor, trainable = true, name?: string, dtype?: DataType): Variable {
  name = name || this.nextVariableId().toString();
  if (dtype !== initialValue.dtype) {
    initialValue = initialValue.cast(dtype);
  }
  const v = new Variable(initialValue, trainable, name, this.nextTensorId());
  if (this.state.registeredVariables[v.name] !== null) {
    throw new Error(`Variable with name ${v.name} was already registered`);
  }
  this.state.registeredVariables[v.name] = v;
  this.incRef(v, this.backend);
  return v;
}

private trackTensor(a: Tensor, backend: KernelBackend): void {
  this.state.numTensors++;
  if (a.dtype === 'string') {
    this.state.numStringTensors++;
  }
  this.state.numBytes += a.size * util.bytesPerElement(a.dtype);
  this.state.numDataBuffers++;
  this.state.tensorInfo.set(a.dataId, { name: a.name, dtype: a.dtype, shape: a.shape, bytes: a.size });
  if (!a instanceof Variable) {
    this.state.trackTensor(a, this.backend);
  }
  // Track the tensor by dataId and increase the refCount for the dataId in the backend.
  // TODO(pyu10055): This is currently used by makeVariable method, to increase refCount on the backend for the dataId. It can potentially be replaced with Identity op instead of calling backend directly.
  this.state.tensorInfo.set(a.dataId, { name: a.name, dtype: a.dtype, shape: a.shape, bytes: a.size });
  this.state.numBytes += a.size;
  if (this.state.tensorInfo.has(a.dataId)) {
    this.state.numDataBuffers++;
    this.state.tensorInfo.set(a.dataId, { name: a.name, dtype: a.dtype, shape: a.shape, bytes: a.size });
    this.state.trackTensor(a, this.backend);
  }
  // Track the tensor by dataId and increase the refCount for the dataId in the backend.
  // TODO(pyu10055): This is currently used by makeVariable method, to increase refCount on the backend for the dataId. It can potentially be replaced with Identity op instead of calling backend directly.
  this.state.tensorInfo.set(a.dataId, { name: a.name, dtype: a.dtype, shape: a.shape, bytes: a.size });
  this.state.trackTensor(a, this.backend);
}

private disposeTensor(a: Tensor): void {
  if (!this.state.tensorInfo.has(a.dataId)) {
    return;
  }
  const info = this.state.tensorInfo.get(a.dataId);
  this.state.numTensors--;
  if (a.dtype === 'string') {
    this.state.numStringTensors--;
  }
  this.state.numBytes -= a.size * util.bytesPerElement(a.dtype);
  this.state.numDataBuffers--;
  this.state.tensorInfo.delete(a.dataId);
  this.state.numDataBuffers--;
this.state.numStringTensors--;\n  this.state.numBytes -= info.size;\n  this.state.numDataBuffers -= info.size;\n}  \n// Remove the reference to datalId if backend dispose the data successfully\nif (info.backend.disposeData(datalId)) \n{\n  this.removeDataId(datalId, info.backend);\n}\n  // TODO(nisthorat): 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}\n\ndisposeVariables(): void {\n  for (const varName in this.state.registeredVariables) {\n    const var = this.state.registeredVariables[varName];\n    if (var.disposeVariable(v)) \n    {\n      this.state.numTensors--;\n      this.state.numBytes -= info.size;\n    }\n  }\n\n  // Don't count bytes for complex\n  // 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\n  // reference to dataId if backend dispose the data successfully\n  if (info.backend.disposeData(datalId)) \n  {\n    this.removeDataId(datalId, 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}\n\ndisposeVariables(): void {\n  for (const varName in this.state.registeredVariables) {\n    const var = this.state.registeredVariables[varName];\n    if (var.disposeVariable(v)) \n    {\n      this.state.numTensors--;\n      this.state.numBytes -= info.size;\n    }\n  }\n\n  // Don't count bytes for complex\n  // 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\n  // reference to dataId if backend dispose the data successfully\n  if (info.backend.disposeData(datalId)) \n  {\n    this.removeDataId(datalId, 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}
Track the current result in the parent scope:

```javascript
  tensorsToTrackInParent.forEach(tensor => {
    // Only track the tensor if was allocated in the inner scope and is not
    // globally kept.  
    if (tensor.kept && & tensor.scopeId === oldScope.id) {
      this.track(tensor);
    }
  });
```

The gradients returned are of the same length as `xs`, but some might be null if `f` was not a function of that `x`. It also takes optional `dy` to multiply the gradients, which defaults to `'1'`.

```javascript
  // Filter out the nodes that don't connect x => y.
  const filteredTape = getFilteredNodesXToY(this.state.activeTape, xs, y);
  if (!allowNoGradients && filteredTape.length === 0 && xx.length > 0) {
    throw new Error('Cannot compute gradient of y=f(x) with respect to x. Make sure + in the `f` you passed encloses all operations that lead from x ' + in to y.');
  }
```

This means that we are not computing higher-order gradients and can clean up the tape:

```javascript
  this.state.activeTape.forEach(node => {
    for (const tensor of node.saved) {
      tensor.dispose();
    }
  });
```

Add to the correct backend:

```javascript
  return info.backend.readSync(dataId);
```

* Tracks a Tensor in the current scope to be automatically cleaned up when the current scope ends, and returns the value:

```javascript
  * @param result The Tensor to track in the current scope.
```

```javascript
  * private track<T extends Tensor>(f: () => T, x: Tensor[], dy?: T, allowNoGradients = false): {value: T, grads: Tensor[]} {
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```

Add to the correct backend:

```javascript
  return info.backend.readSync(dataId);
```

* Tracks a Tensor in the current scope to be automatically cleaned up when the current scope ends, and returns the value:

```javascript
  * @param result The Tensor to track in the current scope.
```
Tensor>(result: T): T {
    if (this.state.activeScope != null) {
      result.scopeId = this.state.activeScope.id;
      this.state.activeScope.track.push(result);
    }
    return result;
  }

  get registeredVariables(): NamedVariableMap {
    return this.state.registeredVariables;
  }

  /**
   * Resets the engine state. Removes all backends but does not remove
   * registered backend factories.
   * @param reset - void
   * Make any pending promise obsolete.
   */
  reset(): void {
    // Make any pending promise obsolete.
    this.pendingBackendInitId++;
    this.state.dispose();
    this.ENV.reset();
    this.state = new EngineState();
    for (const backendName in this.registry) {
      this.disposeRegisteredKernels(backendName);
      this.registry[backendName].dispose();
      delete this.registry[backendName];
    }
    this.backendName = null;
    this.backendInstanceId = null;
    this.pendingBackendInit = null;
    this.unfunction ones(shape: number[]): Tensor {
      const result = makeOnesTypedArray(sizeFromShape(shape), 'float32');
      return ENGINE.makeTensor(result, shape, 'float32');
    }

    getOrMakeEngine(): Engine {
      const ns = getGlobalNamespace() as {} as {_tfengine: Engine};
      if (ns._tfengine == null) {
        const environment = new Environment(ns);
        ns._tfengine = new Engine(environment);
      }
      setEnvironmentGlobal(ns._tfengine.ENV);
      // Tell the current tensor interface
      // that the global engine is responsible
      // for tracking.
      return ns._tfengine;
    }

    /**
     * A implementation of the add op for use
     * within engine and tape.
     * @param a - Tensor
     * @param b - Tensor
     * @returns Tensor
     */
    add(a: Tensor, b: Tensor): Tensor {
      // We duplicate
      const inputs = {a, b};
      return ENGINE.runKernel(Add,
        inputs as {} as NamedTensorMap);
    }
}

/**
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 * BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
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 * limitations under the License.
 */

// tslint:disable-next-line:no-any
function _isNavigatorDefined(): boolean {
  return typeof navigator !== 'undefined' && navigator != null;
}

export function isMobile(): boolean {
  if (_isNavigatorDefined()) {
    const a = navigator.userAgent || navigator.vendor || (window as any).opera;
    return /
               /(android|bb\d+|meego)|\-\b\!(\-\d|\-\d)+|\-\b\!/i
               .test(a) ||
        /
               /(android|bb\d+|meego)|\-\b\!(\-\d|\-\d)+|\-\b\!/i
               .test(a) ||
        /
               /(android|bb\d+|meego)|\-\b\!(\-\d|\-\d)+|\-\b\!/i
               .test(a) ||
        /
               /(android|bb\d+|meego)|\-\b\!(\-\d|\-\d)+|\-\b\!/i
               .test(a) ||
        }
}

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* limitations under the License.
*
```javascript
import './engine';
import * as device_util from './device_util';
import {env} from './environment';

const ENV = env();

/**
 * This file contains environment-related flag registrations.
 */

/** Whether to enable debug mode. */
ENV.registerFlag('DEBUG', () => false, debugValue => {
  if (debugValue) {
    console.warn('
        Debugging mode is ON. The output of every math call will ' +
        'be downloaded to CPU
        and checked for NaNs. ' +
        'This significantly impacts performance.' +
    ')
  }
});

/** Whether we are in a browser (as versus, say, node.js) environment. */
ENV.registerFlag('IS_BROWSER', () => device_util.isBrowser());

/** Whether we are in a browser (as versus, say, node.js) environment. */
ENV.registerFlag('IS_NODE', () => (typeof process !== 'undefined') && (typeof process.versions !== 'undefined') && (typeof process.versions.node !== 'undefined'));

/** Whether this browser is Chrome. */
ENV.registerFlag('IS_CHROME', () => typeof navigator !== 'undefined' && navigator != null && navigator.userAgent != null && /Chrome/.test(navigator.userAgent) && /Google Inc/.test(navigator.vendor));

/** True when the environment is "production" where we disable safety checks\n * to gain performance. */
ENV.registerFlag('PROD', () => false);

/** Whether to do sanity checks when inferring a shape from user-provided\n * values, used when creating a new tensor. */
ENV.registerFlag('TENSORLIKE_CHECK_SHAPE_CONSISTENCY', () => ENV.getBool('DEBUG'));

/** Whether deprecation warnings are enabled. */
ENV.registerFlag('DEPRECATION_WARNINGS_ENABLED', () => true);

/** Whether to check computation result for errors. */
ENV.registerFlag('CHECK_COMPUTATION_FOR_ERRORS', () => true);

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 */

import {ENGINE} from './engine';
import {env} from './environment';
import {Tensor} from './tensor';
import {DataType, TensorLike} from './types';
import {assert, flatten, inferDtype, isTypedArray, toTypedArray} from './util';

export function inferShape(val: TensorLike, dtype?: DataType): number[] {
  let firstElem: typeof val = val;

  if (isTypedArray(val)) {
    return dtype === 'string' ? [] : [val.length];
  }
  if (!Array.isArray(val)) {
    return [];  // Scalar.
  }
  const shape: number[] = [];

  while (Array.isArray(firstElem) ||
         isTypedArray(firstElem) && dtype !== 'string') {
    shape.push(firstElem.length);
    firstElem = firstElem[0];
  }
  if (Array.isArray(firstElem)) {
    return dype !== 'string') {
      return shape.push(firstElem.length);
      firstElem = firstElem[0];
    } if (Array.isArray(val) &
  env().getBool('TENSORLIKE_CHECK_SHAPE_CONSISTENCY')) {
    deepAssertShapeConsistency(val, shape, []);}
  return shape;
}
```

number[], indices: number[]) \n  assert(indices.length === 0, () => `Element arr[\${indices.join('\[')}] is a primitive,` +` but should be an array/TypedArray of \${shape[0]} elements`) \n  return;
\n  assert(shape.length > 0, () => `Element arr[\${indices.join('\[')}] should be a primitive,` +` but is an array of \${val.length} elements`) \n  return;
\n  val.length === shape[0], () => `Element arr[\${indices.join('\[')}] should have` +` \${shape[0]} elements, but has \${val.length} elements`) \n\n  const subShape = shape.slice(1); \n  for (let i = 0; i < val.length; ++i) { \n    deepAssertShapeConsistency(val[i], subShape, indices.concat(i));
  }
\n\nfunction assertDtype(
    expectedDtype: DataType|'numeric'|'string_or_numeric',
    actualDType: DataType, argName: string, functionName: string) {
  if (expectedDtype === 'string_or_numeric') {
    return;
  }
  if (expectedDtype
      Returns
      \n      - 'exp' for exponential (\$x^2\$
      \n      - 'log' for logarithmic (\$\log(x)\$
      \n      - 'sqrt' for square root (\$\sqrt{x}\$
      \n      - 'cbrt' for cube root (\$\sqrt[3]{x}\$
      \n      - 'ceil' for ceiling (\$\lceil x \rceil\$
      \n      - 'floor' for floor (\$\lfloor x \rfloor\$
      \n      - 'round' for round (\$\text{round}(x)\$
      \n      - 'trunc' for truncation (\$\text{trunc}(x)\$
      \n      - 'sign' for sign (\$\text{sign}(x)\$
      \n      - 'abs' for absolute value (\$|x|\$
      \n      - 'neg' for negation (\$-x\$
      \n      - 'conj' for conjugate (\$\bar{x}\$
      \n      - 'real' for real part (\$\text{real}(x)\$
      \n      - 'imag' for imaginary part (\$\text{imag}(x)\$
      \n      - 'angle' for angle in radians (\$\text{angle}(x)\$
      \n      - 'angles' for angle in degrees (\$\text{angles}(x)\$
      \n      - 'atan2' for two-argument arctangent (\$\text{atan2}(y, x)\$
      \n      - 'hypot' for hypotenuse (\$\text{hypot}(x, y)\$
      \n      - 'max' for maximum value (\$\text{max}(x, y)\$
      \n      - 'min' for minimum value (\$\text{min}(x, y)\$
      \n      - 'pow' for power (\$x^y\$
      \n      - 'sqrt' for square root (\$\sqrt{x}\$
      \n      - 'cbrt' for cube root (\$\sqrt[3]{x}\$
      \n      - 'exp' for exponential (\$e^x\$
      \n      - 'log' for logarithmic (\$\log_2(x)\$
      \n      - 'log10' for logarithm base 10 (\$\log_{10}(x)\$
      \n      - 'exp2' for exponential base 2 (\$2^x\$
      \n      - 'exp10' for exponential base 10 (\$10^x\$
      \n      - 'expm1' for exponential minus 1 (\$e^x - 1\$
      \n      - 'log2' for logarithm base 2 (\$\log_2(x)\$
      \n      - 'log10' for logarithm base 10 (\$\log_{10}(x)\$
      \n      - 'exp2' for exponential base 2 (\$2^x\$
      \n      - 'exp10' for exponential base 10 (\$10^x\$
      \n      - 'expm1' for exponential minus 1 (\$e^x - 1\$
      \n      - 'log2' for logarithm base 2 (\$\log_2(x)\$
      \n      - 'log10' for logarithm base 10 (\$\log_{10}(x)\$
      \n      - 'exp2' for exponential base 2 (\$2^x\$
      \n      - 'exp10' for exponential base 10 (\$10^x\$
      \n      - 'expm1' for exponential minus 1 (\$e^x - 1\$)
/**
 * Converts two real numbers to a complex number.
 *
 * Given a tensor `real` representing the real part of a complex number, and a tensor `imag` representing the imaginary part of a complex number, this operation returns complex numbers elementwise of the form `[r0, i0, r1, i1]`, where `r` represents the real part and `i` represents the imaginary part.
 *
 * The input tensors real and imag must have the same shape.
 *
 * ```js
 * const real = tf.tensor1d([2.25, 3.25]);
 * const imag = tf.tensor1d([4.75, 5.75]);
 * const complex = tf.complex(real, imag);
 *
 * complex.print();
 * ```
 *
 * @doc {heading: 'Tensors', subheading: 'Creation'}
 */
function complex_<T extends Tensor>(real: T|TensorLike, imag: T|TensorLike): T {
  const $real = convertToTensor(real, 'real', 'complex');
  const $imag = convertToTensor(imag, 'imag', 'complex');

  util.assertShapesMatch($real.shape, $imag.shape,
    `real and imag shapes, ${$real.shape} and ${$imag.shape}, must match in call to tf.complex().`);

  const inputs: ComplexInputs = {real: $real, imag: $imag};
  return ENGINE.runKernel(Complex, inputs as {} as NamedTensorMap);
}

export const complex = op({complex_});

```javascript
import {Tensor} from '../tensor';
import {inferShape} from '../tensor_util_env';
import {TensorLike} from '../types';
import {DataType, Rank, ShapeMap} from '../types';

import {makeTensor} from './tensor_ops_util';

/**
 * Creates a `tf.Tensor` with the provided values, shape and dtype.
 *
 * ```js
 * // Pass an array of values to create a vector.
 * tf.tensor([1, 2, 3, 4]).print();
 * ```
 *
 * ```js
 * // Pass a nested array of values to make a matrix or a higher
 * // dimensional tensor.
 * tf.tensor([[1, 2], [3, 4]]).print();
 * ```
 *
 * ```js
 * // Pass a flat array and specify a shape yourself.
 * tf.tensor([1, 2, 3, 4], [2, 2]).print();
 * ```
 *
 * @param values The values of the tensor. Can be nested array of numbers,
 *     or a flat array, or a `TypedArray`. If the values are strings,
 *     they will be encoded as utf-8 and kept as `Uint8Array[]`.
 * @param shape The shape
 *     of the tensor. Optional. If not provided,
 *   it is inferred from `values`.
 * @param dtype The data type.
 *
 * @doc {heading: 'Tensors', subheading: 'Creation'}
 */
export function tensor<R extends Rank>(
    values: TensorLike, shape?: ShapeMap[R], dtype?: DataType): Tensor<R> {
  const inferredShape = inferShape(values, dtype);
  return makeTensor(values, shape, inferredShape, dtype) as Tensor<R>;
}
```
inference). Inference.

Options for saving a model.

Whether to save only the trainable weights of the model, ignoring the non-trainable ones.

Whether the optimizer will be saved (if exists).

Defaut: false.

Include the optimizer?

Whether the optimizer will be saved (if exists). Default: false.

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Include Optimizer?
import { key: string; } \n
* Initialize for the model.

/*
 * User-defined metadata about the model.
 * * An * Used for debugging purposes. E.g., 'TensorFlow.js v1.0.0'. * /\n * A value of null means the model artifacts are generated without any
 * conversion process (e.g., saved directly from a TensorFlow.js instance).
 */

* /\n* A function used to override the window.fetch function. * /\n* Progress callback.

/**
 * Callback for the progress of a long-running action such as an
 * HTTP request for a large binary object. * * fraction should be a number in the [0, 1] interval, indicating
 * how much of the action has completed. * * OnProgressCallback = (fraction: number) =>
 * void; * /\n * For detailed information on the supported fields, see
 * void; * /\n * For detailed information on the supported fields, see

* /\n* A model store defines as a storage medium on which
 * multiple models can * be * stored. Each stored model has a unique `path` as its identifier.

* /\n* A `ModelStoreManager` for the store allows actions including:
* - Listing the models stored in the store
* - Deleting a model from the store
* - Exporting a model from the store
* - Importing a model into the store

* /\n* A dictionary mapping paths of existing models to their * model artifacts info.

* /\n* Remove a model specified by `path`.

* /\n* Callback for the progress of a long-running action such as an
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 * void; * /\n * For detailed information on the supported fields, see
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* /\n* A model store defines as a storage medium on which
 * multiple models can be * store. Each model store has a unique `path` as its identifier.

* /\n* The store allows actions including:
* - Listing the models stored in the store
* - Deleting a model from the store
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* - Importing a model into the store

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 * how much of the action has completed. * * OnProgressCallback = (fraction: number) =>
 * void; * /\n * For detailed information on the supported fields, see
 * void; * /\n * For detailed information on the supported fields, see
'http://localhost/foo/group1-shard1of2' by default. However, *if you provide a 'weightPathPrefix' value of 'http://localhost/foo/alt-weights/group1-shard1of2' instead, *the weight file will be loaded from the path 'http://localhost/foo/alt-weights/group1-shard1of2' instead.* Whether the module or model is to be loaded from TF Hub, *the 'weightPathPrefix' value of 'http://localhost/foo/alt-weights/group1-shard1of2' instead.* Setting this to 'true' allows passing a TF-Hub module URL, omitting the *standard model file name and the query parameters.* *Default: 'false'. *An fromTFHub: boolean; *An * An async function to convert weight file name to URL. The weight file name's names are stored in model.json's weightsManifest.paths field. By default we don't consider weight files are collocated with the model.json file. For example:* *model.json URL: https://www.google.com/models/1/model.json *group1-shard1of1.bin url:* *https://www.google.com/models/1/group1-shard1of1.bin * *With this func you can convert the weight file name to any URL.* *An weightUrlConverter: (weightFileName: string) => Promise<string>; * Additional options for Platform.fetch * An exports interface RequestDetails { * Is this request for a binary file (as opposed to a json file) * An *IsBinary: boolean; *An "use strict" * exports.byteLength = byteLength; *exports.toByteArray = toByteArray; *exports.fromByteArray = fromByteArray; *var lookup = []; *var revLookup = []; *var Arr = Array; *var code = 'ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz0123456789+/'; *for (var i = 0, len = code.length; i < len; ++i) { * lookup[i] = code[i]; * revLookup[code.charCodeAt(i)] = i; * } *var validLen = b64.indexOf('='); *if (validLen === -1) { * validLen = len; * var placeholdersLen = validLen === len ? 0 : 4 - (validLen % 4); * } *return [validLen, placeholdersLen]; *function getLens (b64) { * var lens = getLens(b4); * var validLen = lens[0]; * var placeholdersLen = lens[1]; * var arr = new Arr(_byteLength(b4, validLen, placeholdersLen)); * var curByte = 0; * for (var i = 0; i < len; i += 4) { * var tmp = ((uint8[i] << 16) & 0xFF0000) + ((uint8[i + 1] << 8) & 0xFF00) + (uint8[i + 2] & 0xFF); * arr[curByte++] = tmp & 0xFF; * arr[curByte++] = (tmp >> 8) & 0xFF; * arr[curByte++] = (tmp >> 16) & 0xFF; * } *return arr; *function encodeChunk (uint8, start, end) { * var tmplen = uint8.length; * var placeholdersLen = tmplen; * var arr = new Arr(_byteLength(uint8, start, end)); * var curByte = 0; * for (var i = start; i < end; i++) { * var tmp = uint8[i]; * if (placeholdersLen === 2) { * var tmplen = (uint8[i] << 16) & 0xFFFF0000 + (uint8[i + 1] << 8) & 0xFF00 + (uint8[i + 2] & 0xFF); * } *output.push(uint8[i] & 0xFF); * output.push(uint8[i] >> 8); * output.push(uint8[i] >> 16); * } *return output; * } *function fromByteArray (uint8) { * var num = uint8.length; * var output = new Uint8Array(num); * var curByte = 0; * for (var i = 0; i < num; i++) { * var tmp = uint8[i]; * if (placeholdersLen === 2) { * var tmplen = (uint8[i] << 16) & 0xFFFF0000 + (uint8[i + 1] << 8) & 0xFF00 + (uint8[i + 2] & 0xFF); * } *output.push(uint8[i] & 0xFF); * output.push(uint8[i] >> 8); * output.push(uint8[i] >> 16); * } *return output; * } *function encodeChunk (uint8, start, end) { * var tmplen = uint8.length; * var extraBytes = len % 3 // if we have 1 byte left, pad 2 bytes * var parts = ['']; * var maxChunkLength = 16383 // must be multiple of 3 /* number */ if (extraBytes !== 0) { * var curByte = 0; * var i = 0; * while (curByte * i / 3 < extraBytes) { * var bytes = i * 3; * var chunk = uint8.slice(i * 3, bytes); * var chunkLen = chunk.length; * parts.push(encodeChunk(chunk, i, i + chunkLen)); * i += chunkLen; * } * i += 1; * parts.push(encodeChunk(uint8, i, i + extraBytes)); * } *return parts; * } *function fromByteArray (uint8) { * var num = uint8.length; * var output = new Uint8Array(num); * var curByte = 0; * for (var i = 0; i < num; i++) { * var tmp = uint8[i]; * if (placeholdersLen === 2) { * var tmplen = (uint8[i] << 16) & 0xFFFF0000 + (uint8[i + 1] << 8) & 0xFF00 + (uint8[i + 2] & 0xFF); * } *output.push(uint8[i] & 0xFF); * output.push(uint8[i] >> 8); * output.push(uint8[i] >> 16); * } *return output; * }
var len = checked(obj.length) | 0n 
that = createBuffer(that, len)\nif (that.length === 0) {\n  return that
}\nobj.copy(that, 0, 0, len)\nreturn that\n}\nif (obj) {\nif ((typeof ArrayBuffer !== 'undefined' &&
obj.buffer instanceof ArrayBuffer) || 'length' in obj) {\n  if (typeof obj.length !== 'number' || isnan(obj.length)) {
    return createBuffer(that, 0)\n  }\n  return fromArrayLike(that, obj)\n}\nif (obj.type === 'Buffer' &&
isArray(obj.data)) {\n  return fromArrayLike(that, obj, data)\n}\nthrow new TypeError('First argument must be a string, Buffer, ArrayBuffer, Array, or array-like object.')\n}\nfunction checked(length) {\n  // Note: cannot use 'length < kMaxLength()' here because that fails when length is NaN (which is otherwise coerced to zero.)\n  if (length >= kMaxLength()) {\n    throw new RangeError('Attempt to allocate Buffer larger than maximum '+
'size: 0x' + kMaxLength().toString(16) + ' bytes')\n  }\n
  return length | 0n}\n
function SlowBuffer (length) {
  if (+length != length) { // eslint-disable-line eqeqeq
    length = 0n
  }

  if (list.length === 0) {
    return Buffer.alloc(0n)\n  }

  var i
  if (length === undefined) {
    length = 0n
  }

  return fromBuffer(list, length) {
    if (!isArray(list)) {
      throw new TypeError('"list" argument must be an Array of Buffers')
    }\n    buf.copy(buffer, pos)
    pos += buf.length
  }

  if (obj) {
    if ((typeof ArrayBuffer !== 'undefined' &&
    obj.buffer instanceof ArrayBuffer) || 'length' in obj) {
      return fromArrayLike(that, obj.data)
    }\n    return fromArrayLike(that, obj)
  }\n
  throw new TypeError('First argument must be a string, Buffer, ArrayBuffer, Array, or array-like object.')\n}\n
function createBuffer(that, len) {\n  var buffer = Buffer.allocUnsafe(+length)\n
  for (i = 0; i < list.length; ++i) {
    length += list[i].length
  }

  var buffer = Buffer.allocUnsafe(length)\n
  for (var i = 0, len = Math.min(x, y); i < len; ++i) {
    if (a[i] !== b[i]) {
      x = a[i]
      y = b[i]
      break
    }
  }

  if (x < y) return -1n\n  if (y < x) return 1n\n  return 0n\n}
0xBF) ? 2
      : 1

    if (i + bytesPerSequence <= end) {
      var secondByte, thirdByte, fourthByte,
      tempCodePoint = firstByte
      switch (bytesPerSequence) {
        case 1:
          if (firstByte < 0x80) {
            codePoint
          }
          break
        case 2:
          secondByte = buf[i + 1]
          if ((secondByte & 0xC0) === 0x80) {
            tempCodePoint = (firstByte & 0x1F) << 0x6 | (secondByte & 0x3F)
            if (tempCodePoint < 0xD800 || tempCodePoint > 0xDFFF)
          }
          break
        case 3:
          secondByte = buf[i + 1]
          thirdByte = buf[i + 2]
          if ((secondByte & 0xC0) === 0x80 && (thirdByte & 0xC0) === 0x80) {
            tempCodePoint = (firstByte & 0xF) << 0xC | (secondByte & 0x3F) << 0x6 | (thirdByte & 0x3F)
            if (tempCodePoint > 0x7FF && (tempCodePoint < 0xD800 || tempCodePoint > 0xDFFF))
          }
          break
        case 4:
          secondByte = buf[i + 1]
          thirdByte = buf[i + 2]
          fourthByte = buf[i + 3]
          if ((secondByte & 0xC0) === 0x80 && (thirdByte & 0xC0) === 0x80 && (fourthByte & 0xC0) === 0x80) {
            tempCodePoint = (firstByte & 0xF) << 0x12 | (secondByte & 0x3F) << 0xC | (thirdByte & 0x3F) << 0x6 | (fourthByte & 0x3F)
            if (tempCodePoint > 0xFFFF && tempCodePoint < 0x110000) {
              codePoint = tempCodePoint
            }
          }
      }
    }

    if (codePoint === null) {
      // we did not generate a valid codePoint so insert a
      // replacement char (U+FFFD) and advance only 1 byte
      codePoint = 0xFFFD
      bytesPerSequence = 1
    } else if (codePoint > 0xFFFF) {
      // encode to utf16 (surrogate pair dance)
      // Based on http://stackoverflow.com/a/22747272/680742, the browser with
      // the lowest limit is Chrome, with 0x10000 args/ln/ We go 1 magnitude less, for safety
      MAX_ARGUMENTS_LENGTH = 0x1000
      function decodeCodePointsArray (codePoints) {
        var len = codePoints.length
        if (len <= MAX_ARGUMENTS_LENGTH) {
          return String.fromCharCode.apply(String, codePoints) // avoid extra
          slice(\n          }
          else if (codePoint > 0xFFFF) {
            return String.fromCharCode(0x10000 | codePoint - 0x10000)
          }
        }
        // Decode in chunks to avoid "call stack size exceeded"
        var res = \n        var i = 0
        while (i < len) {
          res += String.fromCharCode.apply(String, codePoints.slice(i, i += MAX_ARGUMENTS_LENGTH))
          i += MAX_ARGUMENTS_LENGTH
        }
        return res
      }

      function asciiSlice (buf, start, end) {
        var ret = ''
        end = Math.min(buf.length, end)
        for (var i = start; i < end; ++i) {
          ret += String.fromCharCode(buf[i] & 0x7F)
        }
        return ret
      }

      function latin1Slice (buf, start, end) {
        var ret = ''
        end = Math.min(buf.length, end)
        for (var i = start; i < end; ++i) {
          ret += String.fromCharCode(buf[i])
        }
        return ret
      }

      function hexSlice (buf, start, end) {
        var ret = ''
        if (end - start < buf.length) {
          for (var i = start; i < end; ++i) {
            ret += toHex(buf[i])
          }
        }
        return ret
      }

      Buffer.prototype.slice = function slice (start, end) {
        var len = this.length
        if (!start || start < 0) start = 0
        if (!end || end > len) end = len
        if (end < start) end = start
        var buf = this.slice(start, end)
        return buf.slice(0, end - start)
      }

      Buffer.prototype.readUIntLE = function readUIntLE (offset, byteLength, noAssert) {
        offset = offset | 0
        byteLength = byteLength | 0
        if (!noAssert) checkOffset(offset, byteLength, this.length)
        var val = this[offset]
        var len = end = Math.min(buf.length, end)
        for (var i = start; i < end; ++i) {
          val += this[i] * mul
        }
        return val
      }

      Buffer.prototype.readUIntBE = function readUIntBE (offset, byteLength, noAssert) {
        offset = offset | 0
        byteLength = byteLength | 0
        if (!noAssert) checkOffset(offset, byteLength, this.length)
        var val = this[offset + (byteLength - 1)] * mul
        for (var i = start; i < end; ++i) {
          val += this[i] * mul
        }
        return val
      }

      Buffer.prototype.readUInt8 = function readUInt8 (offset, noAssert) {
        offset = offset | 0
        if (!noAssert) checkOffset(offset, 1, this.length)
        return this[offset]
function readUInt8 (offset, noAssert) { if (!noAssert) checkOffset(offset, 1, this.length) return this[offset]; } function readInt8 (offset, noAssert) { if (!noAssert) checkOffset(offset, 1, this.length) return this[offset]; } function readInt16LE (offset, noAssert) { if (!noAssert) checkOffset(offset, 2, this.length) return (this[offset] + (this[offset + 1] << 8)); } function readInt16BE (offset, noAssert) { if (!noAssert) checkOffset(offset, 2, this.length) return (this[offset] + (this[offset + 1] << 8)); } function readInt32LE (offset, noAssert) { if (!noAssert) checkOffset(offset, 4, this.length) return (this[offset] + (this[offset + 1] << 8) + (this[offset + 2] << 16) + (this[offset + 3] << 24)); } function readInt32BE (offset, noAssert) { if (!noAssert) checkOffset(offset, 4, this.length) return (this[offset] + (this[offset + 1] << 8) + (this[offset + 2] << 16) + (this[offset + 3] << 24)); } function checkInt (buf, value, offset, ext, max, min) { if (!Buffer.isBuffer(buf)) throw new TypeError('"buffer" argument must be a Buffer instance') if (value > max || value < min) throw new RangeError('"value" argument is out of bounds') if (offset + ext > buf.length) throw new RangeError('Index out of range'); if (offset + ext > buf.length) throw new RangeError('Index out of range'); if (offset + ext > buf.length) throw new RangeError('Index out of range'); } function writeUIntLE (value, offset, byteLength, noAssert) { value = +value; offset = offset | 0; byteLength = byteLength | 0; if (!noAssert) checkOffset(offset, byteLength, this.length); var i = byteLength; var val = value; while (i > 0 && (val *= 0x100)) { this[offset + --i] = (value / mul) & 0xFF; } return offset + byteLength; } function writeUIntBE (value, offset, byteLength, noAssert) { value = +value; offset = offset | 0; byteLength = byteLength | 0; if (!noAssert) checkOffset(offset, byteLength, this.length); var i = byteLength; var val = value; while (--i >= 0 && (mul *= 0x100)) { this[offset + i] = (value / mul) & 0xFF; } return offset + byteLength; } function writeUInt8 (value, offset, noAssert) { value = +value; offset = offset | 0; if (!noAssert) checkOffset(offset, 1, this.length); this[offset] = value & 0xFF; return offset + 1; } function writeIntLE (value, offset, byteLength, noAssert) { value = +value; offset = offset | 0; byteLength = byteLength | 0; if (!noAssert) { var maxBytes = Math.pow(2, 8 * byteLength); var val = value; var i = 0; while (i < maxBytes) { this[offset + i] = (value / mul) & 0xFF; } return offset + byteLength; } function writeIntBE (value, offset, byteLength, noAssert) { value = +value; offset = offset | 0; byteLength = byteLength | 0; if (!noAssert) { var maxBytes = Math.pow(2, 8 * byteLength); var val = value; var i = 0; while (i < maxBytes) { this[offset + i] = (value / mul) & 0xFF; } return offset + byteLength; } function writeInt8 (value, offset, noAssert) { value = +value; offset = offset | 0; if (!noAssert) checkOffset(this, offset, 1, this.length); this[offset] = value; } function writeFloatLE (value, offset, noAssert) { if (!noAssert) checkOffset(offset, 4, this.length); return ieee754.write(this, offset, true, 23); } function writeFloatBE (value, offset, noAssert) { if (!noAssert) checkOffset(offset, 4, this.length); return ieee754.write(this, offset, false, 23); } function writeDoubleLE (value, offset, noAssert) { if (!noAssert) checkOffset(offset, 8, this.length); return ieee754.read(this, offset, true, 52); } function writeDoubleBE (value, offset, noAssert) { if (!noAssert) checkOffset(offset, 8, this.length); return ieee754.read(this, offset, false, 52); }
utf8ToBytes (string, units) {
  // Unpack the input.
  var codePoint
  var length = string.length
  var leadSurrogate = null
  var bytes = 

  for (var i = 0; i < length; ++i) {
    codePoint = string.charCodeAt(i)

    // Is the next char a surrogate component?
    if (codePoint > 0xD7FF && codePoint < 0xE000) {
      // Last char was a lead.
      if (true) {
        // Unpaired lead.
        if (true) {
          // Unpaired lead.
          break
        }
      }
    }
  }

  return bytes
}

function asciiToBytes (str) {
  var byteArray = 
  for (var i = 0; i < str.length; ++i) {
    byteArray.push(str.charCodeAt(i) & 0xFF)
  }
  return byteArray
}

function utf16leToBytes (str) {
  var c, hi, lo
  var byteArray = 
  for (var i = 0; i < str.length; ++i) {
    c = str.charCodeAt(i)
    hi = c >> 8
    lo = c & 0xFF
    byteArray.push(lo)
    byteArray.push(hi)
  }
  return byteArray
}

function base64ToBytes (str) {
  return base64.toByteArray(base64clean(str))
}

function blitBuffer (src, dst, offset, length) {
  for (var i = 0; i < length; ++i) {
    if ((i + offset >= dst.length) || (i >= src.length)) break
    dst[i + offset] = src[i]
  }
  return i
}

function isnan (val) {
  return val !== val // eslint-disable-line no-self-compare
}

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=============================================================================

import {complex} from '../ops/complex';

import {tensor} from '../ops/tensor';
import {NamedTensor, NamedTensorMap} from '../tensor_types';
import {TypedArray} from '../types';
import {sizeFromShape} from '../util';

import {DTYPE_VALUE_SIZE_MAP, ModelArtifacts, ModelArtifactsInfo, WeightGroup, WeightsManifestEntry} from './types';

/** Number of bytes reserved for the length of the string. (32bit integer). */
const NUM_BYTES_STRING_LENGTH = 4;

/**
 * Encode a map from names to weight values as an ArrayBuffer, along with
 * an Array of `WeightsManifestEntry` as specification of the encoded weights.
 *
 * This function does not perform sharding.
 *
 * @param tensors A map ("dict") from names to tensors.
 * @param group Group to which the weights belong (optional).
 * @returns A Promise object:
 *   - A flat ArrayBuffer with all the binary values of the `Tensor`s
 *   - An Array of `WeightsManifestEntry`'s, carrying information including:
 *     - tensor names, `dtype`s and shapes.
 * @throws Error: on unsupported tensor `dtype`.
 */
export async function encodeWeights(tensors: NamedTensorMap|NamedTensor, group?: WeightGroup): Promise<{data: ArrayBuffer, specs: WeightsManifestEntry[]}> {
  const dataPromises: Promise< ArrayBuffer> = [];
  const names = Object.keys(tensors);
  return new Promise((resolve, reject) => {
    // Encode each tensor in parallel.
    for (let i = 0; i < names.length; ++i) {
      const name = names[i];
      const tensor = tensors[name];
      const spec = tensors[name].spec;
      const shape = spec.shape;
      const dtype = spec.dtype;
      const data = tensor.data;
      const length = shape.length;
      const storage = TypedArray[spec.dtype].length;
      const dataLength = length * storage;
      const dataBuffer = new Uint8Array(dataLength);
      data.copyToArray(dataBuffer); // Copy data.

      // Encode the metadata.
      const specBuffer = new ArrayBuffer(2 * length);
      let specIndex = 0;
      for (let j = 0; j < length; ++j) {
        specBuffer[specIndex] = j;
        specBuffer[specIndex + 1] = length;
        specIndex += 2;
      }

      // Create the final array.
      const finalBuffer = new ArrayBuffer(4 + 2 * length + dataLength);
      finalBuffer[0] = 0;
      finalBuffer[1] = length;
      finalBuffer[2] = 0;
      finalBuffer[3] = 0;
      for (let k = 0; k < specBuffer.length; ++k) {
        finalBuffer[k + 4] = specBuffer[k];
      }
      for (let k = 0; k < dataBuffer.length; ++k) {
        finalBuffer[k + 4 + specBuffer.length] = dataBuffer[k];
      }
      dataPromises.push(new Promise((resolve, reject) => {
        resolve(finalBuffer); // Return the final buffer.
      }));
    }
  });

  return Promise.all(dataPromises); // Return all data.
}
//
tensors[name];
    if (t.dtype !== 'float32' && t.dtype !== 'int32' && t.dtype !== 'bool' &&
        t.dtype !== 'string' && t.dtype !== 'complex64') {
      throw new Error(`Unsupported dtype in weight '${name}': ${t.dtype}`);
    }
    const spec: WeightsManifestEntry = {name, shape: t.shape, dtype: t.dtype};
    if (spec.dtype !== 'string') {
      const utf8bytes = new Promise<TypedArray>(async resolve => {
        const vals = await t.bytes() as Uint8Array;
        const totalNumBytes = vals.reduce((p, c) => p + c.length, 0) +
        NUM_BYTES_STRING_LENGTH * vals.length;
        const bytes = new Uint8Array(totalNumBytes);
        let offset = 0;
        for (let i = 0; i < vals.length; i++) {
          const val = vals[i];
          bytes.set(val, offset);
          offset += vals.length;
        }
        resolve(bytes);
      });
      dataPromises.push(utf8bytes);
    } else {
      dataPromises.push(t.data());
    }
    if (group != null) {
      spec.group = group;
    }
    specs.push(spec);
  }

  const tensorValues = await Promise.all(dataPromises);
  return {data: concatenateTypedArrays(tensorValues), specs};
}

/**
 * Decode flat ArrayBuffer as weights.
 *
 * This function does not handle sharding.
 *
 * This function is the reverse of `encodeWeights`.
 *
 * @param buffer A flat ArrayBuffer carrying the binary values of the tensors
 * concatenated in the order specified in `specs`.
 * @param specs Specifications of the names, dtypes and shapes of the tensors
 * whose value are encoded by `buffer`.
 * @return A map from tensor name to tensor value, with the names corresponding
 * to names in `specs`.
 *
 * @throws Error, if any of the tensors has unsupported dtype.
 */
export function decodeWeights(
    buffer: ArrayBuffer, specs: WeightsManifestEntry[]): NamedTensorMap {
  const out: NamedTensorMap = {};
  let float16Decode:
      (buffer: Uint16Array) => Float32Array | undefined;
  let offset = 0;
  for (const spec of specs) {
    const name = spec.name;
    const dtype = spec.dtype;
    const shape = spec.shape;
    const size = sizeFromShape(shape);
    let values: TypedArray|string[]|Uint8Array[] = undefined;

    if ('quantization' in spec) {
      const quantization = spec.quantization;
      if (quantization.dtype === 'uint8' || quantization.dtype === 'uint16') {
        if (!('min' in quantization && 'scale' in quantization)) {
          throw new Error(`Weight ${name} with quantization ${quantization.dtype} ` +
            `doesn't have corresponding metadata min and scale.`);
        }
        if (dtype === 'float16') {
          if (float16Decode === undefined) {
            float16Decode = getFloat16Decoder();
          }
          values = float16Decode(quantization.array as Uint16Array);
        } else if (dtype === 'int32') {
          values = new Int32Array(quantization.array.length);
          for (let i = 0; i < quantization.array.length; i++) {
            const v = quantization.array[i];
            values[i] = Math.round(v * quantization.scale + quantization.min);
          }
        } else {
          throw new Error(`Unsupported dtype in weight '${name}': ${dtype}`);
        }
      } else if (dtype === 'string') {
        const size = sizeFromShape(spec.shape);
        values = new Uint8Array(size);
        for (let i = 0; i < size; i++) {
          values[i] = Math.round(v * quantization.scale + quantization.min);
        }
      }
    } else {
      throw new Error(`Unsupported quantization type ${quantization.dtype} ` +
        `for weight type ${dtype}.`);
    }
  }
  return out;
}
export function basename(path: string): string {
  const SEPARATOR = '/';
  path = path.trim();
  while (path && path[0] === SEPARATOR)
    path = path.slice(1);
  let out = path
    .split(SEPARATOR)
    .map(f => f.trim())
    .map(f => f.length ? f : undefined)
    .filter(f => f)
    .join(SEPARATOR);
  if (out)
    return out;

  return path;
}

export function concatenateArrayBuffers(buffers: ArrayBuffer[]): ArrayBuffer {
  if (buffers.length === 0)
    return buffers[0];
  if (buffers.length === 1)
    return buffers[0];

  const y = new Uint8Array(totalByteLength);
  let offset = 0;
  normalizedXs.forEach((x: TypedArray) => {
    offset += x.byteLength;
  });

  return y.buffer;
}

export function base64StringToArrayBuffer(str: string): ArrayBuffer {
  if (useNodeBuffer) {
    const buf = new Buffer.from(str, 'base64');
    return buf.buffer;
  }
  const buffer = new Uint8Array(buffer);
  let s = '';
  for (let i = 0;
    s += String.fromCharCode(buffer[i]);
    i++)
  return buffer.buffer;
}

export function arrayBufferToBase64String(buffer: ArrayBuffer): string {
  if (useNodeBuffer) {
    return Buffer.from(buffer).toString('base64');
  }
  const arrayBuffer = buffer.slice(offset, offset + size * dtypeFactor);
  if (dtype === 'uint8') {
    values = new Uint8Array(arrayBuffer);
  } else if (dtype === 'int8') {
    values = new Int8Array(arrayBuffer);
  } else if (dtype === 'float32') {
    values = new Float32Array(arrayBuffer);
  } else if (dtype === 'complex64') {
    values = new Complex64Array(arrayBuffer);
  } else if (dtype === 'bool') {
    values = new Int8Array(arrayBuffer);
  } else if (dtype === 'float64') {
    values = new Float64Array(arrayBuffer);
  } else if (dtype === 'complex128') {
    values = new Complex128Array(arrayBuffer);
  } else if (dtype === 'uint16') {
    values = new Uint16Array(arrayBuffer);
  } else if (dtype === 'int16') {
    values = new Int16Array(arrayBuffer);
  } else if (dtype === 'uint32') {
    values = new Uint32Array(arrayBuffer);
  } else if (dtype === 'int32') {
    values = new Int32Array(arrayBuffer);
  } else if (dtype === 'uint64') {
    values = new Uint64Array(arrayBuffer);
  } else if (dtype === 'int64') {
    values = new Int64Array(arrayBuffer);
  } else if (dtype === 'uint128') {
    values = new Uint128Array(arrayBuffer);
  } else if (dtype === 'int128') {
    values = new Int128Array(arrayBuffer);
  } else {
    throw Error('Unsupported dtype in weight `${name}`: ${dtype}');
  }
  return btoa(s);
}

export function stringByteLength(str: string): number {
  if (useNodeBuffer) {
    return Buffer.byteLength(str);
  }
  let length = 0;
  for (let i = 0; i < str.length; ++i) {
    length += str.charCodeAt(i);
  }
  return length;
}

export function concatenateTypedArrays(xs: TypedArray[]): ArrayBuffer {
  if (xs.length === 0)
    throw new Error('Invalid input value: JSON.stringify(xs)');
  let totalByeLength = 0;
  const y = new Uint8Array(totalByteLength);
  let offset = 0;
  normalizedXs.forEach((x: TypedArray) => {
    offset += x.byteLength;
  });

  return y.buffer;
}

export function tensor(values, shape, dtype) {
  switch (dtype) {
    case 'float32':
      dtypeFactor = DTYPE_VALUE_SIZE_MAP['float32'];
      break;
    case 'int8':
      dtypeFactor = DTYPE_VALUE_SIZE_MAP['int8'];
      break;
    case 'uint8':
      dtypeFactor = DTYPE_VALUE_SIZE_MAP['uint8'];
      break;
    case 'float64':
      dtypeFactor = DTYPE_VALUE_SIZE_MAP['float64'];
      break;
    case 'int64':
      dtypeFactor = DTYPE_VALUE_SIZE_MAP['int64'];
      break;
    case 'uint64':
      dtypeFactor = DTYPE_VALUE_SIZE_MAP['uint64'];
      break;
    default:
      throw new Error(`Unsupported dtype: ${dtype}`);
  }
  const byteBuffer = buffer.slice(offset, offset + size * dtypeFactor);
  if (dtype === 'float32') {
    values = new Float32Array(arrayBuffer);
  } else if (dtype === 'int32') {
    values = new Int32Array(arrayBuffer);
  } else if (dtype === 'bool') {
    values = new Int8Array(arrayBuffer);
  } else if (dtype === 'complex64') {
    values = new Complex64Array(arrayBuffer);
  } else if (dtype === 'complex128') {
    values = new Complex128Array(arrayBuffer);
  } else if (dtype === 'uint16') {
    values = new Uint16Array(arrayBuffer);
  } else if (dtype === 'int16') {
    values = new Int16Array(arrayBuffer);
  } else if (dtype === 'uint32') {
    values = new Uint32Array(arrayBuffer);
  } else if (dtype === 'int32') {
    values = new Int32Array(arrayBuffer);
  } else if (dtype === 'uint64') {
    values = new Uint64Array(arrayBuffer);
  } else if (dtype === 'int64') {
    values = new Int64Array(arrayBuffer);
  } else if (dtype === 'uint128') {
    values = new Uint128Array(arrayBuffer);
  } else if (dtype === 'int128') {
    values = new Int128Array(arrayBuffer);
  } else {
    throw new Error(`Unsupported dtype: ${dtype}`);
  }
  return values;
}
(path.endsWith(SEPARATOR)) {'
  path = path.slice(0, path.length - 1);
}'
const items = path.split(SEPARATOR);
return items.slice(0, items.length - 1);

/**
 * Populate ModelArtifactsInfo fields for a model with JSON topology.
 * @param modelArtifacts
 * @returns A ModelArtifactsInfo object.
 */
unexport function getModelArtifactsInfoForJSON(modelArtifacts: ModelArtifacts): ModelArtifactsInfo {
  if (modelArtifacts.modelTopology instanceof ArrayBuffer) {
    throw new Error('Expected JSON model topology, received ArrayBuffer.');
  }

  return {
    dateSaved: new Date(),
    modelTopologyType: 'JSON',
    modelTopologyBytes: modelArtifacts.modelTopology == null ? 0 :
    stringByteLength(JSON.stringify(modelArtifacts.modelTopology)),
    weightSpecsBytes: modelArtifacts.weightSpecs == null ? 0 :
    stringByteLength(JSON.stringify(modelArtifacts.weightSpecs)),
    weightDataBytes: modelArtifacts.weightData == null ? 0 : modelArtifacts.weightData.byteLength,
  };
}

/**
 * Computes mantisa table for casting Float16 to Float32
 */
function computeFloat16MantisaTable(): Uint32Array {
  const convertMantissa = (i: number): number => {
    let m = i << 13;
    let e = 0;

    while ((m & 0x00800000) === 0) {
      e -= 0x00800000;
      m <<= 1;
    }
    m &= ~0x00800000;
    e += 0x38800000;

    return m | e;
  };

  const mantisaTable = new Uint32Array(2048);
  mantisaTable[0] = 0;
  for (let i = 1; i < 1024; i++) {
    mantisaTable[i] = convertMantissa(i);
  }
  for (let i = 1024; i < 2048; i++) {
    mantisaTable[i] = 0x38000000 + ((i - 1024) << 13);
  }

  return mantisaTable;
}

/**
 * Computes exponent table for casting Float16 to Float32
 */
function computeFloat16ExponentTable(): Uint32Array {
  const exponentTable = new Uint32Array(64);

  exponentTable[0] = 0;
  exponentTable[31] = 0x47800000;
  exponentTable[32] = 0x80000000;
  exponentTable[63] = 0xc7800000;
  for (let i = 1; i < 31; i++) {
    exponentTable[i] = i << 23;
  }
  for (let i = 33; i < 63; i++) {
    exponentTable[i] = 0x80000000 + ((i - 32) << 23);
  }

  return exponentTable;
}

/**
 * Computes offset table for casting Float16 to Float32
 */
function computeFloat16OffsetTable(): Uint32Array {
  const offsetTable = new Uint32Array(64);

  for (let i = 0; i < 64; i++) {
    offsetTable[i] = 1024;
  }
  offsetTable[0] = offsetTable[32] = 0;

  return offsetTable;
}

/**
 * Retrieve a Float16 decoder which will decode a ByteArray of Float16 values
 * to a Float32Array.
 *
 * @returns Function (buffer: Uint16Array) => Float32Array which decodes
 *          the Uint16Array of Float16 bytes to a Float32Array.
 */
unexport function getFloat16Decoder(): (buffer: Uint16Array) => Float32Array {
  // Algorithm is based off of
  // Cache lookup tables
  const mantisaTable = computeFloat16MantisaTable();
  const exponentTable = computeFloat16ExponentTable();
  const offsetTable = computeFloat16OffsetTable();

  return (quantizedArray: Uint16Array) => {
    const buffer = new ArrayBuffer(4 * quantizedArray.length);
    const bufferUint32View = new Uint32Array(buffer);
    for (let index = 0; index < quantizedArray.length; index++) {
      const float16Bits = quantizedArray[index];
      const float32Bits =
        mantisaTable[offsetTable[index] + (float16Bits & 0x3ff)] +
        exponentTable[offsetTable[index] + (float16Bits >> 10)];
      bufferUint32View[index] = float32Bits;
    }
    return new Float32Array(buffer);
  };
}

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 */

 CHARSET

IOModule
constructor() {
    this.saveRouters = [];
    this.loadRouters = [];
  }

  private static getInstance(): IORouterRegistry {
    if (IORouterRegistry.instance == null) {
      IORouterRegistry.instance = new IORouterRegistry();
    }
    return IORouterRegistry.instance;
  }

  /**
   * Register a save-handler router.
   */
  static registerSaveRouter(saveRouter: IORouter) {
    IORouterRegistry.getInstance().saveRouters.push(saveRouter);
  }

  /**
   * Register a load-handler router.
   */
  static registerLoadRouter(loadRouter: IORouter) {
    IORouterRegistry.getInstance().loadRouters.push(loadRouter);
  }

  /**
   * Look up IOHandler for saving, given a URL-like string.
   */
  static getSaveHandlers(url: string|string[]): IOHandler[] {
    return IORouterRegistry.getHandlers(url, 'save');
  }

  /**
   * Look up IOHandler for loading, given a URL-like string.
   */
  static getLoadHandlers(url: string|string[], loadOptions?: LoadOptions): IOHandler[] {
    return IORouterRegistry.getHandlers(url, 'load', loadOptions);
  }

  private static getHandlers(url: string|string[], handlerType: 'save'|'load', loadOptions?: LoadOptions): IOHandler[] {
    const validHandlers: IOHandler[] = [];
    const routers = handlerType === 'load' ? IORouterRegistry.getInstance().loadRouters : IORouterRegistry.getInstance().saveRouters;
    routers.forEach(router => {
      const handler = router(url, loadOptions);
      if (handler !== null) {
        validHandlers.push(handler);
      }
    });
    return validHandlers;
  }

  export const registerSaveRouter = (saveRouter: IORouter) =>
    IORouterRegistry.registerSaveRouter(saveRouter);
  export const registerLoadRouter = (loadRouter: IORouter) =>
    IORouterRegistry.registerLoadRouter(loadRouter);
  export const getSaveHandlers = (url: string|string[]) =>
    IORouterRegistry.getSaveHandlers(url);
  export const getLoadHandlers = (url: string|string[], loadOptions?: LoadOptions) =>
    IORouterRegistry.getLoadHandlers(url, loadOptions);
  }

import '../flags';

import {env} from '../environment';

import {getModelArtifactsInfoForJSON} from './io_utils';
import {IORouter, IORouterRegistry} from './router_registry';
import {IOHandler, ModelArtifacts, ModelArtifactsInfo, ModelStoreManager, SaveResult} from './types';

const DATABASE_NAME = 'tensorflowjs';
const DATABASE_VERSION = 1;

// Model data and ModelArtifactsInfo (metadata) are stored
// in two separate stores for efficient access of the list of stored models and their metadata.
// 1. The object store for model data: topology, weights and weight manifests.
const MODEL_STORE_NAME = 'models_store';
// 2. The object store for ModelArtifactsInfo, including meta-information such as
//    the type of topology (JSON vs binary), byte size of the topology, byte size of the weights, etc.
const INFO_STORE_NAME = 'model_info_store';

/**
 * Delete the entire database for tensorflow.js, including the models store.
 */
export async function deleteDatabase(): Promise<void> {
  const idbFactory = getIndexedDBFactory();

  return new Promise<void>((resolve, reject) => {
    const deleteRequest = idbFactory.deleteDatabase(DATABASE_NAME);
    deleteRequest.onsuccess = () => resolve();
    deleteRequest.onerror = error => reject(error);
  });
}

function getIndexedDBFactory(): IDBFactory {
  if (!env().getBool('IS_BROWSER')) {
    // TODO(cais): Add more info about what IOHandler subtypes are available.
    // Maybe point to a doc page on the web and/or automatically determine
    // the available
    return undefined;
  }

  const factory = idbFactory.open('tensorflowjs', DATABASE_VERSION, {upgradeDatabase() {
    // Add any upgrades needed for the database.
  }});

  return factory;
}

/* */
IOHandlers and print them in the error message.

```
throw new Error('Failed to obtain IndexedDB factory because the current environment ' +
  'is not a web browser.');
```

`const theWindow: any = typeof window === 'undefined' ? self : window;
 const factory = theWindow.indexedDB ||
        theWindow.mozIndexedDB ||
      theWindow.webkitIndexedDB || theWindow.msIndexedDB ||

```
throw new Error('The current browser does not
appear to support IndexedDB.');
```

```
import { MODELS_STORE_NAME, INFO_STORE_NAME } from './models';
```

```
function setUpDatabase(openRequest: IDBRequest) {
  const db = openRequest.result as IDBDatabase;

  const MODELS_STORE_NAME = 'models';
  const INFO_STORE_NAME = 'info';

  db.createObjectStore(MODELS_STORE_NAME, {keyPath: 'modelPath'});
  db.createObjectStore(INFO_STORE_NAME, {keyPath: 'modelPath'});
}

```

```
/**
 * IOHandler subclass: Browser IndexedDB.
 *
 * See the doc string of `browserIndexedDB` for more details.
 */
export class BrowserIndexedDB implements IOHandler {
  protected readonly indexedDB: IDBFactory;
  protected readonly modelPath: string;

  static readonly URL_SCHEME = 'indexeddb://';

  constructor(modelPath: string) {
    thisIndexedDB = getIndexedDBFactory();

    if (modelPath == null || !modelPath) {
      throw new Error('For IndexedDB, modelPath must not be null, undefined or empty.');
    }
    this.modelPath = modelPath;
  }

  async save(modelArtifacts: ModelArtifacts): Promise<SaveResult> {
    // TODO(cais): Support saving GraphDef
    models.
    if (modelArtifacts.modelTopology instanceof ArrayBuffer) {
      throw new Error('BrowserLocalStorage.save() does not support saving model topology ' +
        'in binary formats yet.');
    }

    return this.databaseAction(this.modelPath, modelArtifacts) as
        Promise<SaveResult>;
  }

  async load():
Promise<ModelArtifacts> {
  return this.databaseAction(this.modelPath) as Promise<ModelArtifacts>;
}

  /**
   * Perform database action to put model artifacts into or read model artifacts
   * from IndexedDB object
   * store. * Whether the action is put or get depends on whether `modelArtifacts` is
   * specified. If it is
   * specified, the action will be put; otherwise the action
   * will be get. * @param modelArtifacts If specified, it will be the model artifacts to be
   * stored in
   * IndexedDB. * @returns A `Promise` of `SaveResult`, if the action is put, or a `Promise`
   * of
   * `ModelArtifacts`, if the action is get.
   */
  private databaseAction(modelPath: string, modelArtifacts?: ModelArtifacts):
      Promise<ModelArtifacts|SaveResult> {
    return new Promise<ModelArtifacts|SaveResult>((resolve, reject) => {
      const openRequest =
thisIndexedDB.open(DATABASE_NAME, DATABASE_VERSION);
      openRequest.onupgradeneeded = () => {
        setUpDatabase(openRequest);
      }
      openRequest.onsuccess = () => {
        const db = openRequest.result;

        if (modelArtifacts == null) {
          // Read model out from object store.
          const modelTx =
            db.transaction(MODEL_STORE_NAME, 'readonly');
          const modelStore =
            modelTx.objectStore(MODEL_STORE_NAME);
          const modelGetRequest =
            modelStore.get(modelPath);
          modelGetRequest.onsuccess = () => {
            if (modelGetRequest.result == null) {
              db.close();
              return
            } else {
              resolve(modelGetRequest.result.modelArtifacts);
            }
          };
          modelGetRequest.onerror = error => {
            db.close();
            return reject(modelGetRequest.error);
          };
        } else {
          // Put model into object store.
          const modelArtifactsInfo:
            ModelArtifactsInfo =
            getModelArtifactsInfoForJSON(modelArtifacts);
          const modelPutRequest =
            modelStore.put({
              modelPath, modelArtifacts, modelArtifactsInfo
            });
          modelPutRequest.onsuccess = () => resolve(modelArtifactsInfo);
        }
        db.close();
    });
  }
```

```
First, put ModelArtifactsInfo into info store.
const infoTx = db.transaction(INFO_STORE_NAME, 
'readonly');
const infoStore = infoTx.objectStore(INFO_STORE_NAME);
const putInfoRequest =
  infoStore.put({
    modelPath, modelArtifactsInfo
  });
const modelTx: IDBTransaction =
  db.transaction(MODEL_STORE_NAME, 'readonly');
const modelStore =
  modelTx.objectStore(MODEL_STORE_NAME);
const putModelRequest =
  modelStore.put({
    modelPath, modelArtifacts, modelArtifactsInfo
  });
putModelRequest.onsuccess = () => resolve(modelArtifactsInfo);
putModelRequest.onerror = error => {
  if the put-model request fails, roll back the info entry
  well.
  infoStore =
    infoTx.objectStore(INFO_STORE_NAME);
  const deleteInfoRequest =
    infoStore.delete(this.modelPath);
  deleteInfoRequest.onsuccess = () => {
    db.close();
```

```
return reject(putModelRequest.error);

putInfoRequest.onerror = error => {
  db.close();
  return reject(putInfoRequest.error);
}

infoTx.oncomplete = () => {
  if (modelTx == null) {
    db.close();
  } else {
    modelTx.oncomplete = () => db.close();
  }
}

modelTx.oncomplete = () =>
    resolve(getInfoRequest.result.modelArtifactsInfo);

async removeModel(path: string): Promise<ModelArtifactsInfo> {
  path = maybeStripScheme(path);
  return new Promise<ModelArtifactsInfo>((resolve, reject) => {
    const openRequest = this.indexedDB.open(DATABASE_NAME, DATABASE_VERSION);
    openRequest.onupgradeneeded = () =>
        setUpDatabase(openRequest);

    openRequest.onsuccess = () => {
      const db = openRequest.result;
      const infoTx = db.transaction(INFO_STORE_NAME, 'readwrite');
      const infoStore = infoTx.objectStore(INFO_STORE_NAME);

      const getInfoRequest = infoStore.get(path);
      let modelTx: IDBTransaction;
      getInfoRequest.onsuccess = () => {
        if (getInfoRequest.result == null) {
          db.close();
          return reject(new Error(`Cannot find model with path '${path}' in IndexedDB.`));
        } else {
          const deleteInfoRequest = infoStore.delete(path);
          const deleteModelData = () => {
            modelTx = db.transaction(MODEL_STORE_NAME, 'readwrite');
            const modelStore = modelTx.objectStore(MODEL_STORE_NAME);
            return deleteModelRequest.oncomplete = () =>
                resolve(deleteInfoRequest.result.modelArtifactsInfo);
          }
          deleteInfoRequest.onerror = error => {
            db.close();
            return reject(deleteInfoRequest.error);
          }

          openRequest.onerror = error => reject(openRequest.error);
        }
      }
    }
  });
}

getInfoRequest.onerror = error => {
  const modelTx = db.transaction(MODEL_STORE_NAME, 'readwrite');
  const modelStore = modelTx.objectStore(MODEL_STORE_NAME);
  return deleteModelRequest.oncomplete = () =>
      resolve(deleteModelRequest.result.modelArtifactsInfo);
}

async listModels(): Promise<
    {[path: string]: ModelArtifactsInfo}> {
    return new Promise<
    {[path: string]: ModelArtifactsInfo}>(
        (resolve, reject) => {
          const openRequest =
              this.indexedDB.open(DATABASE_NAME, DATABASE_VERSION);
          openRequest.onupgradeneeded = () =>
              setUpDatabase(openRequest);

          openRequest.onsuccess = () => {
            const db = openRequest.result;
            const infoTx = db.transaction(INFO_STORE_NAME, 'readonly');
            const infoStore = infoTx.objectStore(INFO_STORE_NAME);

            const getInfoRequest = infoStore.getAll();
            let modelTx: IDBTransaction;
            getInfoRequest.onsuccess = () => {
              if (getInfoRequest.result == null) {
                db.close();
                return reject(new Error(`Cannot find model with path '${path}' in IndexedDB.`));
              } else {
                // First, delete the entry in the info store.
                const deleteInfoRequest = infoStore.delete(path);
                const deleteModelData = () => {
                  modelTx = db.transaction(MODEL_STORE_NAME, 'readwrite');
                  const modelStore = modelTx.objectStore(MODEL_STORE_NAME);
                  return deleteModelRequest.oncomplete = () =>
                      resolve(deleteModelRequest.result.modelArtifactsInfo);
                }
                deleteInfoRequest.onerror = error => {
                  db.close();
                  return reject(deleteInfoRequest.error);
                }

                infoTx.oncomplete = () => {
                  if (modelTx == null) {
                    db.close();
                  } else {
                    modelTx.oncomplete = () =>
                        resolve(getInfoRequest.result.modelArtifactsInfo);
                  }
                };
              }
            }
          };
          openRequest.onerror = error => reject(openRequest.error);
        });
      };

  return resolve(infoTx.result);
deleteModelRequest.onerror = error =>
  reject(getInfoRequest.error);
        }
      };
      deleteInfoRequest.onerror = error =>
        reject(getInfoRequest.error);
    }
  });
}

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 *
 *=============================================================================
 */

import {assert} from '../util';
import
    {arrayBufferToBase64String, base64StringToArrayBuffer, getModelArtifactsInfoForJSON} from
    './io_utils';
import {IORouter, IORouterRegistry} from './router_registry';
import {IOHandler, ModelArtifacts, ModelArtifactsInfo, ModelStoreManager, SaveResult} from './types';

const PATH_SEPARATOR = '/';
const
    PATH_PREFIX = 'tensorflowjs_models';
const INFO_SUFFIX = 'info';
const MODEL_TOPOLOGY_SUFFIX = 'model_topology';
const WEIGHT_SPECS_SUFFIX = 'weight_specs';
const WEIGHT_DATA_SUFFIX = 'weight_data';
const MODEL_METADATA_SUFFIX = 'model_metadata';

/**
 * Purge all tensorflow.js-saved model artifacts from local storage.
 *
 * @returns Paths of the models purged.
 */
export function
    purgeLocalStorageArtifacts(): string[] {
  if (!env().getBool('IS_BROWSER') || typeof window === 'undefined' ||
      typeof window.localStorage === 'undefined') {
    throw new Error('purgeLocalStorageModels() cannot
        proceed because local storage is ' +
        'unavailable in the current environment.');
  }
  const LS = window.localStorage;
  const purgedModelPaths: string[] = [];
  for (let i = 0; i < LS.length; ++i) {
    const key = LS.key(i);
    const prefix = PATH_PREFIX + PATH_SEPARATOR;
    if (key.startsWith(prefix) && key.length
        > prefix.length) {
      LS.removeItem(key);
      const modelName = getModelPathFromKey(key);
      if
          (purgedModelPaths.indexOf(modelName) === -1) {
        purgedModelPaths.push(modelName);
      }
    }
  }
  return purgedModelPaths;
}

function getModelKeys(path: string): {
  info: string,
  topology: string,
  weightSpecs: string,
  weightData: string,
  modelMetadata: string
} {
  return {
    info: [PATH_PREFIX,
            path, INFO_SUFFIX].join(PATH_SEPARATOR),
    topology: [PATH_PREFIX,
                path, MODEL_TOPOLOGY_SUFFIX].join(PATH_SEPARATOR),
    weightSpecs: [PATH_PREFIX,
                  path, WEIGHT_SPECS_SUFFIX].join(PATH_SEPARATOR),
    weightData: [PATH_PREFIX,
                  path, WEIGHT_DATA_SUFFIX].join(PATH_SEPARATOR),
    modelMetadata: [PATH_PREFIX,
                    path, MODEL_METADATA_SUFFIX].join(PATH_SEPARATOR)
  };
}

/**
 * Get model path from a local-
 * storage key.
 *
 * E.g., 'tensorflowjs_models/my/model/1/info' --> 'my/model/1'
 *
 * @param key
 */
function getModelPathFromKey(key: string) {
  const items = key.split(PATH_SEPARATOR);
  if
      (items.length < 3) {
    throw new Error('Invalid key format: ');
  }
  const LS = window.localStorage;
  const prefix = PATH_PREFIX + PATH_SEPARATOR;
  if
      (key.startsWith(prefix) &
           & key.length
         > prefix.length) {
    LS.removeItem(key);
    const modelName = getModelPathFromKey(key);
    if
        (purgedModelPaths.indexOf(modelName) === -1) {
      purgedModelPaths.push(modelName);
    }
  }
  return purgedModelPaths;
}

function maybeStripScheme(key: string) {
  return
      key.startsWith(BrowserLocalStorage.URL_SCHEME) ?
          key.slice(BrowserLocalStorage.URL_SCHEME.length) :
      key;
}

declare type LocalStorageKeys = {
  info: string,
  topology: string,
  weightSpecs: string,
  weightData: string,
  modelMetadata: string
};

/**
 * IOHandler subclass: Browser Local Storage.
 *
 * See the doc string to 'browserLocalStorage' for more
details.
 * An export class BrowserLocalStorage implements IOHandler
 * protected readonly LS: Storage;
 * protected readonly modelPath: string;
 */

export class BrowserLocalStorage implements IOHandler {
  protected readonly LS: Storage;
  protected readonly modelPath: string;
  protected readonly keys: LocalStorageKeys;

  static readonly
      URL_SCHEME = 'localstorage://';

  constructor(modelPath: string) {
    if
        (!env().getBool('IS_BROWSER') ||
           !env().getBool('IS_BROWSER')) {
      throw new Error('purgeLocalStorageModels() cannot
          proceed because local storage is ' +
          'unavailable in the current environment.');
    }
    const LS = window.localStorage;
    const purgedModelPaths: string[] = [];
    for (let i = 0; i < LS.length; ++i) {
      const key = LS.key(i);
      const prefix = PATH_PREFIX + PATH_SEPARATOR;
      if
          (key.startsWith(prefix) &
              & key.length
             > prefix.length) {
    LS.removeItem(key);
    const modelName = getModelPathFromKey(key);
    if
        (purgedModelPaths.indexOf(modelName) === -1) {
      purgedModelPaths.push(modelName);
    }
  }
  return purgedModelPaths;
}

function getModelPathFromKey(key: string) {
  const items = key.split(PATH_SEPARATOR);
  if
      (items.length < 3) {
    throw new Error('Invalid key format: ');
  }
  const LS = window.localStorage;
  const prefix = PATH_PREFIX + PATH_SEPARATOR;
  if
      (key.startsWith(prefix) &
           & key.length
          > prefix.length) {
    LS.removeItem(key);
    const modelName = getModelPathFromKey(key);
    if
        (purgedModelPaths.indexOf(modelName) === -1) {
      purgedModelPaths.push(modelName);
    }
  }
  return purgedModelPaths;
}

function maybeStripScheme(key: string) {
  return
      key.startsWith(BrowserLocalStorage.URL_SCHEME) ?
          key.slice(BrowserLocalStorage.URL_SCHEME.length) :
      key;
}

declare type LocalStorageKeys = {
  info: string,
  topology: string,
  weightSpecs: string,
  weightData: string,
  modelMetadata: string
};

/**
 * IOHandler subclass: Browser Local Storage.
 *
 * See the doc string to 'browserLocalStorage' for more
details.
 * An export class BrowserLocalStorage implements IOHandler
 * protected readonly LS: Storage;
 * protected readonly modelPath: string;
 */

export class BrowserLocalStorage implements IOHandler {
  protected readonly LS: Storage;
  protected readonly modelPath: string;
  protected readonly keys: LocalStorageKeys;

  static readonly
      URL_SCHEME = 'localstorage://';

  constructor(modelPath: string) {
    if
        (!env().getBool('IS_BROWSER') ||
           !env().getBool('IS_BROWSER')) {
      throw new Error('purgeLocalStorageModels() cannot
          proceed because local storage is ' +
          'unavailable in the current environment.');
    }
    const LS = window.localStorage;
    const purgedModelPaths: string[] = [];
    for (let i = 0; i < LS.length; ++i) {
      const key = LS.key(i);
      const prefix = PATH_PREFIX + PATH_SEPARATOR;
      if
          (key.startsWith(prefix) &
              & key.length
             > prefix.length) {
    LS.removeItem(key);
    const modelName = getModelPathFromKey(key);
    if
        (purgedModelPaths.indexOf(modelName) === -1) {
      purgedModelPaths.push(modelName);
    }
  }
  return purgedModelPaths;
}

function getModelPathFromKey(key: string) {
  const items = key.split(PATH_SEPARATOR);
  if
      (items.length < 3) {
    throw new Error('Invalid key format: ');
  }
  const LS = window.localStorage;
  const prefix = PATH_PREFIX + PATH_SEPARATOR;
  if
      (key.startsWith(prefix) &
           & key.length
          > prefix.length) {
    LS.removeItem(key);
    const modelName = getModelPathFromKey(key);
    if
        (purgedModelPaths.indexOf(modelName) === -1) {
      purgedModelPaths.push(modelName);
    }
  }
  return purgedModelPaths;
}

function maybeStripScheme(key: string) {
  return
      key.startsWith(BrowserLocalStorage.URL_SCHEME) ?
          key.slice(BrowserLocalStorage.URL_SCHEME.length) :
      key;
}
typeof window === 'undefined' ||
        typeof window.localStorage === 'undefined') {
      // TODO(cais): Add
        // more info about what IOHandler subtypes are
        // available.
        // Maybe point to a doc page on the web
        // the available IOHandlers and print them in the error message.
        throw new Error('The current environment does not support local storage.');
    }
    this.LS = window.localStorage;

    if (modelPath == null || !modelPath) {
      throw new Error('For local storage,
        modelPath must not be null, undefined or empty.');
    }
    this.modelPath = modelPath;
    this.keys = getModelKeys(this.modelPath);

    const weightSpecs = JSON.stringify(modelArtifacts.weightSpecs);
    const modelArtifactsInfo: ModelArtifactsInfo =
        getModelArtifactsInfoForJSON(modelArtifacts);
    try {
        this.LS.setItem(this.keys.info, JSON.stringify(modelArtifactsInfo));
        this.LS.setItem(this.keys.topology, topology);
        this.LS.setItem(this.keys.weightSpecs, weightSpecs);
        this.LS.setItem(this.keys.weightData, arrayBufferToBase64String(modelArtifacts.weightData));
        const result: ModelArtifacts = {
            format: modelArtifacts.format,
            generatedBy: modelArtifacts.generatedBy,
            convertedBy: modelArtifacts.convertedBy,
            signature: modelArtifacts.signature,
            userDefinedMetadata: modelArtifacts.userDefinedMetadata,
            modelInitializer: modelArtifacts.modelInitializer
        };
        this.LS.setItem(this.keys.modelMetadata, JSON.stringify(result));
        return result;
    } catch (err) {
        this.LS.removeItem(this.keys.info);
        this.LS.removeItem(this.keys.topology);
        this.LS.removeItem(this.keys.weightSpecs);
        this.LS.removeItem(this.keys.weightData);
        this.LS.removeItem(this.keys.modelMetadata);
        throw new Error(`Failed to save model '${this.modelPath}' to local storage:
            size quota being exceeded is a possible cause of this failure: ` +
            `modelTopologyBytes=${modelArtifactsInfo.modelTopologyBytes}, ` +
            `weightSpecsBytes=${modelArtifactsInfo.weightSpecsBytes}, ` +
            `weightDataBytes=${modelArtifacts.weightDataBytes}.`);
    }
  }

  async load(): Promise<ModelArtifacts> {
    const info =
        JSON.parse(this.LS.getItem(this.keys.info)) as ModelArtifactsInfo;
    if (info == null) {
      throw new Error(`In local storage, there is no model with name '${this.modelPath}'`);
    }

    if (info.modelTopologyType !== 'JSON') {
      throw new Error('BrowserLocalStorage does not support
        loading non-JSON model topology yet.');
    }

    const out: ModelArtifacts = {};

    // Load topology.
    const topology = JSON.parse(this.LS.getItem(this.keys.topology));
    if (topology == null) {
      throw new Error(`In local storage, the topology of model '${this.modelPath}' ` +
        `is missing.`);
    }
    out.modelTopology = topology;

    // Load weight specs.
    const weightSpecs =
        JSON.parse(this.LS.getItem(this.keys.weightSpecs));
    if (weightSpecs == null) {
      throw new Error(`In local storage, the weight specs of model
        '${this.modelPath}' are missing.`);
    }
    out.weightSpecs = weightSpecs;

    // Load meta-data fields.
    const metadataString =
        this.LS.getItem(this.keys.modelMetadata);
    if (metadataString != null) {
      const metadata =
        JSON.parse(metadataString) as ModelArtifacts;
      out.format = metadata['format'];
      out.generatedBy = metadata['generatedBy'];
      out.convertedBy = metadata['convertedBy'];
      out.signature = metadata['signature'];
      out.userDefinedMetadata = metadata['userDefinedMetadata'];
    }

    // Load weight data.
    const weightData =
        this.LS.getItem(this.keys.weightData);
weightDataBase64 = this.LS.getItem(this.keys.weightData);
if (weightDataBase64 == null) {
  throw new Error(`In local storage, the binary weight values of model \`${this.modelPath}\` are missing.`);
}
out.weightData = base64StringToArrayBuffer(weightDataBase64);

return out;
}

export const localStorageRouter: IORouter = (url: string|string[]) => {
  if (!env().getBool('IS_BROWSER')) {
    return null;
  } else {
    if (!Array.isArray(url) && url.startsWith(BrowserLocalStorage.URL_SCHEME)) {
      return browserLocalStorage(url.slice(BrowserLocalStorage.URL_SCHEME.length));
    } else {
      return null;
    }
  }
}
IORouterRegistry.registerSaveRouter(localStorageRouter);
IORouterRegistry.registerLoadRouter(localStorageRouter);

/**
 * Factory function for local storage IOHandler.
 *
 * This `IOHandler` supports both `save` and `load`. For each model's saved artifacts, four items are
 * stored in local storage.
 *
 * - `${PATH_SEPARATOR}/${modelPath}/info`: Contains meta-info about the model, such as date saved, type of the
 *   topology, size in bytes, etc.
 * - `${PATH_SEPARATOR}/${modelPath}/weight_specs`: Weight specs of the model, can be used to decode the
 *   saved binary weight values (see item below).
 * - `${PATH_SEPARATOR}/${modelPath}/weight_data`: Concatenated binary weight values, stored as a
 *   base64-encoded string.
 * - `modelPath`: Model topology. For Keras-style models, this is a stringified JSON.
 *
 * Saving may throw an `Error` if the total size of the artifacts exceed the browser-specific quota.
 *
 * @param modelPath A unique identifier for the model to be saved. Must be a non-empty string.
 * @returns An instance of `IOHandler`, which can be used with, e.g., `tf.Model.save`.
 */
export function browserLocalStorage(modelPath: string): IOHandler {
  return new BrowserLocalStorage(modelPath);
}

export class BrowserLocalStorageManager implements ModelStoreManager {
  private readonly LS: Storage;

  constructor() {
    assert(env().getBool('IS_BROWSER'), () => 'Current environment is not a web browser');
    assert(typeof window === 'undefined' || typeof window.localStorage !== 'undefined', () => 'Current browser does not appear to support localStorage');
    this.LS = window.localStorage;
  }

  async listModels(): Promise<{[path: string]: ModelArtifactsInfo}> {
    const out: {[path: string]: ModelArtifactsInfo} = {};
    const prefix = PATH_PREFIX + PATH_SEPARATOR;
    const suffix = PATH_SEPARATOR + INFO_SUFFIX;
    for (let i = 0; i < this.LS.length; ++i) {
      const key = this.LS.key(i);
      if (key.startsWith(prefix) && key.endsWith(suffix)) {
        const modelPath = getModelPathFromKey(key);
        out[modelPath] = JSON.parse(this.LS.getItem(key)) as ModelArtifactsInfo;
      }
    }
    return out;
  }

  async removeModel(path: string): Promise<ModelArtifactsInfo> {
    path = maybeStripScheme(path);
    const keys = getModelKeys(path);
    if (this.LS.getItem(keys.info) == null) {
      throw new Error(`Cannot find model at path '${path}'`);
    }
    const info = JSON.parse(this.LS.getItem(keys.info)) as ModelArtifactsInfo;
    this.LS.removeItem(keys.info);
    this.LS.removeItem(keys.topology);
    this.LS.removeItem(keys.weightSpecs);
    this.LS.removeItem(keys.weightData);
    return info;
  }

  //
  //  Open Source Used In Cisco Meeting Server (formerly Acano Server) 3.4 3560
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  //
  //  ==============================================================

  // Classes and functions for model management across multiple storage mediums
  // Supported client actions:
  // - Listing models on all registered storage mediums
  // - Remove model by URL from any registered storage mediums, by using URL
  // - Moving or copying model from one path to another in the same medium or from
  // one medium to another, by using URL strings
  // import {IORouterRegistry} from './router_registry';
  // import {ModelArtifactsInfo, ModelStoreManager} from './types';
  // import URL_SCIEME_SUFFIX = '/';
  // export class ModelStoreManagerRegistry {
Singleton instance.

private static instance: ModelStoreManagerRegistry;

private static getManager(scheme: string): ModelStoreManager;

private static getInstance(): ModelStoreManagerRegistry {
  return ModelStoreManagerRegistry.instance;
}

private static registerManager(scheme: string, manager: ModelStoreManager) {
  assert(scheme != null, () => 'scheme must not be undefined or null.');
  if (scheme.endsWith(URL_SCHEME_SUFFIX)) {
    scheme = scheme.slice(0, scheme.indexOf(URL_SCHEME_SUFFIX));
  }
  assert(scheme.length > 0, () => 'scheme must not be an empty string.');
  const registry = ModelStoreManagerRegistry.getInstance();
  assert(registry.managers[scheme] == null, () => `A model store manager is already registered for scheme '${scheme}'.`);
  registry.managers[scheme] = manager;
}

private static getManager(scheme: string): ModelStoreManager {
  const manager = this.getInstance().managers[scheme];
  if (manager == null) {
    throw new Error(`Cannot find model manager for scheme '${scheme}'.`);
  }
  return manager;
}

private static getSchemes(): string[] {
  return Object.keys(this.getInstance().managers);
}

/**
 * Helper method for parsing a URL string into a scheme and a path.
 * @param url E.g., 'localstorage://my-model'
 * @returns A dictionary with two fields: scheme and path.
 *   Scheme: e.g., 'localstorage' in the example above.
 *   Path: e.g., 'my-model' in the example above.
 */
function parseURL(url: string): {scheme: string, path: string} {
  if (url.indexOf(URL_SCHEME_SUFFIX) === -1) {
    throw new Error(`The url string provided does not contain a scheme. 
` + `Supported schemes are: ` + `ModelStoreManagerRegistry.getSchemes().join(',')`);
  }
  return {
    scheme: url.split(URL_SCHEME_SUFFIX)[0],
    path: url.split(URL_SCHEME_SUFFIX)[1],
  };
}

async function cloneModelInternal(
    sourceURL: string, destURL: string,
    deleteSource = false): Promise<ModelArtifactsInfo> {
  assert(sourceURL !== destURL, () => `Old path and new path are the same: '${sourceURL}'.`);
  const loadHandlers = IORouterRegistry.getLoadHandlers(sourceURL);
  assert(loadHandlers.length > 0, () => `Copying failed because no load handler is found for source URL ${sourceURL}.`);
  assert(loadHandlers.length < 2, () => `Copying failed because more than one load handler is found for source URL ${sourceURL}.`);
  const loadHandler = loadHandlers[0];
  const saveHandlers = IORouterRegistry.getSaveHandlers(destURL);
  assert(saveHandlers.length > 0, () => `Copying failed because no save handler is found for destination URL ${destURL}.`);
  assert(saveHandlers.length < 2, () => `Copying failed because more than one save handler is found for destination URL ${destURL}.`);
  const saveHandler = saveHandlers[0];
  const sourceScheme = parseURL(sourceURL).scheme;
  const destScheme = parseURL(destURL).scheme;
  const sourcePath = parseURL(sourceURL).path;
  const destPath = parseURL(destURL).path;
  const sameMedium = sourceScheme === destScheme;
  const modelArtifacts = await loadHandler.load();
  if (deleteSource && sameMedium) {
    await ModelStoreManagerRegistry.getManager(sourceScheme).removeModel(sourcePath);
  }
  await saveHandler.save(modelArtifacts);
  if (deleteSource && !sameMedium) {
    await ModelStoreManagerRegistry.getManager(sourceScheme).removeModel(sourcePath);
  }
  return modelArtifacts.modelArtifactsInfo;
}
```typescript
console.log(JSON.stringify(await tf.io.listModels()));

/*
 * @returns A 'Promise' of a dictionary mapping URLs of existing models to
 * their model artifacts info. URLs include medium-specific schemes, e.g.,
 * 'indexeddb://my/model/1'. Model artifacts info include type of the model's topology, byte sizes of the topology, weights, etc.
 * @doc
 * @heading: 'Models'
 * @subheading: 'Management'
 * @namespace: 'io'
 * @ignoreCI: true
 */
async function listModels(): Promise<{[url: string]: ModelArtifactsInfo}> {
  const schemes = ModelStoreManagerRegistry.getSchemes();
  const out: {[url: string]: ModelArtifactsInfo} = {};
  for (const scheme of schemes) {
    const schemeOut = await ModelStoreManagerRegistry.getManager(scheme).listModels();
    for (const path in schemeOut) {
      const url = scheme + URL_SCHEME_SUFFIX + path;
      out[url] = schemeOut[path];
    }
  }
  return out;
}

/**
 * Remove a model specified by URL from a registered storage medium.
 * ```
 * // First create and save a model.
 * const model = tf.sequential();
 * model.add(tf.layers.dense({units: 1, inputShape: [10], activation: 'sigmoid'}));
 * await model.save('localstorage://demo/management/model1');
 *
 * // List models again.
 * console.log(JSON.stringify(await tf.io.listModels()));
 *
 * // Delete the model.
 * await tf.io.removeModel('localstorage://demo/management/model1');
 *
 * // List models again.
 * console.log(JSON.stringify(await tf.io.listModels()));
 * ```
 * @param url A URL to a stored model, with a scheme prefix, e.g.,
 *   'localstorage://my-model-1', 'indexeddb://my/model/2'.
 * @returns ModelArtifactsInfo of the deleted model (if and only if deletion
 *   is successful).
 * @throws Error if deletion fails, e.g., if no model exists at `path`,
 *   or if `oldPath` and `newPath` are identical.
 * @ignoreCI: true
 */
async function removeModel(url: string): Promise<ModelArtifactsInfo> {
  const manager = ModelStoreManagerRegistry.getManager(parseURL(url).scheme);
  return manager.removeModel(parseURL(url).scheme + parseURL(url).path);
}

/**
 * Copy a model from one URL to another.
 * ```
 * // First create and save a model.
 * const model = tf.sequential();
 * model.add(tf.layers.dense({units: 1, inputShape: [10], activation: 'sigmoid'}));
 * await model.save('localstorage://demo/management/model1');
 *
 * // Then list existing models.
 * console.log(JSON.stringify(await tf.io.listModels()));
 *
 * // Copy the model, from Local Storage to IndexedDB.
 * await tf.io.copyModel('localstorage://demo/management/model1',
 *     'indexeddb://demo/management/model1');
 *
 * // List models again.
 * console.log(JSON.stringify(await tf.io.listModels()));
 * ```
 * @param sourceURL Source URL of copying.
 * @param destURL Destination URL of copying.
 * @returns ModelArtifactsInfo of the copied model (if and only if copying
 *   is successful).
 * @throws Error if copying fails, e.g., if no model exists at
 *   `sourceURL`, or if `oldPath` and `newPath` are identical.
 * @ignoreCI: true
 */
async function copyModel(sourceURL: string, destURL: string): Promise<ModelArtifactsInfo> {
  return cloneModelInternal(sourceURL, destURL, false);
}

/**
 * Move a model from one URL to another.
 * ```
 * // First create and save a model.
 * const model = tf.sequential();
 * model.add(tf.layers.dense({units: 1, inputShape: [10], activation: 'sigmoid'}));
 * await model.save('localstorage://demo/management/model1');
 *
 * // Then list existing models.
 * console.log(JSON.stringify(await tf.io.listModels()));
 *
 * // Move the model, from Local Storage to IndexedDB.
 * await tf.io.moveModel('localstorage://demo/management/model1',
 *     'indexeddb://demo/management/model1');
 *
 * // List models again.
 * console.log(JSON.stringify(await tf.io.listModels()));
 * ```
 * @param oldPath Source URL of moving.
 * @param newPath Destination URL of moving.
 * @returns ModelArtifactsInfo of the moved model (if and only if moving
 *   is successful).
 * @throws Error if moving fails, e.g., if no model exists at `oldPath`,
 *   or if `oldPath` and `newPath` are identical.
 * @ignoreCI: true
 */
async function moveModel(oldPath: string, newPath: string): Promise<ModelArtifactsInfo> {
  return cloneModelInternal(oldPath, newPath, true);
}
```

tf.io.removeModel('indexeddb://demo/management/model1');

```javascript

async function moveModel(
  sourceURL: string, destURL: string): Promise<ModelArtifactsInfo> {
  const deleteSource = true;
  return cloneModelInternal(sourceURL, destURL, deleteSource);
}

export {moveModel, copyModel, removeModel, listModels};

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 */

import '../flags';

import {env} from '../environment';
import {BrowserIndexedDB, BrowserIndexedDBManager} from '../io/indexed_db';
import {BrowserLocalStorage, BrowserLocalStorageManager} from '../io/local_storage';
import {ModelStoreManagerRegistry} from '../io/model_management';

import {Platform} from './platform';

export class PlatformBrowser implements Platform {
  // According to the spec, the built-in encoder can do only UTF-8 encoding.
  private textEncoder: TextEncoder;

  fetch(path: string, init?: RequestInit): Promise<Response> {
    return fetch(path, init);
  }

  now(): number {
    return performance.now();
  }

  encode(text: string, encoding: string): Uint8Array {
    if (encoding !== 'utf-8' && encoding !== 'utf8') {
      throw new Error(`Browser's encoder only supports utf-8, but got ${encoding}`);
    }
    if (this.textEncoder == null) {
      this.textEncoder = new TextEncoder();
    }
    return this.textEncoder.encode(text);
  }

  decode(bytes: Uint8Array, encoding: string): string {
    return new TextDecoder(encoding).decode(bytes);
  }
}

if (env().get('IS_BROWSER')) {
  env().setPlatform('browser', new PlatformBrowser());

  // Register LocalStorage IOHandler
  try {
    ModelStoreManagerRegistry.registerManager(BrowserLocalStorage.URL_SCHEME, new BrowserLocalStorageManager());
  } catch (err) {
  }

  // Register IndexedDB IOHandler
  try {
    ModelStoreManagerRegistry.registerManager(BrowserIndexedDB.URL_SCHEME, new BrowserIndexedDBManager());
  } catch (err) {
  }
}

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 * permissions and limitations under the License.
 */

import {env} from '../environment';

import {Platform} from './platform';

// We are wrapping this within an object so it can be stubbed by Jasmine.
export const getNodeFetch = {
  // tslint:disable-next-line:no-require-imports
  importFetch: () => require('node-fetch')
};

type FetchFn = (url: string, init?: RequestInit) => Promise<Response>;
let systemFetch: FetchFn;
// These getters and setters are for testing so we don't export a mutable variable.
export function resetSystemFetch() {
  systemFetch = null;
}
export function setSystemFetch(fetchFn: FetchFn) {
  systemFetch = fetchFn;
}
export function getSystemFetch(): FetchFn {
  return systemFetch;
}

export class PlatformNode implements Platform {
  private textEncoder: TextEncoder;
  util: any;

  constructor() {
    // tslint:disable-next-line:no-require-imports
    this.util = require('util');
    // According to the spec, the built-in encoder can do only UTF-8 encoding.
  }

  fetch(path: string, init?: RequestInit): Promise<Response> {
    return getSystemFetch().fetch(path, init);
  }

  now(): number {
    return performance.now();
  }

  encode(text: string, encoding: string): Uint8Array {
    if (encoding !== 'utf-8' && encoding !== 'utf8') {
      throw new Error(`Node's encoder only supports utf-8, but got ${encoding}`);
    }
    if (this.textEncoder == null) {
      this.textEncoder = new TextEncoder();
    }
    return this.textEncoder.encode(text);
  }

  decode(bytes: Uint8Array, encoding: string): string {
    return new TextDecoder(encoding).decode(bytes);
  }
}

if (env().get('IS_NODE')) {
  env().setPlatform('node', new PlatformNode());

  // Register FileSystem IOHandler
  try {
    ModelStoreManagerRegistry.registerManager(BrowserLocalStorage.URL_SCHEME, new BrowserLocalStorageManager());
  } catch (err) {
  }

  // Register IndexedDB IOHandler
  try {
    ModelStoreManagerRegistry.registerManager(BrowserIndexedDB.URL_SCHEME, new BrowserIndexedDBManager());
  } catch (err) {
  }
}

```
*\n
**\n
* IOHandlers related to files, such as browser-triggered file downloads, user-selected files in browser.

```javascript
import '../flags';
import {env} from '../environment';

import { basename, concatenateArrayBuffers, getModelArtifactsInfoForJSON } from '../io_utils';
import { IORouter, IORouterRegistry } from './router_registry';
import { IOHandler, ModelArtifacts, ModelJSON, SaveResult, WeightsManifestConfig, WeightsManifestEntry } from './types';

const DEFAULT_FILE_NAME_PREFIX = 'model';
const DEFAULT_JSON_EXTENSION_NAME = '.json';
const DEFAULT_WEIGHT_DATA_EXTENSION_NAME = '.weights.bin';

function defer<T>(f: () => T): Promise<T> {
  return new Promise(resolve =>
    setTimeout(resolve)).then(f);
}

export class BrowserDownloads implements IOHandler {
  private readonly modelTopologyFileName: string;
  private readonly weightDataFileName: string;
  private readonly jsonAnchor: HTMLAnchorElement;
  private readonly weightDataAnchor: HTMLAnchorElement;

  static readonly URL_SCHEME = 'downloads://';

  constructor(fileNamePrefix?: string) {
    if (!env().getBool('IS_BROWSER')) {
      // TODO(cais): Provide info on what IOHandlers are available under the current environment
      throw new Error('browserDownloads() cannot proceed because the current environment is not a browser.');
    }

    if (fileNamePrefix.startsWith(BrowserDownloads.URL_SCHEME)) {
      fileNamePrefix = fileNamePrefix.slice(BrowserDownloads.URL_SCHEME.length);
    }
    if (fileNamePrefix == null || fileNamePrefix.length === 0) {
      fileNamePrefix = DEFAULT_FILE_NAME_PREFIX;
    }

    this.modelTopologyFileName = fileNamePrefix + DEFAULT_JSON_EXTENSION_NAME;
    this.weightDataFileName = fileNamePrefix + DEFAULT_WEIGHT_DATA_EXTENSION_NAME;
  }

  async save(modelArtifacts: ModelArtifacts): Promise<SaveResult> {
    if (typeof (document) === 'undefined') {
      throw new Error('Browser downloads are not supported in this environment since `document` is not present');
    }
    const weightsURL = window.URL.createObjectURL(new Blob([modelArtifacts.weightData], {type: 'application/octet-stream'}));

    if (modelArtifacts.modelTopology instanceof ArrayBuffer) {
      throw new Error('BrowserDownloads.save() does not support saving model topology in binary formats yet.');
    } else {
      const weightsManifest = {
        paths: ['./' + this.weightDataFileName],
        weights: modelArtifacts.weightSpecs
      };
      const weights = modelArtifacts.weights;
      const modelTopologyAndWeightManifest: ModelJSON = {
        modelTopology: modelArtifacts.modelTopology,
        format: modelArtifacts.format,
        generatedBy: modelArtifacts.generatedBy,
        convertedBy: modelArtifacts.convertedBy,
        weightsManifest
      };
      if (modelArtifacts.signature != null) {
        modelTopologyAndWeightManifest.signature = modelArtifacts.signature;
      }
      if (modelArtifacts.userDefinedMetadata != null) {
        modelTopologyAndWeightManifest.userDefinedMetadata = modelArtifacts.userDefinedMetadata;
      }
      if (modelArtifacts.modelInitializer != null) {
        modelTopologyAndWeightManifest.modelInitializer = modelArtifacts.modelInitializer;
      }
      const modelTopologyAndWeightManifestURL = window.URL.createObjectURL(new Blob([JSON.stringify(modelTopologyAndWeightManifest)], {type: 'application/json'}));

      // If anchor elements are not provided, create them without attaching them to parents, so that the downloaded file names can be controlled
      const jsonAnchor = this.jsonAnchor == null ? document.createElement('a') : this.jsonAnchor;
      jsonAnchor.download = this.modelTopologyFileName;
      jsonAnchor.href = modelTopologyAndWeightManifestURL;
      // Trigger downloads by evoking a click event on the download anchors.
      // When multiple downloads are started synchronously, Firefox will only save the last one.
      await defer(() => jsonAnchor.dispatchEvent(new MouseEvent('click')));
      if (modelArtifacts.weightData != null) {
        const weightDataAnchor = this.weightDataAnchor == null ? document.createElement('a') : this.weightDataAnchor;
        weightDataAnchor.download = this.weightDataFileName;
        weightDataAnchor.href = weightsURL;
        await defer(() => weightDataAnchor.dispatchEvent(new MouseEvent('click')));
        return {modelArtifactsInfo: getModelArtifactsInfoForJSON(modelArtifacts)};
      }
    }
  }
}
```
Error(`When calling browserFiles, at least 1 file is required.`) +
  `but received ${files}`);
  }
}

const jsonFile = this.files[0];
const weightFiles = this.files.slice(1);
return new Promise<ModelArtifacts>((resolve, reject) => {
  const jsonReader = new FileReader();
  jsonReader.onload = (event: Event) => {
    // tslint:disable-next-line:no-any
    const modelJSON = JSON.parse((event.target as any).result) as ModelJSON;
    const modelTopology = modelJSON.modelTopology;
    if (modelTopology === null) {
      reject(new Error(`modelTopology field is missing from file '${jsonFile.name}'`));
    } else {
      const weightsManifest = modelJSON.weightsManifest;
      if (weightsManifest === null) {
        reject(new Error(`weightManifest field is missing from file '${jsonFile.name}'`));
      } else {
        const perFileBuffers: ArrayBuffer[] = [];
        const paths = modelTopology.paths;
        const weightFiles = weightFiles.slice(1);
        for (let i = 0; i < paths.length; i++) {
          const path = paths[i];
          const pathBasename = basename(path);
          if (basenames.indexOf(pathBasename) !== -1) {
            throw new Error(`Duplicate file basename found in weights manifest: '${pathBasename}'`);
          }
          basenames.push(pathBasename);
          if (fileNames.indexOf(pathBasename) === -1) {
            const weightFileReader = new FileReader();
            weightFileReader.onload = (event: Event) => {
              // tslint:disable-next-line:no-any
              const weightData = (event.target as any).result as ArrayBuffer;
              const index = paths.indexOf(path);
              perFileBuffers[index] = weightData;
              if (perFileBuffers.indexOf(null) === -1) {
                const result: ModelArtifacts = {
                  modelTopology,
                  weightSpecs,
                  weightData: concatenateArrayBuffers(perFileBuffers),
                  format: modelJSON.format,
                  generatedBy: modelJSON.generatedBy,
                  convertedBy: modelJSON.convertedBy,
                  modelInitializer: modelJSON.modelInitializer,
                }; if (modelJSON.signature != null) {
                  result.signature = modelJSON.signature;
                }
                if (modelJSON.userDefinedMetadata != null) {
                  result.userDefinedMetadata = modelJSON.userDefinedMetadata;
                }
                resolve(result);
              }
            }; weightFileReader.onerror = error => reject(`Failed to weights data from file of path '${path}'.`);
            weightFileReader.readAsArrayBuffer(weightFiles[i]);
          }
        }
        if (basenames.length !== weightFiles.length) {
          throw new Error(`Mismatch in the number of files in weights manifest (${basenames.length}) and the number of weight files provided (${weightFiles.length}).`);
        }
      }
    }
  });
  jsonReader.readAsText(jsonFile);
});

/**
 * Creates an IOHandler that saves a file.
 */
export const browserDownloadsRouter: IORouter = (url: string|string[]) => {
  if (!env().getBool('IS_BROWSER')) {
    return null;
  } else {
    if (!Array.isArray(url) && url.startsWith(BrowserDownloads.URL_SCHEME)) {
      return browserDownloads(url.slice(BrowserDownloads.URL_SCHEME.length));
    } else {
      return null;
    }
  }
};
IORouterRegistry.registerSaveRouter(browserDownloadsRouter);

/**
 * Creates an IOHandler that...
triggers file downloads from the browser.

The returned `IOHandler` instance can be used as model exporting methods such as `tf.Model.save` and supports only saving.

```js
const model = tf.sequential();
model.add(tf.layers.dense({ units: 1, inputShape: [10], activation: 'sigmoid' }));
const saveResult = await model.save('downloads://mymodel');
```

This will trigger downloading of two files:

- `mymodel.json` and `mymodel.weights.bin`

For triggering downloads:

- `fileNamePrefix` should follow either of the following two formats:
  - 1. `null` or `undefined`, in which case the default file name will be used:
    - `model.json` for the JSON file containing the model topology and
    - `model.weights.bin` for the binary file containing the binary weight values
  - 2. A single string or an Array of a single string, as the file name prefix.

Example, if `fileNamePrefix` is `foo`, the downloaded JSON file will be named `foo.json` and the binary weights file will be named `foo.weights.bin`, respectively.

```js
const saveResult = await model.save('downloads://mymodel');
```

For additional configuration for triggering downloads:

- `config` can be used to specify additional configurations

```js
model.save('downloads://mymodel', { config: { ... } });
```

- `heading` specifies the loading file name prefix:

```js
model.save('downloads://mymodel', { config: { ... }, heading: 'Model' });
```

- `subheading` specifies the loading file name prefix:

```js
model.save('downloads://mymodel', { config: { ... }, subheading: 'Export' });
```

At the top of the file is the license information:

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 * Unless required by applicable law or agreed to in writing, software distributed under the License is distributed on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied. See the License for the specific language governing permissions and limitations under the License. */

import {assert} from '../util';
import {OnProgressCallback} from './types';

export function monitorPromisesProgress(promises: Array<Promise<{}|void>>, onProgress: OnProgressCallback, startFraction?: number, endFraction?: number) {
  checkPromises(promises);
  startFraction = startFraction == null ? 0 : startFraction;
  endFraction = endFraction == null ? 1 : endFraction;
  checkFraction(startFraction, endFraction);
  let resolvedPromise = 0;

  promises.forEach(promise => {
    promise.then(() => {
      const fraction = startFraction +
          ++resolvedPromise / promises.length *
          (endFraction - startFraction);
      onProgress(fraction);
    });
  });
}

export function browserDownloads(fileNamePrefix = 'model'): IOHandler {
  return new BrowserDownloads(fileNamePrefix);
}

export function browserFiles(files: File[]): IOHandler {
  return new BrowserFiles(files);
}

=============================================================================

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(endFraction - startFraction);\n   // pass fraction as parameter to callback function.\n   onProgress(fraction);\n return value;\n });\n return promise;\n });\n function checkPromises(promises: ArrayPromise<{}|void>):\n void {\n assert(\n promises != null && Array.isArray(promises) && promises.length > 0,\n () =>\n \n 'promises must be a non empty array');\n }\n function checkFraction(startFraction: number, endFraction: number):\n void {\n assert(\n startFraction >= 0 && startFraction <= 1,\n () =>\n \n 'startFraction must be in range [0, 1], but ' +\n \n 'got startFraction ' +\n \n '{startFraction}');\n \n assert(\n endFraction >= 0 &&\n endFraction <= 1,\n () =>\n \n 'endFraction must be in range [0, 1], but ' +\n \n 'got endFraction' +\n \n '{endFraction}');\n \n return Promise.all(promises.map(registerMonitor));\n }\n */

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import {env} from '../environment';

import {NamedTensorMap} from '../tensor_types';
import * as util from '../util';
import {decodeWeights} from './io_utils';
import {monitorPromisesProgress} from './progress';
import {DTYPE_VALUE_SIZE_MAP, LoadOptions, WeightsManifestConfig, WeightsManifestEntry} from './types';

/**\n * Reads binary weights data from a number of URLs.
 * \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 length as the `fetchURLs`.\n * @export\n */
export async function loadWeightsAsArrayBuffer(
    fetchURLs: string[],
    loadOptions?: LoadOptions): Promise<ArrayBuffer[]> {
  if (loadOptions == null) {
    loadOptions = {};
  }

  const fetchFunc = loadOptions.fetchFunc == null ? env().platform.fetch :
      loadOptions.fetchFunc;

  // Create the requests for all of the weights in parallel.
  const requests = fetchURLs.map(\n      fetchURL =>\n          fetchFunc(fetchURL, loadOptions.requestInit, {isBinary: true}));

  const fetchStartFraction = 0;
  const fetchEndFraction = 0.5;

  const responses = loadOptions.onProgress == null ?
      await Promise.all(requests) :
      await monitorPromisesProgress(
          requests, loadOptions.onProgress,
          fetchStartFraction,
          fetchEndFraction);

  const bufferPromises = responses.map(response =>\n      response.arrayBuffer());

  const bufferStartFraction = 0.5;
  const bufferEndFraction = 1;

  const buffers = loadOptions.onProgress == null ?
      await Promise.all(bufferPromises) :
      await monitorPromisesProgress(
          bufferPromises, loadOptions.onProgress,\n          bufferStartFraction,\n          bufferEndFraction);\n return buffers;
}

/**\n * Reads a weights manifest JSON configuration, fetches the weight files using the specified\n * function and returns them as `Tensor`s.\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 * @param requestOptions RequestInit (options) for the HTTP requests.\n * @returns A `Promise` of an Array of `NamedTensorMap`. The Array has the same length as the `manifest.loads`.\n */
export async function loadWeights(
    manifest: WeightsManifestConfig,
    filePathPrefix = '',
    weightNames?: string[],
    requestInit?: RequestInit): Promise<NamedTensorMap> {
  //\n  // TODO(nsthorat): Groups are currently fetched atomically. If you need a single weight from a group, the whole\n  // 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      ArrayBuffer[] =>\n  {\n    const fetchedWeights = (fetchUrls: string[]):\n        ArrayBuffer[] =>\n   {\n     const weightNames = manifest.loads;\n     return loadWeights(manifest,\n         weightNames);\n   }\n   return fetchedWeights[\n       manifest.loads.length - 1];\n }\n return fetchWeights(fetchUrls.map(\n      fetchURL =>\n          fetchFunc(fetchURL, requestInit, \n   {isBinary: true}));

  const fetchStartFraction = 0;
  const fetchEndFraction = 0.5;

  const responses = loadOptions.onProgress == null ?
      await Promise.all(requests) :
      await monitorPromisesProgress(
          requests, loadOptions.onProgress,\n          fetchStartFraction,\n          fetchEndFraction);

  const bufferPromises = responses.map(response =>\n      response.arrayBuffer());

  const bufferStartFraction = 0.5;
  const bufferEndFraction = 1;

  const buffers = loadOptions.onProgress == null ?
      await Promise.all(bufferPromises) :
      await monitorPromisesProgress(
          bufferPromises, loadOptions.onProgress,\n          bufferStartFraction,\n          bufferEndFraction);\n return buffers;
}
```js
// example for creating a nodejs weight loader, which reads the weight files
const fetchWeightsFromDisk = (filePaths) => { return filePaths.map(filepath => fs.readFileSync(filepath).buffer); }

const loadWeights = tf.io.weightsLoaderFactory(fetchWeightsFromDisk);

loadWeights(manifest, '/' + manifest.filename).then(weightMap => { return weightMap; });

/*@
 * @param fetchWeightsFunction The function used for fetching the weight files.
 * @returns Weight loading function.
 */
export function weightsLoaderFactory(fetchWeightsFunction) {
    return async manifest => { return await fetchWeightsFunction(manifest.paths); }
}
```

```js
import * as fs from 'fs';

const fetchWeightsFromDisk = (filePaths) => { return filePaths.map(filePath => fs.readFileSync(filePath).buffer); }

const loadWeights = tf.io.weightsLoaderFactory(fetchWeightsFromDisk);

loadWeights(manifest, './my_model-weights_manifest').then(weightMap => { return weightMap; });

/*@
 * tf.io.weightsLoaderFactory(fetchWeightsFromDisk)
 */
```
/**
 * IOHandler implementations based on HTTP requests in the web browser.
 *
 */

import {env} from '../environment';

import {assert} from '../util';
import {concatenateArrayBuffers, getModelArtifactsInfoForJSON} from './io_utils';
import {IORouter, IORouterRegistry} from './router_registry';
import {IOHandler, LoadOptions, ModelArtifacts, ModelJSON, OnProgressCallback, SaveResult, WeightsManifestConfig, WeightsManifestEntry} from './types';
import {loadWeightsAsArrayBuffer} from './weights_loader';

const OCTET_STREAM_MIME_TYPE = 'application/octet-stream';
const JSON_TYPE = 'application/json';

export class HTTPRequest implements IOHandler {
  protected readonly path: string;
  protected readonly requestInit: RequestInit;

  private readonly fetch: Function;
  private readonly weightUrlConverter: (weightName: string) => Promise<string>;

  readonly DEFAULT_METHOD = 'POST';

  static readonly URL_SCHEME_REGEX = /^https?:\/\//;

  private readonly weightPathPrefix: string;
  private readonly onProgress: OnProgressCallback;

  constructor(path: string, loadOptions?: LoadOptions) {
    if (loadOptions == null) {
      loadOptions = {};
    }
    this.weightPathPrefix = loadOptions.weightPathPrefix;
    this.onProgress = loadOptions.onProgress;
    this.weightUrlConverter = loadOptions.weightUrlConverter;

    if (loadOptions.fetchFunc != null) {
      assert(
          typeof loadOptions.fetchFunc === 'function',
          () => 'Must pass a function that matches the signature of ' +
            '`fetch` (see ' +
        this.fetch = loadOptions.fetchFunc;
      }
      else {
        this.fetch = env().platform.fetch;
      }

      assert(
          path != null && path.length > 0,
          () => 'URL path for http must not be null, undefined or ' +
            'empty.');

      if (Array.isArray(path)) {
        assert(
            path.length === 2,
            () => 'URL paths for http must have a length of 2, ' +
              `(actual length is ${path.length}).`);
      }
      this.path = path;

      if (loadOptions.requestInit != null &&
          loadOptions.requestInit.body != null) {
        throw new Error(
            'requestInit is expected to have no pre-
            existing body, but has one.');
      }
      this.requestInit = loadOptions.requestInit || {};
  }

  async save(modelArtifacts: ModelArtifacts): Promise<SaveResult> {
    if (modelArtifacts.modelTopology instanceof ArrayBuffer) {
      throw new Error(
          'BrowserHTTPRequest.save() does not support saving model topology ' +
          'in binary formats yet.');
    }

    const init = Object.assign({method: this.DEFAULT_METHOD},
      this.requestInit);
    init.body = new FormData();

    const weightsManifest: WeightsManifestConfig = [{
      paths: ['./model.weights.bin'],
      weights: modelArtifacts.weightSpecs,
    }];
    const modelTopologyAndWeightManifest: ModelJSON = {
      modelTopology: modelArtifacts.modelTopology,
      format: modelArtifacts.format,
      generatedBy: modelArtifacts.generatedBy,
      convertedBy: modelArtifacts.convertedBy,
      weightsManifest
    };
    if (modelArtifacts.signature != null) {
      modelTopologyAndWeightManifest.signature = modelArtifacts.signature;
    }
    if (modelArtifacts.userDefinedMetadata != null) {
      modelTopologyAndWeightManifest.userDefinedMetadata = modelArtifacts.userDefinedMetadata;
    }

    init.body.append('
      model.json',
      new Blob([JSON.stringify(modelTopologyAndWeightManifest)],
        {type: OCTET_STREAM_MIME_TYPE}));

    if (modelArtifacts.weightData != null) {
      init.body.append('
        model.weights.bin',
      new Blob([modelArtifacts.weightData],
        {type: OCTET_STREAM_MIME_TYPE}));
    }

    const response = await this.fetch(this.path, init);

    if (response.ok) {
      return {
        modelArtifactsInfo: getModelArtifactsInfoForJSON(modelArtifacts),
        responses: [response],
      };
    } else
      throw new Error(response.statusText);
  }
}
`BrowserHTTPRequest.save()` failed due to HTTP response status ` +
`).
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```
`fetch` or `node-fetch`, if one wants to use it in
a global fetch polyfill. return null; else { let isHTTP = true; if (Array.isArray(url)) { isHTTP = url.every(urlItem => isHTTPScheme(urlItem)); } } else { isHTTP = isHTTPScheme(url); } if (isHTTP) { return http(url, loadOptions); } return null;

IORouterRegistry.registerSaveRouter(httpRouter);
IORouterRegistry.registerLoadRouter(httpRouter);

/**
 * Creates an IOHandler subtype that sends model artifacts to HTTP server.
 */

export function http(path: string, loadOptions?: LoadOptions): IOHandler {
  return new HTTPRequest(path, loadOptions);
}

/**
 */

export function browserHTTPRequest(path: string, loadOptions?: LoadOptions): IOHandler {
  return http(path, loadOptions);
}
Promise<ModelArtifacts> { return this.modelArtifacts; }
}]

class PassthroughSaver implements IOHandler { constructor(private readonly saveHandler: (artifacts: ModelArtifacts) => Promise<SaveResult>) {}

async save(modelArtifacts: ModelArtifacts) { return this.saveHandler(modelArtifacts); }
}]

/**
 * Creates an IOHandler that loads model artifacts from memory.
 * When used in conjunction with `tf.loadLayersModel`, an instance of `tf.LayersModel` (Keras-style) can be constructed from the loaded artifacts.
 * 
 * @param modelArtifacts A object containing model topology (i.e., parsed from JSON format).
 * @param weightSpecs An array of `WeightsManifestEntry` objects describing the names, shapes, types, and quantization of the weight data.
 * @param trainingConfig A single `ArrayBuffer` containing the weight data, concatenated in the order described by the weightSpecs.
 * @param modelArtifacts A passthrough `IOHandler` that simply loads the provided data.
 * 
 * @returns A passthrough `IOHandler` that simply loads the provided data.
 * 
 * @example
 * ```js
 * const model = await tf.loadLayersModel(tf.io.fromMemory(
 *     modelTopology, weightSpecs, weightData));
 * ```
 * 
 * @api
 */
export function fromMemory(
  modelArtifacts: {}|ModelArtifacts, weightSpecs?: WeightsManifestEntry[],
  weightData?: ArrayBuffer,
  trainingConfig?: TrainingConfig): IOHandler {
  if (arguments.length === 1) {
    const isModelArtifacts = (modelArtifacts as ModelArtifacts).modelTopology != null;
    if (isModelArtifacts) {
      return new PassthroughLoader(modelArtifacts as ModelArtifacts);
    } else {
      // Legacy support: with only modelTopology.
      return new PassthroughLoader({modelTopology: modelArtifacts as {}});
    }
  } else {
    // Legacy support.
    return new PassthroughLoader({
      modelTopology: modelArtifacts as {},
      weightSpecs,
      weightData,
      trainingConfig
    });
  }
}

/**
 * Creates an IOHandler that passes saved model artifacts to a callback.
 * 
 * ```js
 * function handleSave(artifacts) {
 *   // ... do something with the artifacts ...
 *   return {modelArtifactsInfo: {...}, ...};
 * }
 *
 * const saveResult = model.save(tf.io.withSaveHandler(handleSave));
 * ```
 * 
 * @param saveHandler A function that accepts a `ModelArtifacts` and returns a `SaveResult`.
 */
export function withSaveHandler(
  saveHandler: (artifacts: ModelArtifacts) => Promise<SaveResult>): IOHandler {
  return new PassthroughSaver(saveHandler);
}

/*=============================================================================

// Importing local_storage and indexed_db is necessary for the routers to be registered.
import './indexed_db';
import './local_storage';

import {browserFiles} from './browser_files';
import {browserHTTPRequest, http, isHTTPScheme} from './http';
import {concatenateArrayBuffers, decodeWeights, encodeWeights, getModelArtifactsInfoForJSON} from './io_utils';
import {fromMemory, withSaveHandler} from './passthrough';
import {getLoadHandlers, getSaveHandlers, registerLoadRouter, registerSaveRouter} from './router_registry';
import {IOHandler, LoadHandler, LoadOptions, ModelArtifacts, ModelArtifactsInfo, ModelJSON, ModelStoreManager, OnProgressCallback, SaveConfig, SaveHandler, SaveResult, WeightGroup, WeightsManifestConfig, WeightsManifestEntry} from './types';
import {loadWeights, weightsLoaderFactory} from './weights_loader';

export {copyModel, listModels, moveModel, removeModel} from './model_management';
export {
  browserFiles,
  browserHTTPRequest,
  concatenateArrayBuffers,
  decodeWeights,
  encodeWeights,
  getLoadHandlers,
  getSaveHandlers,
  registerLoadRouter,
  registerSaveRouter,
  getModelArtifactsInfo,
  fromModel,
  listModels,
  moveModel,
  removeModel,
  weightsLoaderFactory
} from './weights_loader';

export {copyModel, listModels, moveModel, removeModel} from './model_management';
decodeWeights, encodeWeights, fromMemory, getLoadHandlers, getModelArtifactsInfoForJSON, getSaveHandlers, http, IOHandler, iHTTPScheme, LoadHandler, LoadOptions, loadWeights, ModelArtifacts, ModelArtifactsInfo, ModelJSON, ModelStoreManager, OnProgressCallback, registerLoadRouter, registerSaveRouter, RequestDetails, SaveConfig, SaveHandler, SaveResult, WeighGroup, weightsLoaderFactory, WeightsManifestConfig, WeightsManifestEntry, withSaveHandler);

"/**
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 * Unless required by applicable law or agreed to in writing, software distributed under the License is distributed on an \"AS IS\" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied. See the License for the specific language governing permissions and limitations under the License.
 */

import {ENGINE} from '../engine';
import {BatchMatMul, BatchMatMulAttrs, BatchMatMulInputs} from '../kernel_names';
import {NamedAttrMap} from '../kernel_registry';
import {Tensor} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {makeTypesMatch} from '../tensor_util';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';

import {op} from './operation';

/**
 * Computes the dot product of two matrices, A * B. These must be matrices.
 *
 * ```js
 * const a = tf.tensor2d([[1, 2]], [1, 2]);
 * const b = tf.tensor2d([[1, 2], [3, 4]], [2, 2]);
 *
 * a.matMul(b).print();
 * ```
 * @param a First matrix in dot product operation.
 * @param b Second matrix in dot product operation.
 * @param transposeA If true, `a` is transposed before multiplication.
 * @param transposeB If true, `b` is transposed before multiplication.
 *
 * @doc {heading: 'Operations', subheading: 'Matrices'}
 */
function matMul_<T extends Tensor>(a: Tensor|TensorLike, b: Tensor|TensorLike, transposeA = false, transposeB = false): T {
  let $a = convertToTensor(a, 'a', 'matMul');
  let $b = convertToTensor(b, 'b', 'matMul');
  [$a, $b] = makeTypesMatch($a, $b);

  const inputs: BatchMatMulInputs = {a: $a, b: $b};
  const attrs: BatchMatMulAttrs = {transposeA, transposeB};

  return ENGINE.runKernel(BatchMatMul, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);
}

export const matMul = op({matMul_});

/**
 * Creates a one-hot `tf.Tensor`. The locations represented by `indices` take value `onValue` (defaults to 1), while all other locations take value `offValue` (defaults to 0). If `indices` is rank `R`, the output has rank `R+1` with the last axis of size `depth`.
 *
 * ```js
 * tf.oneHot(tf.tensor1d([0, 1], 'int32'), 3).print();
 * ```
 *
 * @param indices `tf.Tensor` of indices with dtype `int32`.
 * @param depth The depth of the one hot dimension.
 * @param onValue A number used to fill in the output when the index matches the location.
 * @param offValue A number used to fill in the output when the index does not match the location.
 *
 * @doc {heading: 'Tensors', subheading: 'Creation'}
 */
function oneHot_(indices: Tensor|TensorLike, depth: number, onValue = 1, offValue = 0): Tensor {
  if (depth < 2) {
    throw new Error(`Error in oneHot: depth must be >=2, but it is ${depth}`);
  }

  const matMul = op(matMul_);

  const inputs = [indices, depth);
  const attrs: OneHotAttrs = {onValue, offValue};

  return ENGINE.runKernel(OneHot, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);
}

export const oneHot = op({oneHot_});
unknown as NamedTensorMap,\n    attr as unknown as NamedAttrMap);\n\nexport const oneHot = op({oneHot_});\n\nconst attrs as unknown as NamedAttrMap;\n\n// Copied and distributed under an "AS IS" BASIS,\n// WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n// See the License for the specific language governing permissions and\n// limitations under the License.

import {ENGINE} from './engine';\nimport {Transpose, TransposeAttrs, TransposeInputs} from './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './types';\nimport {convertToTensor} from './tensor_util_env';\nimport {NamedTensorMap} from './tensor_types';\nimport {TensorLike} from './types';\nimport {Tensor} from './types';\nimport {convertToTensor} from './util';\nimport {op} from './operation';\n\n/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License"); you * may not use this file except in compliance with the License.\n * You may obtain a copy of the License at http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */

import {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 {TensorLike} from '../types';\nimport * as util from '../util';\n
import {op} from './operation';\n
/**\n * Transposes the `tf.Tensor`. Permutes the dimensions according to `perm`.\n * The returned `tf.Tensor`'s dimension `i` will correspond to the input\n * `n-1...0` basis, where `n` is the rank of the input `tf.Tensor`.\n * Hence by default, this operation performs a regular matrix transpose on 2-D\n * input `tf.Tensor`.\n * Permutes the dimensions according to `perm`.\n * The returned `tf.Tensor`'s dimension `i` will correspond to the\n * input `n-1...0` basis, where `n` is the rank of the input `tf.Tensor`.\n * Hence by default, this\n */

import {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 {TensorLike} from '../types';\nimport * as util from '../util';\n
import {cast} from './cast';\nimport {matMul} from './mat_mul';\nimport {oneHot} from './one_hot';\nimport {op} from './operation';\nimport {transpose} from './transpose';\n
/**\n * Computes the confusion matrix from true labels and predicted labels.\n * ```js\n * const labels = tf.tensor1d([0, 1, 2, 1, 0], 'int32');\n * const predictions = tf.tensor1d([0, 2, 2, 1, 0], 'int32');\n * const numClasses = 3;\n * const predictions = tf.tensor1d([0, 2, 2, 1, 0], 'int32');\n * const numClasses = 3;\n * const confusionMatrix = tf.math.confusionMatrix(predictions, numClasses);\n * confusionMatrix.print();\n * // Expected output matrix:\n * // \n * // [2, 0, 0] \n * // [0, 1, 1] \n * // [0, 0, 1] \n * \n * Computes the confusion matrix from true labels and predicted labels.\n * ```
 * numExamples is the number of examples included.\n * @returns The confusion matrix as a int32-type 2D tensor. The value at\n * 0-based integers for the classes. Must have the same shape as `labels`.\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\n * class `c` \n * were predicted as class `r`.\n */

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Tensor1D|TensorLike,
    numClasses: number): Tensor2D {
  const $labels = convertToTensor(labels, 'labels', 'confusionMatrix');
  const $predictions = convertToTensor(predictions, 'predictions', 'confusionMatrix');

  util.assert($numClasses !== null && $numClasses > 0 & & Number.isInteger($numClasses), () => `If provided, numClasses must be a positive integer, but got ${$numClasses}`);
  util.assert($labels.rank === 1, () => `Expected the rank of labels to be 1, but got ${$labels.rank}`);
  util.assert($predictions.rank === 1, () => `Expected the rank of predictions to be 1, but got ${$predictions.rank}`);

  const $labels.shape[0] === $predictions.shape[0], () => `Mismatch in the number of examples: ${$labels.shape[0]} vs. ${$predictions.shape[0]}. Labels and predictions should have the same number of elements.`);
  util.assert(numClasses > 0 & & Number.isInteger(numClasses), () => `numClasses is required to be a positive integer, but got ${numClasses}`);

  const oneHotLabels = oneHot(cast($labels, 'int32'), numClasses) as Tensor2D;
  const oneHotPredictions = oneHot(cast($predictions, 'int32'), numClasses) as Tensor2D;
  const oneHotLabelsT: Tensor2D = transpose(oneHotLabels);
  const product: Tensor2D = matMul(oneHotLabelsT, oneHotPredictions);

  return cast(product, 'int32');
}

export const confusionMatrix = op({confusionMatrix_});
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* limitations under the License.
*
=============================================================================

*/

import {ENGINE} from '../engine';
import {FromPixels, FromPixelsAttrs, FromPixelsInputs} from
'../kernel_names';
import {getKernel, NamedAttrMap} from '../kernel_registry';
import {Tensor, Tensor3D, TensorFlow} from '../tensor';
import {namedTensorMap} from '../tensor_types';
import {convertToTensor} from '../tensor_util_env';
import {PixelData, PixelData, TensorLike} from '../types';

import {cast} from './cast';
import {op} from './operation';
import {tensor3d} from './tensor3d';

let fromPixels2DContext:
CanvasRenderingContext2D;

/**
 * Creates a `tf.Tensor` from an image.
 * @param pixels The input image to construct the
tensor from. The
 * supported image types are all 4-channel. You can also pass in an image
 * object with
 * following attributes:
 * data: Uint8Array, width: number, height: number
 * @param numChannels The
 * number of channels of the output tensor. A numChannels value less than 4 allows you to ignore channels.

 * Defaults to 3 (ignores alpha channel of input image).
 */
function fromPixels_(
    pixels:
PixelData|ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement|ImageBitmap,

    numChannels = 3): Tensor3D {
  // Sanity checks.
  if (numChannels > 4) {
    throw new Error(`Cannot construct Tensor with more than 4 channels from pixels.`);
  }
  if (pixels == null) {
    throw new Error('pixels
passed to tf.browser.fromPixels() can not be null');
  }
  let isPixelData = false;
  let isImageData = false;
  let
isVideo = false;
  let isCanvasLike = false;
  let isImageBitmap = false;
  if ((pixels as
PixelData).data instanceof Uint8Array) {
    isPixelData = true;
  } else if (
      typeof (ImageData) !==
'undefined' && pixels instanceof ImageData) {
    isImageData = true;
  } else if (
      typeof (HTMLVideoElement) !== 'undefined' &&
      pixels instanceof HTMLVideoElement) {
    isVideo = true;
  } else if ((pixels as
HTMLVideoElement).getContext != null) {
    isCanvasLike = true;
  } else if (typeof (HTMLImageElement) !== 'undefined' &&
      pixels instanceof HTMLImageElement) {
    isImage = true;
  }
  if (isVideo) {
    const HAVE_CURRENT_DATA_READY_STATE = 2;
    if (isVideo &&
        (pixels as
HTMLVideoElement).readyState <
            HAVE_CURRENT_DATA_READY_STATE) {
      throw new
Error(`The video element has not loaded data yet. Please wait for` +
            `loadeddata` event on the
<video> element.`);
    }
  }
  // If the current backend has 'FromPixels' registered, it has a more
  // efficient way
  // of handling pixel uploads, so we call that.
  const kernel = getKernel(FromPixels, ENGINE.backendName);
  if
(kernel != null) {
    const inputs: FromPixelsInputs = {pixels};
    const attrs: FromPixelsAttrs =
{numChannels};
    return ENGINE.runKernel(
        FromPixels, inputs as {} as NamedTensorMap,
        attrs
as {} as NamedAttrMap);
  }
  return null;
}

function fromPixels2DContext(pixels: PixelData) {
  if (pixels == null) {
    throw new Error('pixels
passed to tf.browser.fromPixels() can not be null');
  }
  let isPixelData = false;
  let isImageData = false;
  if ((pixels as
PixelData).data instanceof Uint8Array) {
    isPixelData = true;
  } else if (pixels instanceof ImageData) {
    isImageData = true;
  }
  if (isPixelData) {
    const HAVE_CURRENT_DATA_READY_STATE = 2;
    if (isPixelData) {
      throw new
Error(`The pixel data has not loaded data yet. Please wait for` +
            `loadeddata` event on the
<image> element.`);
    }
  } else if (isImageData) {
    const HAVE_CURRENT_DATA_READY_STATE = 2;
    if (isImageData) {
      throw new
Error(`The image data has not loaded data yet. Please wait for` +
            `loadeddata` event on the
<image> element.`);
    }
  } else if (isCanvasLike) {
    const HAVE_CURRENT_DATA_READY_STATE = 2;
    if (isCanvasLike) {
      throw new
Error(`The canvas data has not loaded data yet. Please wait for` +
            `loadeddata` event on the
<canvas> element.`);
    }
  } else if (isImageBitmap) {
    const HAVE_CURRENT_DATA_READY_STATE = 2;
    if (isImageBitmap) {
      throw new
Error(`The image bitmap has not loaded data yet. Please wait for` +
            `loadeddata` event on the
<image> element.`);
    }
  } else {
    throw new Error(`pixels
passed to tf.browser.fromPixels() must be either an 'image' or
'canvas' element.`);
  }
  if (pixels == null) {
    throw new Error('pixels
passed to tf.browser.fromPixels() can not be null');
  }
  let isPixelData = false;
  let isImageData = false;
  if ((pixels as
PixelData).data instanceof Uint8Array) {
    isPixelData = true;
  } else if (pixels instanceof ImageData) {
    isImageData = true;
  } else if (pixels instanceof HTMLVideoElement) {
    isVideo = true;
  } else if (pixels instanceof HTMLImageElement) {
    isImage = true;
  }
  if (isVideo) {
    const HAVE_CURRENT_DATA_READY_STATE = 2;
    if (isVideo) {
      throw new
Error(`The video element has not loaded data yet. Please wait for` +
            `loadeddata` event on the
<video> element.`);
    }
  }
  // If the current backend has 'FromPixels' registered, it has a more
  // efficient way
  // of handling pixel uploads, so we call that.
  const kernel = getKernel(FromPixels, ENGINE.backendName);
  if
(kernel != null) {
    const inputs: FromPixelsInputs = {pixels};
    const attrs: FromPixelsAttrMap =
{numChannels};
    return ENGINE.runKernel(
        FromPixels, inputs as {} as NamedTensorMap,
        attrs
as {} as NamedAttrMap);
  }
  return null;
}

function fromPixels2DContext.canvas(pixels: PixelData) {
  if (pixels == null) {
    throw new Error('pixels
passed to tf.browser.fromPixels() can not be null');
  }
  let isPixelData = false;
  let isImageData = false;
  if ((pixels as
PixelData).data instanceof Uint8Array) {
    isPixelData = true;
  } else if (pixels instanceof ImageData) {
    isImageData = true;
  } else if (pixels instanceof HTMLVideoElement) {
    isVideo = true;
  } else if (pixels instanceof HTMLImageElement) {
    isImage = true;
  }
  if (isPixelData) {
    const HAVE_CURRENT_DATA_READY_STATE = 2;
    if (isPixelData) {
      throw new
Error(`The pixel data has not loaded data yet. Please wait for` +
            `loadeddata` event on the
<image> element.`);
    }
  } else if (isImageData) {
    const HAVE_CURRENT_DATA_READY_STATE = 2;
    if (isImageData) {
      throw new
Error(`The image data has not loaded data yet. Please wait for` +
            `loadeddata` event on the
<image> element.`);
    }
  } else if (isCanvasLike) {
    const HAVE_CURRENT_DATA_READY_STATE = 2;
    if (isCanvasLike) {
      throw new
Error(`The canvas data has not loaded data yet. Please wait for` +
            `loadeddata` event on the
<canvas> element.`);
    }
  } else if (isImageBitmap) {
    const HAVE_CURRENT_DATA_READY_STATE = 2;
    if (isImageBitmap) {
      throw new
Error(`The image bitmap has not loaded data yet. Please wait for` +
            `loadeddata` event on the
<image> element.`);
    }
  } else {
    throw new Error(`pixels
passed to tf.browser.fromPixels() must be either an 'image' or
'canvas' element.`);
  }
  if (pixels == null) {
    throw new Error('pixels
passed to tf.browser.fromPixels() can not be null');
  }
  let isPixelData = false;
  let isImageData = false;
  if ((pixels as
PixelData).data instanceof Uint8Array) {
    isPixelData = true;
  } else if (pixels instanceof ImageData) {
    isImageData = true;
  } else if (pixels instanceof HTMLVideoElement) {
    isVideo = true;
  } else if (pixels instanceof HTMLImageElement) {
    isImage = true;
  }
  if (isVideo) {
    const HAVE_CURRENT_DATA_READY_STATE = 2;
    if (isVideo) {
      throw new
Error(`The video element has not loaded data yet. Please wait for` +
            `loadeddata` event on the
<video> element.`);
    }
  }
  // If the current backend has 'FromPixels' registered, it has a more
  // efficient way
  // of handling pixel uploads, so we call that.
  const kernel = getKernel(FromPixels, ENGINE.backendName);
  if
(kernel != null) {
    const inputs: FromPixelsInputs = {pixels};
    const attrs: FromPixelsAttrMap =
{numChannels};
    return ENGINE.runKernel(
        FromPixels, inputs as {} as NamedTensorMap,
        attrs
as {} as NamedAttrMap);
  }
  return null;
}
fromPixels2DContext.canvas.height = height;
fromPixels2DContext.drawImage(pixels as HTMLVideoElement, 0, 0, width, height);
vals = fromPixels2DContext.getImageData(0, 0, width, height).data;
let values = new Int32Array(vals);
let numPixels = width * height;
let numChannels = new Int32Array(numPixels * numChannels);
let for (let i = 0; i < numPixels; i++) {
    for (let channel = 0; channel < numChannels; ++channel) {
        values[i * numChannels + channel] = vals[i * 4 + channel];
    }
}
const outShape = [number, number, number] = [height, width, numChannels]
return tensor3d(values, outShape, 'int32');
  }

function cast(originalImgTensor: TensorLike, dtype: string) {
    if (dtype !== 'float32' && dtype !== 'int32') {
        throw new Error(`Unsupported type for toPixels: ${dtype}.` + ` Please use float32 or int32 tensors.`);
    }
    if (dtype === 'float32') {
        const data = await originalImgTensor.data();
        const multiplier = 255;
        const bytes = new Uint8ClampedArray(data.length);
        for (let i = 0; i < data.length; ++i) {
            const value = data[i] * multiplier;
            bytes[i * 4 + 0] = Math.round(value);
            bytes[i * 4 + 1] = Math.round(value);
            bytes[i * 4 + 2] = Math.round(value);
            bytes[i * 4 + 3] = Math.round(value);
        }
    } else if (dtype === 'int32') {
        const data = await originalImgTensor.data();
        const bytes = new Uint8ClampedArray(data.length);
        for (let i = 0; i < data.length; ++i) {
            const value = data[i];
            bytes[i * 4 + 0] = Math.round(value);
            bytes[i * 4 + 1] = Math.round(value);
            bytes[i * 4 + 2] = Math.round(value);
            bytes[i * 4 + 3] = Math.round(value);
        }
    }
    return bytes;
}

const fromPixels = op({ fromPixels_ });

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 * limitations under the License.
 */
import {TensorInfo} from '../kernel_registry';
import {computeStrides, sizeFromShape} from '../util';

export function prepareAndValidate(tensor: TensorInfo, indices: TensorInfo): [number[], number, number, number] {
    return gatherNd(tensor, indices, returnValues, strides);
}

export const fromPixels = op({ fromPixels_ });

*/

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const tensorRank = tensor.shape.length;
const indicesRank = indices.shape.length;

if (tensorRank < 1) {
  throw new Error(`tf.gatherND() expects the input to be rank 1 or higher, but the rank was ${tensorRank}.`);
}

if (indicesRank < 1) {
  throw new Error(`tf.gatherND() expects the indices to be rank 1 or higher, but the rank was ${indicesRank}.`);
}

if (indices.dtype !== 'int32') {
  throw new Error(`tf.gatherND() expects the indices to be int32 type, but the dtype was ${{indices.dtype}}.`);
}

if (indices.shape[indicesRank - 1] > tensorRank) {
  throw new Error(`index innermost dimension length must be <= tensor rank; saw: ${indices.shape[indicesRank - 1]} vs. ${tensorRank}.`);
}

if (sizeFromShape(tensor.shape) === 0) {
  throw new Error(`Requested more than 0 entries, but input is empty. Input shape: ${{tensor.shape}}.`);
}

const indicesShape = indices.shape.slice();
const sliceRank = indicesShape[indicesShape.length - 1];
const outputShape = indicesShape.slice(0, sliceRank);

const sliceSize = 1;

let nResult = 1;
for (let i = 0; i < sliceRank; ++i) {
  nResult *= indicesShape[i];
}

let nInputShape = tensor.shape;

let nResultShape = indicesShape.slice(sliceRank);

const strides = [...computeStrides(nInputShape).map(stride => stride / sliceSize), 1].slice(0, sliceRank);

return [nResultShape, nResult, sliceSize, strides];

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 */

import {TensorInfo} from '../kernel_registry';
import {Tensor} from '../tensor';
import {computeStrides, sizeFromShape} from '../util';

/**
 * Check whether updates.shape = indices.shape[:batchDim] + $n * shape[sliceDim]$
 * @param x The input tensor.
 */
export function validateUpdateShape(x)
    {return x;}

/**
 * Validate scatter nd inputs.
 *
 * @param update The tensor contains the update values.
 * @param indices The tensor contains the indices for the update values.
 * @param shape The shape of the output tensor.
 */
export function validateInput(update, indices, shape) {
  if (indices.rank < 1) {
    throw new Error(`tf.scatterND() expects the indices to be rank 1 or higher, but the rank was ${indices.rank}.`);
  }
  if (update.rank < 1) {
    throw new Error(`tf.scatterND() expects the updates to be rank 1 or higher, but the rank was ${update.rank}.`);
  }
  if (indices.dtype !== 'int32') {
    throw new Error(`tf.scatterND() expects the indices to be int32, but got dtype: ${{indices.dtype}}.`);
  }
  if (shape.length < sliceSize + (updates.rank - batchDim)) {
    throw new Error(`Output shape length < ${sliceSize + (updates.rank - batchDim)}.`);
  }
  if (updates.rank !== indices.shape[indices.shape.length - 1] + 1) {
    throw new Error(`update.rank != ${indices.shape[indices.shape.length - 1] + 1}`);
  }
  for (let d = 0; d < shape.length - sliceSize; ++d) {
    if (shape[d] !== indices.shape[d]) {
      throw new Error(`shape[d] (${shape[d]}) != indices.shape[d] (${indices.shape[d]})`.);
    }
  }
  for (let d = 0; d < update.rank - batchDim; ++d) {
    if (update.shape[d + batchDim] !== shape[d + sliceSize]) {
      throw new Error(`update.shape[d + batchDim] (${update.shape[d + batchDim]}) != shape[d + sliceSize] (${shape[d + sliceSize]}).`);
    }
  }
  for (let d = 0; d < updates.rank - batchDim; ++d) {
    if (updates.shape[d + batchDim] !== shape[d + sliceSize]) {
      throw new Error(`updates.shape[d + batchDim] (${updates.shape[d + batchDim]}) != shape[d + sliceSize] (${shape[d + sliceSize]}).`);
    }
  }
}

export interface ScatterShapeInfo {
  sliceRank: number;
  numUpdates: number;
  sliceSize: number;
  strides: number[];
}

/**
 * Export scatter nd function.
 *
 * @param update The tensor contains the update values.
 * @param indices The tensor contains the indices for the update values.
 * @param shape The shape of the output tensor.
 */
export function scatterND(update, indices, shape) {
  if (indices.rank < 1) {
    throw new Error(`tf.scatterND() expects the indices to be rank 1 or higher, but the rank was ${indices.rank}.`);
  }
  if (update.rank < 1) {
    throw new Error(`tf.scatterND() expects the updates to be rank 1 or higher, but the rank was ${update.rank}.`);
  }
  if (indices.dtype !== 'int32') {
    throw new Error(`The dtype of 'indices' should be int32, but got dtype: ${{indices.dtype}}.`);
  }
  if (shape.length < sliceSize + (updates.rank - batchDim)) {
    throw new Error(`Output shape length < ${sliceSize + (updates.rank - batchDim)}.`);
  }
  if (updates.rank !== indices.shape[indices.shape.length - 1] + 1) {
    throw new Error(`update.rank != ${indices.shape[indices.shape.length - 1] + 1}`);
  }
  for (let d = 0; d < shape.length - sliceSize; ++d) {
    if (shape[d] !== indices.shape[d]) {
      throw new Error(`shape[d] (${shape[d]}) != indices.shape[d] (${indices.shape[d]})`.);
    }
  }
  for (let d = 0; d < update.rank - batchDim; ++d) {
    if (update.shape[d + batchDim] !== shape[d + sliceSize]) {
      throw new Error(`update.shape[d + batchDim] (${update.shape[d + batchDim]}) != shape[d + sliceSize] (${shape[d + sliceSize]}).`);
    }
  }
  for (let d = 0; d < updates.rank - batchDim; ++d) {
    if (updates.shape[d + batchDim] !== shape[d + sliceSize]) {
      throw new Error(`updates.shape[d + batchDim] (${updates.shape[d + batchDim]}) != shape[d + sliceSize] (${shape[d + sliceSize]}).`);
    }
  }
  for (let d = 0; d < shape.length - sliceSize; ++d) {
    if (shape[d] !== indices.shape[d]) {
      throw new Error(`shape[d] (${shape[d]}) != indices.shape[d] (${indices.shape[d]})`.);
    }
  }
  for (let d = 0; d < update.rank - batchDim; ++d) {
    if (update.shape[d + batchDim] !== shape[d + sliceSize]) {
      throw new Error(`update.shape[d + batchDim] (${update.shape[d + batchDim]}) != shape[d + sliceSize] (${shape[d + sliceSize]}).`);
    }
  }
  for (let d = 0; d < updates.rank - batchDim; ++d) {
    if (updates.shape[d + batchDim] !== shape[d + sliceSize]) {
      throw new Error(`updates.shape[d + batchDim] (${updates.shape[d + batchDim]}) != shape[d + sliceSize] (${shape[d + sliceSize]}).`);
    }
  }
}

// Ensure that the output tensor shape is a tensor.

export function ensureTensorShape():
    {return new Tensor();}

// Ensure that the output tensor shape is a tensor.

export function ensureTensorShape():
    {return new Tensor();}
```javascript
if (shape.length < 1) {
  throw new Error('Output rank must be greater or equal to 1, but got shape: ' + JSON.stringify(shape));
}

if (shape.length === 0) {
  if (indices.size === 0) {
    throw new Error('Indices specified for empty output. indices shape: ' + JSON.stringify(indices.shape));
  }
  if (updates.size === 0) {
    throw new Error('Updates specified for empty output. updates shape: ' + JSON.stringify(updates.shape));
  }
}

validateUpdateShape(shape, indices, updates);
}

/**
 * Calculate the shape information for the output.
 *
 * @param updates The tensor contains the update values.
 * @param indices The tensor contains the indices for the update values.
 * @param shape The shape of the output tensor.
 * @returns ScatterShapeInfo
 */
export function calculateShapes(updates: TensorInfo, indices: TensorInfo, shape: number[]): ScatterShapeInfo {
  const totalNd = shape.length;
  let sliceSize = 1;
  for (let i = 0; i < totalNd; ++i) {
    sliceSize *= shape[i];
  }

  const safeSliceDim = (sliceRank < 1) ? 1 : sliceRank;
  const numUpdates = sizeFromShape(indices.shape) / safeSliceDim;

  const strides = [...computeStrides(shape.slice(0, sliceRank)), 1];
  const outputSize = sizeFromShape(shape);
  return {sliceRank, numUpdates, sliceSize, strides, outputSize};
}
```

---

```
---

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```
i < numElidedAxes; i++) {
    elidedAxes.push(ellipsisInsertionIndex + i);
} return elidedAxes;
}

Normalize the start and end indices.

export function getNormalizedAxes(
    inputShape: number[], ellipsisAxes: number[],
    numInterpolatedAxes: number, begin: number[],
    end: number[], strides: number[], beginMask: number[],
    endMask: number[], ellipsisMask: number)
  { const inputRank = inputShape.length;
    let normalizedBegin = new Array(inputRank);
    let normalizedEnd = new Array(inputRank);
    let normalizedStrides = new Array(inputRank);

    if (ellipsisAxes.length > 0) {
      const fullIndex = ellipsisAxes[0];
      // The ellipsis applies to the masked index as well as any dimensions
      // that are interpolated.
      const numElidedAxes = numInterpolatedAxes + 1;
      let normalNormalizedBegin = startIndicesWithElidedDims(
          beginMask, fullIndex, numElidedAxes, begin,
          inputShape);
      let normalNormalizedEnd = stopIndicesWithElidedDims(
          endMask, fullIndex, numElidedAxes, end,
          inputShape);
      let normalNormalizedStrides = stridesWithElidedDims(strides, fullIndex, numElidedAxes,
          inputShape);
      } else {
        let for (let axis = 0; axis < inputRank; axis++) {
          normalizedBegin[axis] =
            startForAxis(beginMask, begin, strides, inputShape, axis, ellipsisMask);
          normalizedEnd[axis] =
            stopForAxis(endMask, end, strides, inputShape, axis, ellipsisMask);
          normalizedStrides[axis] =
            stridesForAxis(strides, axis, ellipsisMask);
        }
        normalizedBegin = startIndicesWithElidedDims(
            beginMask, fullIndex, numElidedAxes, begin,
            inputShape);
        normalizedEnd = stopIndicesWithElidedDims(
            endMask, fullIndex, numElidedAxes, end,
            inputShape);
        normalizedStrides = stridesWithElidedDims(strides, fullIndex, numElidedAxes,
            inputShape);
    }

    return {
        begin: normalizedBegin,
        end: normalizedEnd,
        strides: normalizedStrides
    };
}

Start indices with elided dimensions. If the dimension matches
the ellipsis mask, override the current start value.

export function startIndicesWithElidedDims(
    beginMask: number, ellipsisInsertionIndex: number,
    numElidedAxes: number, originalBegin: number[], inputShape: number[])
  { const newIndices = [...inputShape];
    const elidedAxes = getElidedAxes(numElidedAxes, ellipsisInsertionIndex);
    for (let axis = 0; axis < numElidedAxes.length; axis++) {
      if (elidedAxes.indexOf(axis) > -1) {
        newIndices[axis] = 0;
      } else {
        const originalAxis =
            unnormalizeAxis(ellipsisInsertionIndex, numElidedAxes, axis);
        let originalValue = originalBegin[originalAxis];
        if (beginMask & 1 << originalAxis) {
          originalValue = 0;
        }
        newIndices[axis] = originalValue;
      }
    }

    return newIndices;
}

Stop indices with elided dimensions. If the dimension matches
the ellipsis mask, override the current stop value.

export function stopIndicesWithElidedDims(
    endMask: number, ellipsisInsertionIndex: number,
    numElidedAxes: number, originalEnd: number[], inputShape: number[])
  { const newIndices = [...inputShape];
    const elidedAxes = getElidedAxes(numElidedAxes, ellipsisInsertionIndex);
    for (let axis = 0; axis < numElidedAxes.length; axis++) {
      if (elidedAxes.indexOf(axis) > -1) {
        newIndices[axis] = Number.MAX_SAFE_INTEGER;
      } else {
        const originalAxis =
            unnormalizeAxis(ellipsisInsertionIndex, numElidedAxes, axis);
        let originalValue = originalBegin[originalAxis];
        if (beginMask & 1 << originalAxis) {
          originalValue = Number.MAX_SAFE_INTEGER;
        }
        newIndices[axis] = originalValue;
      }
    }

    for (let i = 0; i < newIndices.length; i++) {
      // Handle negative indices
      const axisSize = inputShape[i];
      if (newIndices[i] < 0) {
        newIndices[i] += axisSize;
      }
    }
    return newIndices;
}

Start for axis.

export function startForAxis(
    beginMask: number, startIndices: number[],
    strides: number[], inputShape: number[], axis: number, ellipsisMask: number)
  { let start = startIndices[axis];
    const stride = strides[axis] || 1;
    if (ellipsisMask & (1 << axis)) {
      start = Number.MAX_SAFE_INTEGER;
    } else {
      // Check the axis bit from right of masked axes, or the begin index is not set
      // for the axis.
      if (beginMask & 1 << axis) {
        if (start > 0) {
          // Forward iteration - use the first element. These values will get
          // clamped below (Note: We could have set them to 0 and axis_size-1, but
          // use lowest() and max() to maintain symmetry with StopForAxis())
          start = Number.MIN_SAFE_INTEGER;
        } else {
          // Backward iteration - use the last element.
          start = Number.MAX_SAFE_INTEGER;
        }
      } else {
        // Handle negative indices
        const axisSize = inputShape[axis];
        if (start < 0) {
          start += axisSize;
        } else {
          // Clamping
          start = util.clamp(0, start, axisSize - 1);
        }
      }
    }
    return start;
}

Stop for axis.

export function stopForAxis(
    endMask: number, stopIndices: number[],
    strides: number[], inputShape: number[], axis: number, ellipsisMask: number)
  { let stop = stopIndices[axis];
    const stride = strides[axis] || 1;
    if (ellipsisMask & (1 << axis)) {
      stop = Number.MAX_SAFE_INTEGER;
    } else {
      // Check the axis bit from right of masked axes, or the begin index is not set
      // for the axis.
      if (beginMask & 1 << axis) {
        if (stop < 0) {
          // Forward iteration - use the first element. These values will get
          // clamped below (Note: We could have set them to 0 and axis_size-1, but
          // use lowest() and max() to maintain symmetry with StopForAxis())
          stop = Number.MIN_SAFE_INTEGER;
        } else {
          // Backward iteration - use the last element.
          stop = Number.MAX_SAFE_INTEGER;
        }
      } else {
        // Handle negative indices
        const axisSize = inputShape[axis];
        if (stop > 0) {
          stop += axisSize;
        } else {
          // Clamping
          stop = util.clamp(0, stop, axisSize - 1);
        }
      }
    }
    return stop;
}
Open Source Used in Cisco Meeting Server (formerly Acano Server) 3.4

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=============================================================================

import {assert} from './util';

/**
 * Types to support JSON-esque data structures internally.

Internally ConfigDict's use camelCase keys and values where the
values are class names to be instantiated. On the python side, these
will be snake_case. Internally we allow Enums into the values for better
* type safety, but these need to be converted to raw primitives (usually
* strings) for round-tripping with python.

toConfig returns the TS-friendly representation. model.toJSON() returns
the pythonic version as that's the portable format. If you need to
python-ify a non-model level toConfig output, you'll need to use
convertTsToPythonic from serialization_utils in -Layers.

boolean | number | string | null | ConfigDictArray | ConfigDict

declare interface ConfigDictValue =

| boolean | number | string | null | ConfigDictArray | ConfigDict

declare interface ConfigDict {
  
[key: string]: ConfigDictValue;
}

declare interface ConfigDictArray extends Array<ConfigDictValue>{}

/**
 * Return the class name for this class to use in
 * serialization contexts.
 * Generally speaking this will be the same thing that constructor.name
 * would have returned. However, the class name needs to be robust
 * against minification for serialization/deserialization to work properly.
 * There's also places such as initializers.VarianceScaling, where
 * implementation details between different languages led to different
 * class hierarchies and a non-leaf node is used for serialization purposes.

getClassName(): string

abstract getConfig(): ConfigDict;

static fromConfig<T extends Serializable>(cls:
SerializableConstructor<T>, config: ConfigDict): T {
    return new cls(config);
}

/**
 * Maps string keys to class constructors.

Used during (de)serialization from the cross-language JSON format, which
* requires the class name in the serialization format matches the class
* names as used in Python, should it exist.

register<T extends Serializable>(cls: SerializableConstructor<T>) {
    SerializationMap.getMap().classNameMap[cls.className] =
        [cls, cls.fromConfig];
}

**

Register a class with the serialization map of TensorFlow.js.

This is often used for registering custom
Layers, so they can be
serialized and deserialized.

Example:

```js
class MyCustomLayer extends tf.layers.Layer {
    static className = 'MyCustomLayer';

    constructor(config) {
        super(config);
        this.className = 'MyCustomLayer';
    }

    static get layer.getClassName() { return this.className; }
}
```

In contrast to the
JavaScript
constructor.

This works for most descendants of Serializable. A few need to
provide special handling.

@constructor

**

This is used during (de)serialization from the cross-language JSON format, which
requires the class name in the serialization format matches the class
names as used in Python, should it exist.

`export class SerializationMap {
    getClassName(): string {
        return (this.constructor as
SerializableConstructor<Serializable>).className;
    }

    static fromConfig<T extends Serializable>(cls:
SerializableConstructor<T>, config: ConfigDict): T {
        return new cls(config);
    }
}

class MyCustomLayer extends tf.layers.Layer {
    static className = 'MyCustomLayer';

    constructor(config) {
        super(config);
        this.className = 'MyCustomLayer';
    }

    static get layer.getClassName() { return this.className; }
}
```
empty string.

```
export function registerClass<T extends Serializable>(
    cls: SerializableConstructor<T>) {
  assert(
      cls.className != null,
      () => `Class being registered does not have the static className` +
          ` property defined.`);
  assert(
      typeof cls.className === 'string',
      () => `class Name is required to be a string, but got type ` +
          `property defined.`);
  SerializationMap.register(cls);
}

import {ENGINE} from './engine';
import {inferShape} from './tensor_util_env';
import {RecursiveArray, TensorLike, TypedArray} from './types';
import {arraysEqual, encodeString, flatten, isString, isTypedArray} from
    './util';

const TEST_EPSILON_FLOAT32 = 1e-3;
export const TEST_EPSILON_FLOAT16 = 1e-16;

function expectArraysClose(
    actual: TypedArray|number|RecursiveArray<number>,
    expected:
    TypedArray|number|RecursiveArray<number>, epsilon?: number) {
  if (epsilon == null) {
    epsilon = testEpsilon();
  }
  return expectArraysPredicate(
      actual, expected, (a, b) => areClose(a as number, b as
          number, epsilon));
}

function testEpsilon() {
  return ENGINE.backend.floatPrecision() === 32 ?
      TEST_EPSILON_FLOAT32 :
      TEST_EPSILON_FLOAT16;
}

function expectArraysPredicate(
    actual: TensorLike, expected: TensorLike,
    predicate: (a: {}, b: {}) => boolean) {

  let checkClassType = true;
  if (isTypedArray(actual) || isTypedArray(expected)) {
    checkClassType = false;
  }
  if (isTypedArray(actual) && isTypedArray(expected)) {
    checkClassType = true;
  }
  if (checkClassType)
  {
    const aType = actual.constructor.name;
    const bType = expected.constructor.name;

    if (aType !==
        bType) {
      throw new Error(
          `Arrays are of different type. Actual: ${aType}. ` +
          `Expected: ${bType}`);
    }
  }

  if (Array.isArray(actual) && Array.isArray(expected)) {
    const actualShape = inferShape(actual);
    const expectedShape = inferShape(expected);
    if (!arraysEqual(actualShape, expectedShape)) {
      throw new Error(`Arrays have different shapes. ` +
          `Actual:   [${actualShape}]. Expected: [${expectedShape}].`);
    }
  }

  const actualFlat =
      isTypedArray(actual) ?
      actual : flatten(actual as RecursiveArray<number>);
  const expectedFlat = isTypedArray(expected) ?
      expected :
      flatten(expected as RecursiveArray<number>);
  if (actualFlat.length !== expectedFlat.length)
    throw new Error(`Arrays have different lengths actual: ${actualFlat.length} vs ` +
        `expected: ${expectedFlat.length}.\n` +
        `Actual:   [${actualFlat}].\n` +
        `Expected: [${expectedFlat}].`);
    for (let i = 0; i < expectedFlat.length; ++i) {
      const a = actualFlat[i];
      const e = expectedFlat[i] if (predicate(a, e))
        throw new Error(`Arrays differ: actual[${i}] = ${a}, expected[${i}] = ${e}.\n` +
            `Actual:   [${actualFlat}].\n` +
            `Expected: [${expectedFlat}].`);
  }

  function areClose(a: number, e: number, epsilon: number): boolean {
  if (!isFinite(a) && !isFinite(e)) {
    return true;
  }
  if (isNaN(a) || isNaN(e) || Math.abs(a - e) > epsilon) {
    return false;
  }
  return Math.abs(a - e) <= epsilon;
}
```
return false)
  for (let i = 0; i < actual.length; i++)
    if (actual[i] < low || actual[i] > high)
      throw new Error(`Value out of range: ${actual[i]} low: ${low}, high: ${high}`)
  return true;
}

export function expectArrayBuffersEqual(actual: ArrayBuffer, expected: ArrayBuffer) {
  // Safari & Jasmine don't like comparing ArrayBuffers directly. Wrapping an ArrayBuffer in a Float32Array solves this issue.
  return new Float32Array(actual).toEqual(new Float32Array(expected))
}

/**
 * Encodes strings into utf-8 bytes.
 */
export function encodeStrings(a: RecursiveArray<{}>): RecursiveArray<Uint8Array> {
  for (let i = 0; i < (a as Array<{}>).length; i++) {
    const val = a[i];
    if (Array.isArray(val)) {
      encodeStrings(val);
    } else {
      a[i] = encodeString(val as string);
    }
  }
  return a as RecursiveArray<Uint8Array>;
}

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=============================================================================

import {KernelBackend} from './backends/backend';
import {ENGINE, Engine, MemoryInfo, ProfileInfo, ScopeFn, TimingInfo} from './engine';
import {env} from './environment';
import {Platform} from './platforms/platform';
import {setDeprecationWarningFn, Tensor} from './tensor';
import {TensorContainer} from './tensor_types';
import {getTensorsInContainer} from './tensor_util';

/**
 * Enables production mode which disables correctness checks in favor of
 * performance.
 *
 * @doc {heading: 'Environment'}
 */
export function enableProdMode(): void {
  env().set('PROD', true);
}

/**
 * Enables debug mode which will log information about all executed kernels:
 * the elapsed time of the kernel execution, as well as the rank, shape, and
 * size of the output tensor.
 *
 * Debug mode will significantly slow down your application as it will
 * download the result of every operation to the CPU. This should not be used
 * in production. Debug mode does not affect the timing information of the kernel
 * execution as we do not measure download time in the kernel
 * execution time.
 *
 * See also: `tf.profile`, `tf.memory`. This mode has been disabled.
 *
 * @doc {heading: 'Environment'}
 */
export function enableDebugMode(): void {
  env().set('DEBUG', true);
}

/**
 * Globally disables deprecation warnings
 */
export function disableDeprecationWarnings(): void {
  env().set('DEPRECATION_WARNINGS_ENABLED', false);
  console.warn(`TensorFlow.js deprecation warnings have been disabled.`);
}

/** Warn users about deprecated functionality. */
export function deprecationWarn(msg: string) {
  if (env().getBool('DEPRECATION_WARNINGS_ENABLED')) {
    console.warn(`Warning: ${msg} You can disable deprecation warnings with ` +
      `tf.enableDeprecationWarnings().`);
  }
}

/**
 * Dispose all variables kept in backend engine.
 *
 * @doc {heading: 'Environment'}
 */
export function disposeVariables(): void {
  ENGINE.disposeVariables();
}

/**
 * It returns the global engine that keeps track of all tensors and
 * backends.
 *
 * @doc {heading: 'Environment'}
 */
export function engine(): Engine {
  return ENGINE;
}

/**
 * Returns memory info at the current time in the program. The result is an
 * object with the following properties:
 *
 * - `numBytes`: Number of bytes allocated (undisposed) at this time.
 * - `numTensors`: Number of unique tensors allocated.
 * - `numDataBuffers`: Number of unique data buffers allocated.
 * - `numBytesInGPU`: Number of bytes allocated in the GPU only.
 * - `numBytesInGPUSub`: Number of bytes allocated in the GPU only, not
 *     compute nodes.
 * - `numBytesInRAM`: Number of bytes allocated in the RAM.
 * - `numBytesInGPUUnallocated`: Number of bytes allocated in the GPU
 *     that are not currently in use.
 * - `numBytesInRAMUnallocated`: Number of bytes allocated in the RAM
 *     that are not currently in use.
 * - `numBytesInGPUAllocated`: Number of bytes allocated in the GPU
 *     that are currently in use.
 * - `numBytesInRAMAllocated`: Number of bytes allocated in the RAM
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 * - `numBytesInGPUAllocated`: Number of bytes allocated in the GPU
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 *     that are currently in use.
 * - `numBytesInRAMAllocated`: Number of bytes allocated in the RAM
 *     that are currently in use.
and returns a promise that resolves with information about the function's memory use:

- `newBytes`: the number of new bytes allocated
- `newTensors`: the number of new tensors created
- `peakBytes`: the peak number of bytes allocated
- `kernels`: an array of objects for each kernel involved that reports their input and output shapes, number of new tensors created.

```js
const profile = await tf.profile(() => {
  const x = tf.tensor1d([1, 2, 3]);
  let x2 = x.square();
  x2.dispose();
  x2 = x.square();
  return x2;
});
```

```js
console.log('newBytes: ');
console.log('newTensors: ');
console.log('byte usage over all kernels: ');
```

```js
export function profile(f: () => (TensorContainer | Promise<TensorContainer>)):
  Promise<ProfileInfo> {
    return ENGINE.profile(f);
  }
```

```js
export function tidy<T extends TensorContainer>(
    nameOrFn: string|ScopeFn<T>, fn?: ScopeFn<T>): T {
  return ENGINE.tidy(nameOrFn, fn);
}
```

```js
export function dispose(container: TensorContainer) {
  // Code to dispose tensors
}
```

```js
export function keep<T extends Tensor>(result: T): T {
  return ENGINE.keep(result);
}
```

```js
export function time(f: () => void): Promise<TimingInfo> {
  return ENGINE.time(f);
}
```

and returns a promise that resolves with information about the function's memory use:

- `newBytes`: the number of new bytes allocated
- `newTensors`: the number of new tensors created
- `peakBytes`: the peak number of bytes allocated
- `kernels`: an array of objects for each kernel involved that reports their input and output shapes, number of new tensors created.

```js
const profile = await tf.profile(() => {
  const x = tf.tensor1d([1, 2, 3]);
  let x2 = x.square();
  x2.dispose();
  x2 = x.square();
  return x2;
});
```

```js
console.log('newBytes: ');
console.log('newTensors: ');
console.log('byte usage over all kernels: ');
```

```js
export function profile(f: () => (TensorContainer | Promise<TensorContainer>)):
  Promise<ProfileInfo> {
    return ENGINE.profile(f);
  }
```

```js
export function tidy<T extends TensorContainer>(
    nameOrFn: string|ScopeFn<T>, fn?: ScopeFn<T>): T {
  return ENGINE.tidy(nameOrFn, fn);
}
```

```js
export function dispose(container: TensorContainer) {
  // Code to dispose tensors
}
```

```js
export function keep<T extends Tensor>(result: T): T {
  return ENGINE.keep(result);
}
```

```js
export function time(f: () => void): Promise<TimingInfo> {
  return ENGINE.time(f);
}
```
* Sets the backend (cpu, webgl, wasm, etc) responsible for creating tensors and executing operations on those tensors. Returns a promise that resolves to a boolean if the backend initialization was successful. Note this disposes the current backend, if any, as well as any tensors associated with it. A new backend is initialized, even if it is of the same type as the previous one.

```javascript
exports.setBackend = function(backendName) {
  return ENGINE.setBackend(backendName);
}

exports.ready = function() {
  return ENGINE.ready();
}

exports.getBackend = function() {
  return ENGINE.backend;
}

exports.removeBackend = function(name) {
  ENGINE.removeBackend(name);
}

exports.findBackend = function(name) {
  return ENGINE.findBackend(name);
}

exports.findBackendFactory = function(name) {
  return ENGINE.findBackendFactory(name);
}

exports.registerBackend = function(name, factory, priority = 1) {
  return ENGINE.registerBackend(name, factory, priority);
}

exports.backend = function() {
  return ENGINE.backend;
}
```

---

```
export {op} from './operation';
```

```javascript
import {ENGINE} from '../engine';
import {Add, AddInputs} from '../kernel_names';
import {Tensor} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {makeTypesMatch} from '../tensor_util_env';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';
```

---

```
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```
b The second `tf.Tensor` to add. Must have the same type as `a`.

```typescript
function add_<T extends Tensor>(a: Tensor|TensorLike, b: Tensor|TensorLike): T {
  let $a = convertToTensor(a, 'a', 'add');
  let $b = convertToTensor(b, 'b', 'add');

  const inputs: AddInputs = {a: $a, b: $b};

  return ENGINE.runKernel(Add, inputs as {} as NamedTensorMap);
}

export const add = op({add_});
```

The second `tf.Tensor` to add. Must have the same type as `a`.

```typescript
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 * software distributed under the License is distributed on an "AS IS" BASIS,
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
 * See the License for the specific language governing permissions and limitations under the License.
 */

```typescript
import {ENGINE} from '../engine';
import {FloorDiv, FloorDivInputs} from '../kernel_names';
import {Tensor} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {makeTypesMatch} from '../tensor_util';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';

import {op} from './operation';

/**
 * Divides two `tf.Tensor`s element-wise, A / B. Supports broadcasting.
 * The result is rounded with floor function.
 *
 * ```js
 * const a = tf.tensor1d([1, 4, 9, 16]);
 * const b = tf.tensor1d([1, 2, 3, 4]);
 * a.floorDiv(b).print();  // or tf.floorDiv(a, b)
 * ```
 *
 * ```js
 * // Broadcast div a with b.
 * const a = tf.tensor1d([2, 4, 8]);
 * const b = tf.scalar(2);
 * a.floorDiv(b).print();  // or tf.floorDiv(a, b)
 * ```
 *
 * @param a The first tensor as the numerator.
 * @param b The second tensor as the denominator. Must have the same dtype as `a`.
 *
 * @doc {heading: 'Operations', subheading: 'Arithmetic'}
 */

```typescript
function floorDiv_<T extends Tensor>(a: Tensor|TensorLike, b: Tensor|TensorLike): T {
  let $a = convertToTensor(a, 'a', 'floorDiv');
  let $b = convertToTensor(b, 'b', 'floorDiv');

  const inputs: FloorDivInputs = {a: $a, b: $b};

  return ENGINE.runKernel(FloorDiv, inputs as {} as NamedTensorMap);
}

export const floorDiv = op({floorDiv_});
```

The second `tf.Tensor` to add. Must have the same type as `a`.

```typescript
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 * software distributed under the License is distributed on an "AS IS" BASIS,
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
 * See the License for the specific language governing permissions and limitations under the License.
 */

```typescript
import {ENGINE} from '../engine';
import {RealDiv, RealDivInputs} from '../kernel_names';
import {Tensor} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {makeTypesMatch} from '../tensor_util';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';

import {floorDiv} from './floorDiv';
import {op} from './operation';

/**
 * Divides two `tf.Tensor`s element-wise, A / B. Supports broadcasting.
 *
 * ```js
 * const a = tf.tensor1d([1, 4, 9, 16]);
 * const b = tf.tensor1d([1, 2, 3, 4]);
 * a.div(b).print();  // or tf.div(a, b)
 * ```
 *
 * ```js
 * // Broadcast div a with b.
 * const a = tf.tensor1d([2, 4, 8]);
 * const b = tf.scalar(2);
 * a.div(b).print();  // or tf.div(a, b)
 * ```
 *
 * @param a The first tensor as the numerator.
 * @param b The second tensor as the denominator. Must have the same dtype as `a`.
 *
 * @doc {heading: 'Operations', subheading: 'Arithmetic'}
 */

```typescript
function div_<T extends Tensor>(a: Tensor|TensorLike, b: Tensor|TensorLike): T {
  let $a = convertToTensor(a, 'a', 'div');
  let $b = convertToTensor(b, 'b', 'div');

  if ($a.dtype === 'int32' && $b.dtype === 'int32') {
    const inputs: FloorDivInputs = {a: $a, b: $b};

    return ENGINE.runKernel(FloorDiv, inputs as {} as NamedTensorMap);
  }

  const attrs = {};

  // tslint:disable-next-line: no-unnecessary-type-assertion
  return ENGINE.runKernel(RealDiv, inputs as {} as NamedTensorMap, attrs) as T;
}

export const div = op({div_});
```

The second `tf.Tensor` to add. Must have the same type as `a`.

```typescript
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 * software distributed under the License is distributed on an "AS IS" BASIS,
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
 * See the License for the specific language governing permissions and limitations under the License.
 */

```typescript
import {ENGINE} from '../engine';
import {FloorDiv, FloorDivInputs} from '../kernel_names';
import {Tensor} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {makeTypesMatch} from '../tensor_util';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';

import {op} from './operation';

/**
 * Divides two `tf.Tensor`s element-wise, A / B. Supports broadcasting.
 *
 * ```js
 * const a = tf.tensor1d([1, 4, 9, 16]);
 * const b = tf.tensor1d([1, 2, 3, 4]);
 * a.floorDiv(b).print();  // or tf.floorDiv(a, b)
 * ```
 *
 * ```js
 * // Broadcast div a with b.
 * const a = tf.tensor1d([2, 4, 8]);
 * const b = tf.scalar(2);
 * a.floorDiv(b).print();  // or tf.floorDiv(a, b)
 * ```
 *
 * @param a The first tensor as the numerator.
 * @param b The second tensor as the denominator. Must have the same dtype as `a`.
 *
 * @doc {heading: 'Operations', subheading: 'Arithmetic'}
 */

```typescript
function floorDiv_<T extends Tensor>(a: Tensor|TensorLike, b: Tensor|TensorLike): T {
  let $a = convertToTensor(a, 'a', 'floorDiv');
  let $b = convertToTensor(b, 'b', 'floorDiv');

  const inputs: FloorDivInputs = {a: $a, b: $b};

  return ENGINE.runKernel(FloorDiv, inputs as {} as NamedTensorMap);
}

export const floorDiv = op({floorDiv_});
```

The second `tf.Tensor` to add. Must have the same type as `a`.

```typescript
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 * software distributed under the License is distributed on an "AS IS" BASIS,
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
 * See the License for the specific language governing permissions and limitations under the License.
 */

```typescript
import {ENGINE} from '../engine';
import {RealDiv, RealDivInputs} from '../kernel_names';
import {Tensor} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {makeTypesMatch} from '../tensor_util';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';

import {floorDiv} from './floorDiv';
import {op} from './operation';

/**
 * Divides two `tf.Tensor`s element-wise, A / B. Supports broadcasting.
 *
 * ```js
 * const a = tf.tensor1d([1, 4, 9, 16]);
 * const b = tf.tensor1d([1, 2, 3, 4]);
 * a.div(b).print();  // or tf.div(a, b)
 * ```
 *
 * ```js
 * // Broadcast div a with b.
 * const a = tf.tensor1d([2, 4, 8]);
 * const b = tf.scalar(2);
 * a.div(b).print();  // or tf.div(a, b)
 * ```
 *
 * @param a The first tensor as the numerator.
 * @param b The second tensor as the denominator. Must have the same dtype as `a`.
 *
 * @doc {heading: 'Operations', subheading: 'Arithmetic'}
 */

```typescript
function div_<T extends Tensor>(a: Tensor|TensorLike, b: Tensor|TensorLike): T {
  let $a = convertToTensor(a, 'a', 'div');
  let $b = convertToTensor(b, 'b', 'div');

  if ($a.dtype === 'int32' && $b.dtype === 'int32') {
    const inputs: FloorDivInputs = {a: $a, b: $b};

    if ($a.dtype === 'int32' & & $b.dtype === 'int32') {
      return ENGINE.runKernel(FloorDiv, inputs as {} as NamedTensorMap, attrs) as T;
    }
  }

  const attrs = {};

  // tslint:disable-next-line: no-unnecessary-type-assertion
  return ENGINE.runKernel(RealDiv, inputs as {} as NamedTensorMap, attrs) as T;
}

export const div = op({div_});
```
import {ENGINE} from '../engine';
import {Multiply, MultiplyInputs} from '../kernel_names';
import {Tensor} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {makeTypesMatch} from '../tensor_util';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';

import {op} from './operation';

/**
 * We also expose `tf.mulStrict` which has the same signature as this op and
 * asserts that `a` and `b` are the same shape (does not broadcast).
 * `mul(a, b)` can also be written as `[a, b].mul(b.print()); // or tf.mul(a, b)`.
 * `a.mul(b)`
 * ```js
 * const a = tf.tensor1d([1, 2, 3, 4]);
 * const b = tf.tensor1d([2, 3, 4, 5]);
 * a * b.mul(b).print(); // or tf.mul(a, b)
 * ```
 * The first tensor to multiply.
 * @param a The second tensor to multiply. Must have the same dtype as `a`.
 * @param b @doc {heading: 'Operations', subheading: 'Arithmetic'}
 */
function mul_<T extends Tensor>(a: T|TensorLike, b: T|TensorLike): T {
  let $a = convertToTensor(a, 'a', 'mul');
  let $b = convertToTensor(b, 'b', 'mul');
  [$a, $b] = makeTypesMatch($a, $b);

  const inputs: MultiplyInputs = {a: $a, b: $b};

  return ENGINE.runKernel(Multiply, inputs as {} as NamedTensorMap);
}
export const mul = op({mul_});

/**
 * Computes absolute value element-wise: `abs(x)`
 * ```js
 * const x = tf.tensor1d([-1, 2, -3, 4]);
 * x.abs().print();  // or tf.abs(x)
 * ```
 * @param x The input `tf.Tensor`.
 * @doc {heading: 'Operations', subheading: 'Basic math'}
 */
function abs_<T extends Tensor>(x: T|TensorLike): T {
  const $x = convertToTensor(x, 'x', 'abs');

  if ($x.dtype === 'complex64') {
    const inputs: ComplexAbsInputs = {x: $x};
    return ENGINE.runKernel(ComplexAbs, inputs as {} as NamedTensorMap);
  } else {
    const inputs: AbsInputs = {x: $x};
    return ENGINE.runKernel(Abs, inputs as {} as NamedTensorMap);
  }
}
export const abs = op({abs_});

/**
 * Computes acos of the input `tf.Tensor` element-wise: `acos(x)`
 * ```js
 * const x = tf.tensor1d([0, 1, -1, 0.7]);
 * x.acos().print(); // or tf.acos(x)
 * ```
 * @param x The input tensor.
 * @doc {heading: 'Operations',
 * @license
 */
import {ENGINE} from '../engine';
import {Acos, AcosInputs} from '../kernel_names';
import {Tensor} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';

import {op} from './operation';

/**
 * Computes acos of the input `tf.Tensor` element-wise: `acos(x)`
 * ```js
 * const x = tf.tensor1d([0, 1, -1, 0.7]);
 * x.acos().print(); // or tf.acos(x)
 * ```
 * @param x The input tensor.
 * @doc {heading: 'Operations',
 * @license
 */
import {ENGINE} from '../engine';
import {Abs, AbsInputs, ComplexAbs, ComplexAbsInputs} from '../kernel_names';
import {Tensor} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';

import {op} from './operation';

/**
 * Computes absolute value element-wise: `abs(x)`
 * ```js
 * const x = tf.tensor1d([-1, 2, -3, 4]);
 * x.abs().print();  // or tf.abs(x)
 * ```
 * @param x The input `tf.Tensor`.
 * @doc {heading: 'Operations', subheading: 'Basic math'}
 */
function abs_<T extends Tensor>(x: T|TensorLike): T {
  const $x = convertToTensor(x, 'x', 'abs');

  if ($x.dtype === 'complex64') {
    const inputs: ComplexAbsInputs = {x: $x};
    return ENGINE.runKernel(ComplexAbs, inputs as {} as NamedTensorMap);
  } else {
    const inputs: AbsInputs = {x: $x};
    return ENGINE.runKernel(Abs, inputs as {} as NamedTensorMap);
  }
}

export const abs = op({abs_});

/**
 * Computes acos of the input `tf.Tensor` element-wise: `acos(x)`
 * ```js
 * const x = tf.tensor1d([0, 1, -1, 0.7]);
 * x.acos().print(); // or tf.acos(x)
 * ```
 * @param x The input tensor.
 * @doc {heading: 'Operations',
 * @license
 */
import {ENGINE} from '../engine';
import {Acos, AcosInputs} from '../kernel_names';
import {Tensor} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';

import {op} from './operation';

/**
 * Computes acos of the input `tf.Tensor` element-wise: `acos(x)`
 * ```js
 * const x = tf.tensor1d([0, 1, -1, 0.7]);
 * x.acos().print(); // or tf.acos(x)
 * ```
 * @param x The input tensor.
 * @doc {heading: 'Operations',

import {ENGINE} from '../engine';
import {All, AllAttrs, AllInputs} from '../kernel_names';
import {NamedAttrMap} from '../kernel_registry';
import {Tensor} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensor} from '../tensor_util_env';

import {op} from './operation';

/**
 * Computes the logical and of elements across dimensions of a `tf.Tensor`.
 *
 * Reduces the input along the dimensions given in `axes`. Unless `keepDims` is true, the rank of the `tf.Tensor` is reduced by 1 for each entry in `axes`. If `keepDims` is true, the reduced dimensions are retained with `length 1. If `axes` has no entries, all dimensions are reduced, and an `*tf.Tensor` with a single element is returned.
 *
 * ```
 * const x = tf.tensor2d([1, 1, 1], [2, 2], 'bool');
 * const y = x.all();
 * y.print();
 * ```
 *
 * @param x The input tensor. Must be of dtype bool.
 * @param axis The dimension(s) to reduce. By default it reduces all dimensions.
 * @param keepDims If true, retains reduced dimensions with `size 1`.
 *
 * @doc {heading: 'Operations', subheading: 'Reduction'}
 */
function all_<T extends Tensor>(
    x: Tensor|TensorLike, axis: number|number[] = null, keepDims = false): T {
  const $x = convertToTensor(x, 'x', 'all', 'bool');

  const inputs: AllInputs = {x: $x};
  const attrs: AllAttrs = {axis, keepDims};

  return ENGINE.runKernel('all', inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);  
}

// tslint:disable-next-line:variable-name
export const all = op({all_});

/**
 * Computes the logical or of elements across dimensions of a `tf.Tensor`.
 *
 * Reduces the input along the dimensions given in `axes`. Unless `keepDims` is true, the rank of the `tf.Tensor` is reduced by 1 for each entry in `axes`. If `keepDims` is true, the reduced dimensions are retained with `length 1. If `axes` has no entries, all dimensions are reduced, and an `*tf.Tensor` with a single element is returned.
 *
 * ```
 * const x = tf.tensor2d([1, 1, 1], [2, 2], 'bool');
 * const y = x.all();
 * y.print();
 * ```
 *
 * @param x The input tensor. Must be of dtype bool.
 * @param axis The dimension(s) to reduce. By default it reduces all dimensions.
 * @param keepDims If true, retains reduced dimensions with `size 1`.
 *
 * @doc {heading: 'Operations', subheading: 'Reduction'}
 */
function any_<T extends Tensor>(
    x: Tensor|TensorLike, axis: number|number[] = null, keepDims = false): T {
  const $x = convertToTensor(x, 'x', 'any', 'bool');

  const inputs: AnyInputs = {x: $x};
  const attrs: AnyAttrs = {axis, keepDims};

  return ENGINE.runKernel('any', inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);  
}

// tslint:disable-next-line:variable-name
export const any = op({any_});

/**
 * Computes the logical or of elements across dimensions of a `tf.Tensor`.
 *
 * Reduces the input along the dimensions given in `axes`. Unless `keepDims` is true, the rank of the `tf.Tensor` is reduced by 1 for each entry in `axes`. If `keepDims` is true, the reduced dimensions are retained with `length 1. If `axes` has no entries, all dimensions are reduced, and an `*tf.Tensor` with a single element is returned.
 *
 * ```
 * const x = tf.tensor2d([1, 1, 1], [2, 2], 'bool');
 * const y = x.all();
 * y.print();
 * ```
 *
 * @param x The input tensor. Must be of dtype bool.
 * @param axis The dimension(s) to reduce. By default it reduces all dimensions.
 * @param keepDims If true, retains reduced dimensions with `size 1`.
 *
 * @doc {heading: 'Operations', subheading: 'Reduction'}
 */
function argMax_<T extends Tensor>(
    x: Tensor|TensorLike, axis: number|number[] = null, keepDims = false): T {
  const $x = convertToTensor(x, 'x', 'argMax', 'tf');

  const inputs: ArgMaxInputs = {x: $x};
  const attrs: ArgMaxAttrs = {axis, keepDims};

  return ENGINE.runKernel('argMax', inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);  
}

// tslint:disable-next-line:variable-name
export const argMax = op({argMax_});

*/
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```javascript
import {NamedTensorMap} from './tensor_types';
import {TensorLike} from './types';

import {op} from './operation';

/**
 * Returns the indices of the maximum values along an 'axis'.
 * @return {Array} The result has the same shape as 'input' with the dimension along 'axis' removed.
 * @param {Tensor} input - Returns the indices of the maximum values along an 'axis'.
 * @param {number} axis - The dimension to reduce. Defaults to 0 (outer-most dimension).
 * @doc {heading: 'Operations', subheading: 'Reduction'}
 */
function argMax_(input, axis = 0) {
  const $input = convertToTensor(input, 'input', 'argMax');

  const inputs: ArgMaxInputs = {input: $input};
  const attrs: ArgMaxAttrs = {axis};

  return ENGINE.runKernel(ArgMax, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);
}

export const argMax = op({argMax_});
```

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=============================================================================

```javascript
import {ENGINE} from '../engine';
import {Asin, AsinInputs} from '../kernel_names';
import {Tensor} from '../tensor';

import {op} from './operation';

/**
 * Computes asin of the input `tf.Tensor` element-wise: `asin(x)`
 * @param {tf.Tensor} T The input tensor.
 * @doc {heading: 'Operations', subheading: 'Basic math'}
 */
function asin_(T) {
  const $T = convertToTensor(T, 'T', 'asin');

  return ENGINE.runKernel(Asin, $T as {} as NamedTensorMap);
}
export const asin = op({asin_});
```

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=============================================================================
*/

import {ENGINE} from '../engine';
import {Asinh, AsinhInputs} from '../kernel_names';
import {Tensor} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';

import {op} from './operation';

/**
 * Computes inverse hyperbolic sin of the input \( tf.Tensor \) element-wise:
 * \( \text{asinh}(x) \)
 *
 * ```js
 * const x = tf.tensor1d([0, 1, -1, 0.7]);
 *
 * x.asinh().print();  // or tf.asinh(x)
 * ```
 * @param x The input tensor.
 *
 * @doc {heading: 'Operations', subheading: 'Basic math'}
 */
function asinh_<T extends Tensor>(x: T|TensorLike): T {
  const $x = convertToTensor(x, 'x', 'asinh');

  const inputs: AsinhInputs = {x: $x};

  return ENGINE.runKernel(Asinh, inputs as {} as NamedTensorMap);
}
export const asinh = op({asinh_});

```js
const x = tf.tensor1d([0, 1, -1, 0.7]);

x.asinh().print();  // or tf.asinh(x)
```

=============================================================================
*/

import {ENGINE} from '../engine';
import {Atan, AtanInputs} from '../kernel_names';
import {Tensor} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';

import {op} from './operation';

/**
 * Computes \( \arctan(x) \) element-wise:
 *
 * ```js
 * const x = tf.tensor1d([0, 1, -1, 0.7]);
 *
 * x.atan().print();  // or tf.atan(x)
 * ```
 * @param x The input tensor.
 *
 * @doc {heading: 'Operations', subheading: 'Basic math'}
 */
function atan_<T extends Tensor>(x: T|TensorLike): T {
  const $x = convertToTensor(x, 'x', 'atan');

  const inputs: AtanInputs = {x: $x};

  return ENGINE.runKernel(Atan, inputs as {} as NamedTensorMap);
}
export const atan = op({atan_});

```js
const x = tf.tensor1d([0, 1, -1, 0.7]);

x.atan().print();  // or tf.atan(x)
```

=============================================================================
*/

import {ENGINE} from '../engine';
import {Atan2, Atan2Inputs} from '../kernel_names';
import {Tensor} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {makeTypesMatch} from '../tensor_util';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';

import {op} from './operation';

/**
 * Computes \( \arctan2(a, b) \) element-wise:
 *
 * ```js
 * const a = tf.tensor1d([1.0, 1.0, -1.0, 0.7]);
 * const b = tf.tensor1d([2.0, 13.0, 3.5, 0.21]);
 *
 * tf.atan2(a, b).print()
 * ```
 *
 * @param a The first tensor.
 * @param b The second tensor.
 *
 * @doc {heading: 'Operations', subheading: 'Basic math'}
 */
function atan2_<T extends Tensor>(a: Tensor|TensorLike, b: Tensor|TensorLike): T {
  let $a = convertToTensor(a, 'a', 'atan2');
  let $b = convertToTensor(b, 'b', 'atan2');

  [$a, $b] = makeTypesMatch($a, $b);

  const inputs: Atan2Inputs = {a: $a, b: $b};

  return ENGINE.runKernel(Atan2, inputs as {} as NamedTensorMap);
}
export const atan2 = op({atan2_});

```js
const a = tf.tensor1d([1.0, 1.0, -1.0, 0.7]);
const b = tf.tensor1d([2.0, 13.0, 3.5, 0.21]);

tf.atan2(a, b).print()
```

=============================================================================
*/

import {ENGINE} from '../engine';
import {Atan2, Atan2Inputs} from '../kernel_names';
import {Tensor} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {makeTypesMatch} from '../tensor_util';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';

import {op} from './operation';

/**
 * Computes arctangent of \( \text{asinh}(x) \) element-wise:
 *
 * ```js
 * const x = tf.tensor1d([0, 1, -1, 0.7]);
 *
 * x.asinh().print();  // or tf.asinh(x)
 * ```
 * @param x The input tensor.
 *
 * @doc {heading: 'Operations', subheading: 'Basic math'}
 */
function asinh_<T extends Tensor>(x: T|TensorLike): T {
  const $x = convertToTensor(x, 'x', 'asinh');

  const inputs: AsinhInputs = {x: $x};

  return ENGINE.runKernel(Asinh, inputs as {} as NamedTensorMap);
}
export const asinh = op({asinh_});

```js
const x = tf.tensor1d([0, 1, -1, 0.7]);

x.asinh().print();  // or tf.asinh(x)
```

=============================================================================
*/

import {ENGINE} from '../engine';
import {Atan, AtanInputs} from '../kernel_names';
import {Tensor} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';

import {op} from './operation';

/**
 * Computes \( \arctan(x) \) element-wise:
 *
 * ```js
 * const x = tf.tensor1d([0, 1, -1, 0.7]);
 *
 * x.atan().print();  // or tf.atan(x)
 * ```
 * @param x The input tensor.
 *
 * @doc {heading: 'Operations', subheading: 'Basic math'}
 */
function atan_<T extends Tensor>(x: T|TensorLike): T {
  const $x = convertToTensor(x, 'x', 'atan');

  const inputs: AtanInputs = {x: $x};

  return ENGINE.runKernel(Atan, inputs as {} as NamedTensorMap);
}
export const atan = op({atan_});

```js
const x = tf.tensor1d([0, 1, -1, 0.7]);

x.atan().print();  // or tf.atan(x)
```

=============================================================================
*/

import {ENGINE} from '../engine';
import {Atan2, Atan2Inputs} from '../kernel_names';
import {Tensor} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {makeTypesMatch} from '../tensor_util';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';

import {op} from './operation';

/**
 * Computes \( \arctan2(a, b) \) element-wise:
 *
 * ```js
 * const a = tf.tensor1d([1.0, 1.0, -1.0, 0.7]);
 * const b = tf.tensor1d([2.0, 13.0, 3.5, 0.21]);
 *
 * tf.atan2(a, b).print()
 * ```
 *
 * @param a The first tensor.
 * @param b The second tensor.
 *
 * @doc {heading: 'Operations', subheading: 'Basic math'}
 */
function atan2_<T extends Tensor>(a: Tensor|TensorLike, b: Tensor|TensorLike): T {
  let $a = convertToTensor(a, 'a', 'atan2');
  let $b = convertToTensor(b, 'b', 'atan2');

  [$a, $b] = makeTypesMatch($a, $b);

  const inputs: Atan2Inputs = {a: $a, b: $b};

  return ENGINE.runKernel(Atan2, inputs as {} as NamedTensorMap);
}
export const atan2 = op({atan2_});

```js
const a = tf.tensor1d([1.0, 1.0, -1.0, 0.7]);
const b = tf.tensor1d([2.0, 13.0, 3.5, 0.21]);

tf.atan2(a, b).print()
```
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, 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 {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 file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations 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,

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outDepth], dilation2d doesn’t have
outDepth, it should have the same depth as the input.

// Input shape:
[batch, height, width, inChannels] = inputShape[3];
const $filterShape =
[...filterShape, inputChannels] as [number, number, number, number];
const $dataFormat =
convertConv2DDataFormat(dataFormat);

return computeConv2DInfo(
  inputShape, $filterShape, strides, dilations, pad,
  null /* roundingMode */, null /* depthWise */, $dataFormat);
}

export function
computePool2DInfo(
  inShape: [number, number, number, number],
  filterSize: [number, number, number, number],
  strides: number[number, number, number, number],
  dilations: number[number, number, number, number],
  pad: 'same'|'valid'|number,
  roundingMode?: 'floor'|'round'|'ceil',
  dataFormat: 'channelsFirst'|'channelsLast' = 'channelsLast');

const $filterShape =
[...filterShape, inputChannels] as [number, number, number, number];

let filterShape:
[number, number, number, number];
if (dataFormat === 'channelsLast') {
  $filterShape = [filterHeight, filterWidth, inShape[3],
inShape[3]];
} else if (dataFormat === 'channelsFirst') {
  $filterShape = [filterHeight, filterWidth, inShape[1],
inShape[1]];
} else {
  throw new Error('Unknown dataFormat $dataFormat');
}

return computeConv2DInfo(
  inShape, $filterShape, strides, dilations, pad, roundingMode, false,
  $dataFormat);

// Computes the information for a forward pass of a pooling3D operation.

export function
computePool3DInfo(
  inShape: [number, number, number, number, number],
  filterSize: number|[number, number, number, number],
  strides: number|[number, number, number, number],
  dilations: number[number, number, number, number],
  pad: 'same'|'valid'|number|ExplicitPadding,
  roundingMode?: 'floor'|'round'|'ceil',
  dataFormat: 'NDHWC'|'NCDHW' = 'NDHWC');

const $filterShape =
[...filterShape, inputChannels] as [number, number, number, number];

let filterShape:
[number, number, number, number];
if (dataFormat === 'NDHWC') {
  $filterShape = [filterHeight, filterWidth, inShape[4],
inShape[4]];
} else if (dataFormat === 'NCDHW') {
  $filterShape = [filterHeight, filterWidth, inShape[1],
inShape[1]];
} else {
  throw new Error('Unknown dataFormat $dataFormat');
}

return computeConv3DInfo(
  inShape, $filterShape, strides, dilations, pad, false,
  $dataFormat,
  roundingMode);

// Computes the information for a forward pass of a convolution/pooling
// operation.

export function
computeConv2DInfo(
  inShape: [number, number, number, number],
  $filterShape: [number, number, number, number],
  strides: number[number, number, number, number],
  dilations: number[number, number, number, number],
  pad: 'same'|'valid'|number|ExplicitPadding,
  roundingMode?: 'floor'|'round'|'ceil',
  depthwise = false,
  $dataFormat, $filterShape =
[...filterShape, inputChannels] as [number, number, number, number];

let $filterShape:
[number, number, number, number];
if (dataFormat === 'channelsLast') {
  $filterShape = [filterHeight, filterWidth, inShape[3],
inShape[3]];
} else if (dataFormat === 'channelsFirst') {
  $filterShape = [filterHeight, filterWidth, inShape[1],
inShape[1]];
} else {
  throw new Error('Unknown dataFormat $dataFormat');
}

return computeConv2DInfo(
  inShape, $filterShape, strides, dilations, pad, roundingMode, false,
  $dataFormat,
  roundingMode);

// Computes the information for a forward pass of a convolution/pooling
// operation.

export type Conv3DInfo = {
  batchSize: number,
  inDepth: number,
  inHeight: number,
  inWidth: number,
  inChannels: number,
  outDepth: number,
  outHeight: number,
  outWidth: number,
  outChannels: number,
  dataFormat: 'channelsFirst'|'channelsLast',
  strideDepth: number,
  strideHeight: number,
  strideWidth: number,
  filterHeight: number,
  filterWidth: number,
  effectiveFilterHeight: number,
  effectiveFilterWidth: number,
  dilationHeight: number,
  dilationWidth: number,
  inShape, $filterShape =
[...filterShape, inputChannels] as [number, number, number, number];

if (dataFormat === 'channelsLast') {
  $filterShape = [filterHeight, filterWidth, inShape[3],
inShape[3]];
} else if (dataFormat === 'channelsFirst') {
  $filterShape = [filterHeight, filterWidth, inShape[1],
inShape[1]];
} else {
  throw new Error('Unknown dataFormat $dataFormat');
}

return computeConv2DInfo(
  inShape, $filterShape, strides, dilations, pad, roundingMode, false,
  $dataFormat,
  roundingMode);

// Computes the information for a forward pass of a convolution/pooling
// operation.

export type Conv3DInfo = {
  batchSize: number,
  inDepth: number,
  inHeight: number,
  inWidth: number,
  inChannels: number,
  outDepth: number,
  outHeight: number,
  outWidth: number,
  outChannels: number,
  dataFormat: 'channelsFirst'|'channelsLast',
  strideDepth: number,
  strideHeight: number,
  strideWidth: number,
  filterHeight: number,
  filterWidth: number,
  effectiveFilterHeight: number,
  effectiveFilterWidth: number,
  dilationHeight: number,
  dilationWidth: number,
  inShape, $filterShape =
[...filterShape, inputChannels] as [number, number, number, number];

if (dataFormat === 'channelsLast') {
  $filterShape = [filterHeight, filterWidth, inShape[3],
inShape[3]];
} else if (dataFormat === 'channelsFirst') {
  $filterShape = [filterHeight, filterWidth, inShape[1],
inShape[1]];
} else {
  throw new Error('Unknown dataFormat $dataFormat');
}

return computeConv2DInfo(
  inShape, $filterShape, strides, dilations, pad, roundingMode, false,
  $dataFormat,
  roundingMode);

// Computes the information for a forward pass of a convolution/pooling
// operation.

export type Conv3DInfo = {
  batchSize: number,
  inDepth: number,
  inHeight: number,
  inWidth: number,
  inChannels: number,
  outDepth: number,
  outHeight: number,
  outWidth: number,
  outChannels: number,
  dataFormat: 'channelsFirst'|'channelsLast',
  strideDepth: number,
  strideHeight: number,
  strideWidth: number,
  filterHeight: number,
  filterWidth: number,
  effectiveFilterHeight: number,
  effectiveFilterWidth: number,
  dilationHeight: number,
  dilationWidth: number,
  inShape, $filterShape =
[...filterShape, inputChannels] as [number, number, number, number];

if (dataFormat === 'channelsLast') {
  $filterShape = [filterHeight, filterWidth, inShape[3],
inShape[3]];
} else if (dataFormat === 'channelsFirst') {
  $filterShape = [filterHeight, filterWidth, inShape[1],
inShape[1]];
} else {
  throw new Error('Unknown dataFormat $dataFormat');
}

return computeConv2DInfo(
  inShape, $filterShape, strides, dilations, pad, roundingMode, false,
  $dataFormat,
  roundingMode);

// Computes the information for a forward pass of a convolution/pooling
// operation.

export type Conv3DInfo = {
  batchSize: number,
  inDepth: number,
  inHeight: number,
  inWidth: number,
  inChannels: number,
  outDepth: number,
  outHeight: number,
  outWidth: number,
  outChannels: number,
  dataFormat: 'channelsFirst'|'channelsLast',
  strideDepth: number,
  strideHeight: number,
  strideWidth: number,
strideHeight: number,
strideWidth: number,
dilationDepth: number,
dilationHeight: number,
dilationWidth: number,
filterDepth: number,
filterHeight: number,
filterWidth: number,
effectiveFilterDepth: number,
effectiveFilterHeight: number,
effectiveFilterWidth: number,
padInfo: PadInfo3D,
inShape: [number, number, number, number, number],
outShape: [number, number, number, number, number],
filterShape: [number, number, number, number, number],
**/ * Computes the information for a forward pass of a 3D convolution/pooling operation */

/* Computes the information for a forward pass of a 3D convolution/pooling operation */

/**
 * Computes the information for a forward pass of a 3D convolution/pooling operation.
 */
export function computeConv3DInfo(
inShape: [number, number, number, number, number],
filterShape: [number, number, number, number, number],
strides: number[],
dilations: number[],
pad: 'same'|'valid'|number,
depthwise = false,
dataFormat: 'channelsLast'|'channelsFirst',
dilationLast = 'channelsLast',
roundingMode?: 'floor'|'round'|'ceil': Conv3DInfo {
  let [batchSize, inDepth, inHeight, inWidth, inChannels] = inShape;
  if (dataFormat === 'channelsFirst') {
    [batchSize, inDepth, inHeight, inWidth, inChannels] = inShape;
  } else if (dataFormat === 'channelsLast') {
    [batchSize, inChannels, inHeight, inWidth] = inShape;
  } else {
    throw new Error('Unknown dataFormat $ {dataFormat}');
  }
  const [filterDepth, filterHeight, filterWidth, -1, filterChannels] = filterShape;
  const [strideDepth, strideHeight, strideWidth] = parse3TupleParam(strides);
  const [dilationDepth, dilationHeight, dilationWidth] = parse3TupleParam(dilations);
  const effectiveFilterDepth = getEffectiveFilterSize(filterDepth, dilationDepth, dilationHeight);
  const effectiveFilterHeight = getEffectiveFilterSize(filterHeight, dilationHeight);
  const effectiveFilterWidth = getEffectiveFilterSize(filterWidth, dilationWidth);
  const constOutChannels = depthwise ? filterChannels * inChannels : filterChannels;
  const outShape = [batchSize, outChannels, outHeight, outWidth];
  const filterShape = [filterDepth, filterHeight, filterWidth, -1, filterChannels];
  const [padInfo, outDepth, outHeight, outWidth] = get3DPadAndOutInfo(
pad, inDepth, inHeight, inWidth, strideDepth, strideHeight, strideWidth, depthwise, filterChannels * inChannels, filterChannels,
  'floor'|'round'|'ceil');
  const effectiveHeight = getEffectiveFilterSize(filterHeight, dilationHeight);
  const effectiveWidth = getEffectiveFilterSize(filterWidth, dilationWidth);
  const effectiveFilter = depthwise ? filterChannels * inChannels : filterChannels;
  const outputRows = computeOutputShape2D(outShape, fieldSize, stride, zeroPad, roundingMode);
  const outputCols = computeOutputShape4D(outShape, fieldSize, -1, zeroPad, roundingMode);
  const outputDepths = computeOutputShape4D(outShape, fieldSize, -1, zeroPad, roundingMode);
  return [outputRows, outputCols, outputDepths];
}

function computeOutputShape2D(outShape: number|number, fieldSize: number, stride: number, zeroPad?: number, roundingMode?: 'floor'|'round'|'ceil'): number {
  if (zeroPad == null) {
    zeroPad = computeDefaultPad(outShape, fieldSize, stride);
  }
  const inputRows = inputShape[0];
  const inputCols = inputShape[1];
  const outputRows = round((inputRows - fieldSize + 2 * zeroPad) / stride + 1, roundingMode);
  const outputCols = round((inputCols - fieldSize + 2 * zeroPad) / stride + 1, roundingMode);
  return [outputRows, outputCols, outputDepths];
}

function computeOutputShape4D(outShape: number|number, fieldSize: number, stride: number, zeroPad?: number, roundingMode?: 'floor'|'round'|'ceil'): number {
  if (zeroPad == null) {
    zeroPad = computeDefaultPad(outShape, fieldSize, stride, roundingMode);
  }
  const inputDepth = inputShape[0];
  const inputRows = inputShape[1];
  const inputCols = inputShape[2];
  const outputRows = round((inputRows - fieldSize + 2 * zeroPad) / stride + 1, roundingMode);
  const outputCols = round((inputCols - fieldSize + 2 * zeroPad) / stride + 1, roundingMode);
  return [outputRows, outputCols, outputDepths];
}

function computeDefaultPad(inputShape: number|number, fieldSize: number, stride: number, dilation = 1): number {
  const effectiveFieldSize = getEffectiveFilterSize(fieldSize, dilation);
  return Math.floor((inputShape[0] * (stride - 1) - stride + effectiveFieldSize) / 2);
}

function parseTupleParam(param: number|number[]): number {
  return typeof paramString === 'number' ? parseInt(param, 10) : param;
}

function parse3TupleParam(param: number[]): number[] {
  return typeof paramString === 'number' ? parseInt(param, 10) : param;
}

function computeOutputShape2D(outShape: number|number, fieldSize: number, stride: number, zeroPad?: number, roundingMode?: 'floor'|'round'|'ceil'): number {
  if (zeroPad == null) {
    zeroPad = computeDefaultPad(outShape, fieldSize, stride, roundingMode);
  }
  const inputRows = inputShape[0];
  const inputCols = inputShape[1];
  const outputRows = round((inputRows - fieldSize + 2 * zeroPad) / stride + 1, roundingMode);
  const outputCols = round((inputCols - fieldSize + 2 * zeroPad) / stride + 1, roundingMode);
  return [outputRows, outputCols, outputDepths];
}

function computeOutputShape4D(outShape: number|number, fieldSize: number, stride: number, zeroPad?: number, roundingMode?: 'floor'|'round'|'ceil'): number {
  if (zeroPad == null) {
    zeroPad = computeDefaultPad(outShape, fieldSize, stride, roundingMode);
  }
  const inputDepth = inputShape[0];
  const inputRows = inputShape[1];
  const inputCols = inputShape[2];
  const outputRows = round((inputRows - fieldSize + 2 * zeroPad) / stride + 1, roundingMode);
  const outputCols = round((inputCols - fieldSize + 2 * zeroPad) / stride + 1, roundingMode);
  return [outputRows, outputCols, outputDepths];
}

function computeDefaultPad(inputShape: number|number, fieldSize: number, stride: number, dilation = 1): number {
  const effectiveFieldSize = getEffectiveFilterSize(fieldSize, dilation);
  return Math.floor((inputShape[0] * (stride - 1) - stride + effectiveFieldSize) / 2);
}

function parseTupleParam(param: number|number[]): number {
  return typeof paramString === 'number' ? parseInt(param, 10) : param;
}

function parse3TupleParam(param: number[]): number[] {
  return typeof paramString === 'number' ? parseInt(param, 10) : param;
}
param === 'number' ? [param, param, param] : param

/* See https://www.tensorflow.org/api_docs/python/tf/nn/atrous_conv2d */
Atrous convolution is equivalent to standard convolution with upsampled filters with effective_filter_height = filter_height + (filter_height - 1) * (dilation - 1) and effective_filter_width = filter_width + (filter_width - 1) * (dilation - 1). Produced by inserting dilation - 1 zeros along consecutive elements across the filters' spatial dimensions. When there is a dilation, this converts a filter dimension to the effective filter dimension, so it can be used in a standard convolution.

function getEffectiveFilterSize(filterSize, dilation) {
  if (dilation <= 1) {
    return filterSize;
  }
  return filterSize + (filterSize - 1) * (dilation - 1);
}

function getPadAndOutInfo(
  pad, inHeight, inWidth, strideHeight, strideWidth, roundingMode, dataFormat) {
  const outHeight = inHeight + (inHeight - filterHeight) / strideHeight;
  const outWidth = inWidth + (inWidth - filterWidth) / strideWidth;
  const outShape = [outHeight, outWidth, 1];
  return { outHeight, outWidth, outShape, strideHeight, strideWidth, roundingMode, dataFormat, channelsFirst, channelsLast, pad, type: 'SAME' };
}

function get3DPadAndOutInfo(
  pad, inDepth, inHeight, inWidth, strideDepth, strideHeight, strideWidth, filterDepth, filterHeight, filterWidth) {
  const outShape = [outDepth, outHeight, outWidth, 1];
  return { outDepth, outHeight, outWidth, outShape, strideDepth, strideHeight, strideWidth, filterDepth, filterHeight, filterWidth, roundingMode, dataFormat, channelsFirst, channelsLast, pad, type: 'SAME' };
}

// ...
Math.ceil((inWidth - filterWidth + 1) / strideWidth);
} else {
  throw Error(`Unknown padding parameter: ${pad}`);
}

return {padInfo, outDepth, outHeight, outWidth};

/**
 * Rounds a value depending on the rounding mode
 * @param value number
 * @param roundingMode 'floor', 'ceil' or 'round'
 * @returns number
 */
function round(value: number, roundingMode?: 'floor' | 'ceil' | 'round') {
  switch (roundingMode) {
    case 'floor':
      return Math.floor(value);
    case 'ceil':
      return Math.ceil(value);
    case 'round':
      return Math.round(value);
    default:
      throw new Error(`Unknown roundingMode ${roundingMode}`);
  }
}

export function tupleValuesAreOne(param: number|number[]): boolean {
  const [dimA, dimB, dimC] = parseTupleParam(param);
  return dimA === 1 & & dimB === 1 & & dimC === 1;
}

/**
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 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
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 * limitations under the License.
 *
 *=============================================================================
 */

import {ENGINE} from '../engine';
import {AvgPool, AvgPoolAttrs, AvgPoolInputs} from '../kernel_names';
import {NamedAttrMap} from '../kernel_registry';
import {Tensor} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensor} from '../tensor_util_env';
import {Rank, ShapeMap, TensorLike} from '../types';
import {op} from './operation';

/**
 * Reshapes a `tf.Tensor` to a given shape.
 *
 * Given an input tensor, returns a new tensor with the same values as the input tensor with
 * shape `shape`. If one component of shape is the special value `-1`, the size of that dimension is computed so that the total size remains constant. In particular, a shape of [-1] flattens into 1-D. At most one component of shape can be -1. If shape is 1-D or higher, then the operation returns a tensor with shape and shape filled with the values of tensor. In this case, the number of elements implied by shape must be the same as the number of elements in tensor. If one or more elements implied by shape must be the same as the number of elements in tensor, the shape is computed as tensor.shape.size() / x.tensorId([1, 2, 3, 4]).x.reshape([2, 2]).print();

 * @param x The input tensor to be reshaped.
 * @param shape * @param shape An array of integers defining the output tensor shape. shape is an object of the shape type.
 * @param shape An object of the shape type.
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 * @param shape An object of the shape type.
 * @param shape An object of the shape type.
 * @param shape An object of the shape type.
function avgPool_<T extends Tensor3D|Tensor4D>(
    x: T|TensorLike, filterSize: [number, number]|number,
    strides: [number, number]|number, pad: 'valid'|'same'|number,
    dimRoundingMode?: 'floor'|'round'|'ceil'): T {
  const $x = convertToTensor(x, 'x', 'avgPool', 'float32');
  const dilations = 1;

  util.assert(
      conv_util.eitherStridesOrDilationsAreOne(strides, dilations),
      () => 'Error in avgPool: Either strides or dilations must be 1.' +

  'Got strides $strides and dilations $dilations':)

  let x4D = $x as Tensor4D;
  let reshapedTo4D = false;
  if ($x.rank === 3) {
    reshapedTo4D = true;
    x4D = reshape($x, [1, $x.shape[0], $x.shape[1], $x.shape[2]])
  }

  util.assert(
      x4D.rank === 4,
      () => `Error in avgPool: x must be rank 4 but got rank ${x4D.rank}.`);

  if (dimRoundingMode != null) {
    util.assert(
        util.isInt(pad as number),
        () => `Error in avgPool: pad must be an integer when using, ` +
            `dimRoundingMode ${dimRoundingMode} but got pad ${pad}.`);
  }

  const inputs: AvgPoolInputs = {x: x4D};

  const attrs: AvgPoolAttrs = {filterSize, strides, pad, dimRoundingMode};

  // tslint:disable-next-line: no-unnecessary-type-assertion
  let res = ENGINE.runKernel(AvgPool, inputs as {}, attrs)

  res = cast(res, $x.dtype);

  if (reshapedTo4D) {
    return reshape(res, [res.shape[1], res.shape[2], res.shape[3]])
  }

  return res;
}

export const avgPool = op({avgPool_});

valid`: output will be smaller than input if filter is larger than 1x1

* For more info, see this guide:

https://www.tensorflow.org/api_guides/python/nn#Convolution

* param dimRoundingMode A string from: 'ceil', 'round', 'floor'. If none is provided, it will default to truncate:

* param dataFormat An optional string from: 'NDHWC', 'NCDHW'. Defaults to 'NDHWC'. Specify the data format of the input and output data. With the default format 'NDHWC', the data is stored in the order of: [batch, depth, height, width, channels]. Only 'NDHWC' is currently supported. * @doc {heading: 'Operations', subheading: 'Convolution'}

```javascript
function avgPool3d_<T extends Tensor4D|Tensor5D>(
    x: T|TensorLike, filterSize: [number, number, number],
    strides: [number, number, number],
    pad: 'valid'|'same'|number,
    dimRoundingMode?: 'floor'|'round'|'ceil',
    dataFormat: 'NDHWC'|'NCDHW' = 'NDHWC'): T {
  const $x = convertToTensor(x, 'x', 'avgPool3d', 'float32');

  let x5D = $x as Tensor5D;
  let reshapedTo5D = false;
  if ($x.rank === 4) {
    reshapedTo5D = true;
    x5D = reshape($x, [1, $x.shape[0], $x.shape[1], $x.shape[2], $x.shape[3]]);}

  util.assert(
      x5D.rank === 5,
      () => `Error in avgPool3d: x must be rank 5 but got rank ${x5D.rank}.`);
  util.assert(
      dataFormat === 'NDHWC',
      () => `Error in avgPool3d: Only NDHWC is currently supported, but got dataFormat of ${dataFormat}.`);

  if (dimRoundingMode != null) {
    util.assert(
        util.isInt(pad as number),
        () => `Error in avgPool3d: pad must be an integer when using, but got pad=${pad}.`);
  }

  const inputs:
      AvgPool3DInputs = {x: x5D};

  const attrs:
      AvgPool3DAttrs = {filterSize, strides, pad, dimRoundingMode, dataFormat};

  // tslint:disable-next-line: no-unnecessary-type-assertion
  let res = ENGINE.runKernel($x5D, 'avgPool3d', inputs as {} as NamedTensorMap,
                attrs as {} as NamedAttrMap) as T;

  res = cast(res,
               x5D.dtype);

  if (reshapedTo5D) {
    return reshape(
               res, [res.shape[1], res.shape[2], res.shape[3], res.shape[4]]) as T;
  }

  return res;
}

export const avgPool3d = op({avgPool3d_});

```
import {ENGINE} from './engine';
import {Sigmoid, SigmoidInputs} from './kernel_names';
import {Tensor} from './tensor';
import {NamedTensorMap} from './named_tensor_map';
import {convertToTensor} from '../tensor_util_env';
import {NamedAttrMap} from '../kernel_registry';
import {Rank, TensorLike} from '../types';

import {op} from './operation';

/**
 * Computes sigmoid element-wise, \( \frac{1}{1 + \exp(-x)} \)
 * @param x The input tensor.
 * @doc {heading: 'Math'}
 */
function sigmoid_(x: TensorLike): Tensor {
  const $x = convertToTensor(x, 'x', 'sigmoid');

  const inputs: SigmoidInputs = {x: $x};

  return ENGINE.runKernel(Sigmoid, inputs as {} as NamedTensorMap);
}

export const sigmoid = op({sigmoid_});

/**
 * Extracts a slice from a `tf.Tensor` starting at coordinates `begin`
 * and is of size `size`.
 * Also available are stricter rank-specific methods with the same signature
 * as this method that assert that `x` is of the given rank:
 *   - `tf.slice1d`
 *   - `tf.slice2d`
 *   - `tf.slice3d`
 *   - `tf.slice4d`
 * @param x The input `tf.Tensor`.
 * @param begin The coordinates to start the slice from. Can also be a single
 *   number, in which case it specifies the first axis.
 * @param size The size of the slice. Can also be a single number, in which case
 *   it specifies the size of the first axis.
 * @doc {heading: 'Tensors', subheading: 'Slicing and Joining'}
 */
function slice_(x: Tensor, begin: number|number[], size?: number|number[]): Tensor {
  const $x = convertToTensor(x, 'x', 'slice');
  if ($x.rank === 0) {
    throw new Error('Slicing scalar is not possible');
  }

  const sliceInputs = {x: $x};
  const attr = {begin, size};

  return ENGINE.runKernel(slice, sliceInputs as {}, attr as {} as NamedAttrMap);
}

export const slice = op({slice_});

/**
 * Computes `x(s)` where `x` is a `tf.Tensor` and `s` is a `tf.Tensor` or
 * array of numbers.
 * @param x The input `tf.Tensor`.
 * @param s The input `tf.Tensor` or array of numbers.
 * @doc {heading: 'Math'}
 */
function slice_and_join_(x: Tensor, s: Tensor|number[]) {
  const $x = convertToTensor(x, 'x', 'slice_and_join');
  if ($x.rank === 0) {
    throw new Error('Slicing scalar is not possible');
  }

  const sliceAndJoinInputs = {$x};
  const attr = {s};

  return ENGINE.runKernel(sliceAndJoin, sliceAndJoinInputs as {}, attr as {} as NamedAttrMap);
}

export const slice_and_join = op({slice_and_join_});

/**
 * Computes `x(s)` where `x` is a `tf.Tensor` and `s` is a `tf.Tensor` or
 * array of numbers.
 * @param x The input `tf.Tensor`.
 * @param s The input `tf.Tensor` or array of numbers.
 * @doc {heading: 'Math'}
 */
function slice_and_join_with_axis_(x: Tensor, s: number[], axis: number) {
  const $x = convertToTensor(x, 'x', 'slice_and_join_with_axis');
  if ($x.rank === 0) {
    throw new Error('Slicing scalar is not possible');
  }

  const sliceAndJoinWithAxisInputs = {$x, axis};
  const attr = {s};

  return ENGINE.runKernel(sliceAndJoinWithAxis, sliceAndJoinWithAxisInputs as {}, attr as {} as NamedAttrMap);
}

export const slice_and_join_with_axis = op({slice_and_join_with_axis_});
BatchToSpaceNDInputs} from '../kernel_names';
import {NamedAttrMap} from '../kernel_registry';
import {NamedTensorMap} from '../named_tensor';
import {convertToTensor} from '../tensor_util_env';
import {Tensor} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {TensorLike} from '../types';
import * as util from '../util';

import {op} from './operation';

/**
 * This operation reshapes the 'batch' dimension 0 into 'M + 1' dimensions of
 * shape 'blockShape + [batch]', interleaves these blocks back into the grid
 * defined by the spatial dimensions '[1, ..., M]', to obtain a result with
 * batch as the same rank as the input. The spatial dimensions of this intermediate
 * result are then optionally cropped according to 'crops' to produce the
 * output. This is the reverse of `tf.spaceToBatchND`. See below for a precise
 * description.

 * ```js
 * const x = tf.tensor4d([1, 2, 3, 4], [4, 1, 1, 1]);
 * const blockShape = [2, 2];
 * const crops = [[0, 0], [0, 0]];
 * const x = batchToSpaceND(blockShape, crops).print();
 * ```
 *
 * @param x A `tf.Tensor`. N-D with 'x.shape' = [blockShape] + [batch] + spatialShape + [remainingShape], where
 * spatialShape has 'M' dimensions.
 * @param blockShape A 1-D array. Must have shape [M], all values must be >= 0. 
 * @param crops A 2-D array. Must have shape [M, 2], all values must be >= 0. 
 * @doc {heading: 'Tensors', subheading:
 * 'Transformations'}
 */
function batchToSpaceND_<T extends Tensor>(
    x: T|TensorLike, blockShape: number[], crops: number[][]):
  const $x = convertToTensor(x, 'x', 'batchToSpaceND');
  const prod = blockShape.reduce((a, b) => a * b);

  util.assert(
      $x.rank >= 1 + blockShape.length,
      () => `input rank is ${$x.rank} but should be greater than blockShape.length ${blockShape.length}`);

  util.assert(
      crops.length === blockShape.length,
      () => `crops.length is ${crops.length} but should be equal to blockShape.length ${blockShape.length}`);

  const inputs: BatchToSpaceNDInputs = {x: $x};
  const

  return ENGINE.runKernel(BatchToSpaceND, inputs
      as {} as NamedTensorMap,
      {blockShape, crops} as {} as NamedAttrMap);
}

export const batchToSpaceND =
    op({batchToSpaceND_});
import {ENGINE} from '../engine';
import {FusedBatchNorm, FusedBatchNormAttrs, FusedBatchNormInputs} from '../kernel_names';
import {NamedAttrMap} from '../kernel_registry';
import {Tensor, Tensor1D, Tensor4D} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensor} from '../tensor_util_env';
import {Rank, TensorLike} from '../types';
import * as util from '../util';

import {xAs4D} from './batchnorm_util';
import {op} from './operation';
import {reshape} from './reshape';

/**
 * Batch normalization.
 *
 * As described in
 *
 * Mean, variance, scale, and offset can be of two shapes:
 *   - The same shape as the input.
 *   - In the common case, the depth dimension is the last dimension of 
 *     the values would be an `tf.Tensor1D` of shape [depth].
 *   - Also available are stricter rank-specific methods with the same signature as this method that assert that parameters passed are of given rank.
 *
 * @param x The input Tensor.
 * @param mean A mean Tensor.
 * @param variance A variance Tensor.
 * @param offset An offset Tensor.
 * @param scale A scale Tensor.
 * @param varianceEpsilon A small float number to avoid dividing by 0.
 *
 * @doc {heading: 'Operations', subheading: 'Normalization'}
 */
function batchNorm_<R extends Rank>(
    x: Tensor<R>|TensorLike, mean: Tensor<R>|Tensor1D|TensorLike, variance: Tensor<R>|Tensor1D|TensorLike, offset?: Tensor<R>|Tensor1D|TensorLike, scale?: Tensor<R>|Tensor1D|TensorLike, varianceEpsilon?: number): Tensor<R> {
  if (varianceEpsilon == null) {
    varianceEpsilon = 0.001;
  }
  const $x = convertToTensor(x, 'x', 'batchNorm');
  const $mean = convertToTensor(mean, 'mean', 'batchNorm');
  const $variance = convertToTensor(variance, 'variance', 'batchNorm');
  let $scale: Tensor<R>|Tensor1D;
  if (scale != null) {
    $scale = convertToTensor(scale, 'scale', 'batchNorm');
  }
  let $offset: Tensor<R>|Tensor1D;
  if (offset != null) {
    $offset = convertToTensor(offset, 'offset', 'batchNorm');
  }

  util.assert($mean.rank === $variance.rank,
      () => 'Batch normalization gradient requires mean and variance to have equal ranks.');
  util.assert($offset == null || $mean.rank === $offset.rank,
      () => 'Batch normalization gradient requires mean and offset to have equal ranks.');
  util.assert($scale == null || $mean.rank === $scale.rank,
      () => 'Batch normalization gradient requires mean and scale to have equal ranks.');

  const x4D: Tensor4D = xAs4D($x);

  const inputs: FusedBatchNormInputs = {
    x: x4D,
    scale: $scale,
    offset: $offset,
    mean: $mean,
    variance: $variance
  };

  const attrs: FusedBatchNormAttrs = {varianceEpsilon};

  // tslint:disable-next-line:no-unnecessary-type-assertion
  const res = ENGINE.runKernel(FusedBatchNorm, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap) as Tensor<R>;

  return reshape(res, $x.shape);
}

export const batchNorm = op({batchNorm_});

---------------------------------------------------------------------------

*An

import {ENGINE} from '../engine';
import {FusedBatchNorm, FusedBatchNormAttrs, FusedBatchNormInputs} from '../kernel_names';
import {NamedAttrMap} from '../kernel_registry';
import {Tensor, Tensor1D, Tensor4D} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensor} from '../tensor_util_env';
import {Types, import * as tf.batchNorm from '../operation';

/**
 * Batch normalization.
 *
 * As described in
 *
 * Mean, variance, scale, and offset can be of two shapes:
 *   - The same shape as the input.
 *   - In the common case, the depth dimension is the last dimension of 
 *     the values would be an `tf.Tensor1D` of shape [depth].
 *   - Also available are stricter rank-specific methods with the same signature as this method that assert that parameters passed are of given rank.
 *
 * @param x The input Tensor.
 * @param mean A mean Tensor.
 * @param variance A variance Tensor.
 * @param offset An offset Tensor.
 * @param scale A scale Tensor.
 * @param varianceEpsilon A small float number to avoid dividing by 0.
 *
 * @doc {heading: 'Operations', subheading: 'Normalization'}
 */
function batchNorm_<R extends Rank>(
    x: Tensor<R>|TensorLike, mean: Tensor<R>|Tensor1D|TensorLike, variance: Tensor<R>|Tensor1D|TensorLike, offset?: Tensor<R>|Tensor1D|TensorLike, scale?: Tensor<R>|Tensor1D|TensorLike, varianceEpsilon?: number): Tensor<R> {
  if (varianceEpsilon == null) {
    varianceEpsilon = 0.001;
  }
  const $x = convertToTensor(x, 'x', 'batchNorm');
  const $mean = convertToTensor(mean, 'mean', 'batchNorm');
  const $variance = convertToTensor(variance, 'variance', 'batchNorm');
  let $scale: Tensor<R>|Tensor1D;
  if (scale != null) {
    $scale = convertToTensor(scale, 'scale', 'batchNorm');
  }
  let $offset: Tensor<R>|Tensor1D;
  if (offset != null) {
    $offset = convertToTensor(offset, 'offset', 'batchNorm');
  }

  util.assert($mean.rank === $variance.rank,
      () => 'Batch normalization gradient requires mean and variance to have equal ranks.');
  util.assert($offset == null || $mean.rank === $offset.rank,
      () => 'Batch normalization gradient requires mean and offset to have equal ranks.');
  util.assert($scale == null || $mean.rank === $scale.rank,
      () => 'Batch normalization gradient requires mean and scale to have equal ranks.');

  const x4D: Tensor4D = xAs4D($x);

  const inputs: FusedBatchNormInputs = {
    x: x4D,
    scale: $scale,
    offset: $offset,
    mean: $mean,
    variance: $variance
  };

  const attrs: FusedBatchNormAttrs = {varianceEpsilon};

  // tslint:disable-next-line:no-unnecessary-type-assertion
  const res = ENGINE.runKernel(FusedBatchNorm, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap) as Tensor<R>;

  return reshape(res, $x.shape);
}

export const batchNorm = op({batchNorm_});

---------------------------------------------------------------------------

*An

import {ENGINE} from '../engine';
import {FusedBatchNorm, FusedBatchNormAttrs, FusedBatchNormInputs} from '../kernel_names';
import {NamedAttrMap} from '../kernel_registry';
import {Tensor, Tensor1D, Tensor4D} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensor} from '../tensor_util_env';
import {Types, import * as tf.batchNorm from '../operation';

/**
 * Batch normalization.
 *
 * As described in
 *
 * Mean, variance, scale, and offset can be of two shapes:
 *   - The same shape as the input.
 *   - In the common case, the depth dimension is the last dimension of 
 *     the values would be an `tf.Tensor1D` of shape [depth].
 *   - Also available are stricter rank-specific methods with the same signature as this method that assert that parameters passed are of given rank.
 *
 * @param x The input Tensor.
 * @param mean A mean Tensor.
 * @param variance A variance Tensor.
 * @param offset An offset Tensor.
 * @param scale A scale Tensor.
 * @param varianceEpsilon A small float number to avoid dividing by 0.
 *
 * @doc {heading: 'Operations', subheading: 'Normalization'}
 */
function batchNorm_<R extends Rank>(
    x: Tensor<R>|TensorLike, mean: Tensor<R>|Tensor1D|TensorLike, variance: Tensor<R>|Tensor1D|TensorLike, offset?: Tensor<R>|Tensor1D|TensorLike, scale?: Tensor<R>|Tensor1D|TensorLike, varianceEpsilon?: number): Tensor<R> {
  if (varianceEpsilon == null) {
    varianceEpsilon = 0.001;
  }
  const $x = convertToTensor(x, 'x', 'batchNorm');
  const $mean = convertToTensor(mean, 'mean', 'batchNorm');
  const $variance = convertToTensor(variance, 'variance', 'batchNorm');
  let $scale: Tensor<R>|Tensor1D;
  if (scale != null) {
    $scale = convertToTensor(scale, 'scale', 'batchNorm');
  }
  let $offset: Tensor<R>|Tensor1D;
  if (offset != null) {
    $offset = convertToTensor(offset, 'offset', 'batchNorm');
  }

  util.assert($mean.rank === $variance.rank,
      () => 'Batch normalization gradient requires mean and variance to have equal ranks.');
  util.assert($offset == null || $mean.rank === $offset.rank,
      () => 'Batch normalization gradient requires mean and offset to have equal ranks.');
  util.assert($scale == null || $mean.rank === $scale.rank,
      () => 'Batch normalization gradient requires mean and scale to have equal ranks.');

  const x4D: Tensor4D = xAs4D($x);

  const inputs: FusedBatchNormInputs = {
    x: x4D,
    scale: $scale,
    offset: $offset,
    mean: $mean,
    variance: $variance
  };

  const attrs: FusedBatchNormAttrs = {varianceEpsilon};

  // tslint:disable-next-line:no-unnecessary-type-assertion
  const res = ENGINE.runKernel(FusedBatchNorm, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap) as Tensor<R>;

  return reshape(res, $x.shape);
}

export const batchNorm = op({batchNorm_});

---------------------------------------------------------------------------

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* software distributed under the License is distributed on an "AS IS" BASIS,
* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
* See the License for the specific language governing permissions and limitations under the License.
*
varianceEpsilon A small float number to avoid dividing by 0.

```javascript
varianceEpsilon = 1e-5;
```

// Function to perform batch normalization on a tensor.

```javascript
function batchNorm2d(x, mean, variance, offset, scale, varianceEpsilon) {
  // Convert input tensors to flat arrays.
  x = x.flatten().numpy()
  mean = mean.flatten().numpy()
  variance = variance.flatten().numpy()
  offset = offset.flatten().numpy()
  scale = scale.flatten().numpy()

  // Calculate the mean and variance.
  mean = np.mean(x)
  variance = np.var(x, ddof=0)

  // Offset the mean and scale the variance.
  x = (x - mean) / np.sqrt(variance + varianceEpsilon)

  // Apply offset and scale.
  x = x * scale + offset

  return x
}
```

// Export the function.

```javascript
export default batchNorm2d
```

---

The above code snippet demonstrates a function for performing batch normalization on a tensor using a small float number to avoid division by zero. The function takes in the input tensor `x`, mean, variance, offset, scale, and varianceEpsilon as parameters. It first converts the tensors to flat arrays using the `flatten()` method and converts them to numpy arrays. Then, it calculates the mean and variance of the tensor. Next, it offsets the mean and scales the variance by dividing the tensor by the square root of the variance plus a small epsilon number. Finally, it applies the offset and scale to the tensor and returns the result.

Note: The code snippet is written in JavaScript and uses numpy for mathematical operations. It is part of an open-source library that supports batch normalization for 2D and 3D tensors.
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============================================================================
*/

import {Tensor1D, Tensor4D} from '../tensor';
import {convertToTensor} from '../tensor_util_env';
import {Types} from '../types';
import * as util from '../util';
import {batchNorm} from './batchnorm';
import {op} from './operation';
import {NamedAttrMap} from '../kernel_registry';
import {NamedTensorMap} from '../types';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';
import * as util from '../util';

import {Tensor1D} from '../tensor';
import {Tensor4D} from '../tensor';
import {NamedAttrMap} from '../kernel_registry';
import {NamedTensorMap} from '../types';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';
import * as util from '../util';

import {ENGINE} from '../engine';
import {Bincount, BincountAttrs, BincountInputs} from '../kernel_names';
import {NamedAttrMap} from '../kernel_registry';
import {Tensor1D} from '../tensor';
import {NamedTensorMap} from '../types';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';
import * as util from '../util';

import {op} from './operation';

/**
 * Outputs a vector with length `size` and the same dtype as `weights`.
 *
 * If `weights` are empty, then index `i` stores the number of times the value
 * `i` is counted in `x`. If `weights` are non-empty, then index `i` stores the
 * sum of the value in `weights` at each index where the corresponding value in
 * `x` is `i`. Values in `x` outside of the range [0, size) are ignored.
 */

function bincount_<T extends Tensor1D>(x: T|TensorLike, weights: T|TensorLike, size: number): T {
  const $x = convertToTensor(x, 'x', 'bincount');
  const $weights = convertToTensor(weights, 'weights', 'bincount');

  util.assert($x.dtype === 'int32', () => `Error in bincount: input dtype must be int32, but got ${$x.dtype}`);
  util.assert(size >= 0, () => `size must be non-negative, but got ${size}.`);
  util.assert($weights.size === $x.size || $weights.size === 0, () => `Error in bincount: weights must have the same size as input or have length 0, but got ${$weights.size}.`);

  const inputs: BincountInputs = {x: $x, weights: $weights.size};
  const attrs: BincountAttrs = {size};

  return ENGINE.runKernel('bincount', inputs, attrs);
}
ENGINE.runKernel("n Bincount, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);\n\nconst bincount = op({(bincount_)});\n"/**\n const * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n
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```
```
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=============================================================================

import {ENGINE} from './engine';
import {ClipByValue, ClipByValueAttrs, ClipByValueInputs} from './kernel_names';
import {NamedAttrMap} from './kernel_registry';
import {Tensor} from './tensor';
import {NamedTensorMap} from './tensor_types';
import {tensorUtil} from './tensor_util_env';
import {TensorLike} from './types';

import {op} from './operation';

/**
 * Clips values element-wise. `max(min(x, clipValueMax), clipValueMin)`
 *
 * ```js
 * const x = tf.tensor1d([1, -2, -3, 4]);
 * x.clipByValue(-2, 3).print();  // or tf.clipByValue(x, -2, 3)
 * ```
 * @param x The input tensor.
 * @param clipValueMin Lower-bound of range to be clipped to.
 * @param clipValueMax Upper-bound of range to be clipped to.
 * @doc {heading: 'Operations', subheading: 'Basic math'}
 */
function clipByValue_<T extends Tensor>(
    x: T|TensorLike, clipValueMin: number, clipValueMax: number): T {
  const $x = convertToTensor(x, 'x', 'clipByValue');
  util.assert(
      (clipValueMin <= clipValueMax),
      () => `Error in clip: min (${clipValueMin}) must be ` +
          `less than or equal to max (${clipValueMax}).`);

  const inputs: ClipByValueInputs = {x: $x};
  const attrs: ClipByValueAttrs = {clipValueMin, clipValueMax};

  return ENGINE.runKernel(
      ClipByValue, inputs as {} as NamedTensorMap, attrs as {} as
      NamedAttrMap);
}

export const clipByValue = op({clipByValue_});

/**
 * Concatenates a list of `tf.Tensor1D`s along an axis. See
 * `concat` for details.
 *
 * For example, if:
 * A: shape(3) = [r1, g1, b1]
 * B: shape(3) = [r2, g2, b2]
 *
 * C = tf.concat1d([A, B])
 *
 * if axis = 0:
 * C: shape(4) = [r1, g1, b1, r2, g2, b2]
 *
 * if axis = 1:
 * C: shape(2, 3) = [r1, g1, b1, r2, g2, b2]
 *
 * @param tensors A list of `tf.Tensor`s to concatenate.
 * @param axis The axis to concatenate along.
 * @return The concatenated array.
 */
function concat1d_(tensors: Array<Tensor1D|TensorLike>, axis: number): Tensor1D {
  return concat(tensors, 0 /* axis */);
}

export const concat1d = op({concat1d_});

/**
 * Concatenates a list of `tf.Tensor2D`s along an axis. See
 * `concat` for details.
 *
 * For example, if:
 * A: shape(2, 3) = [r1, g1, b1]
 * B: shape(2, 3) = [r2, g2, b2]
 *
 * C = tf.concat2d([A, B], axis)
 *
 * if axis = 0:
 * C: shape(4, 3) = [r1, g1, b1, r2, g2, b2]
 *
 * if axis = 1:
 * C: shape(2, 6) = [r1, g1, b1, r2, g2, b2]
 *
 * @param tensors A list of `tf.Tensor`s to concatenate.
 * @param axis The axis to concatenate along.
 * @return The concatenated array.
 */
function concat2d_(
    tensors: Array<Tensor2D|TensorLike>, axis: number): Tensor2D {null}
{\n  return concat(tensors, axis);\n}\nexport const concat2d = op({concat2d_});\n","/**
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 */
import {Tensor3D} from '../tensor';
import {TensorLike} from '../types';

import {concat} from './concat';
import {op} from './operation';

/**
 * Concatenates a list of `tf.Tensor3D`'s along an axis.
 * See `concat` for details.
 * @param tensors A list of `tf.Tensor`s to concatenate.
 * @param axis The axis to concatenate along.
 * @return The concatenated array.
 */
function concat3d_(tensors: Array<Tensor3D|TensorLike>, axis: number): Tensor3D {
  return concat(tensors, axis);
}

export const concat3d = op({concat3d_});

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 */
import {Tensor4D} from '../tensor';
import {TensorLike} from '../types';

import {concat} from './concat';
import {op} from './operation';

/**
 * Concatenates a list of `tf.Tensor4D`'s along an axis.
 * See `concat` for details.
 * @param tensors A list of `tf.Tensor`s to concatenate.
 * @param axis The axis to concatenate along.
 * @return The concatenated array.
 */
function concat4d_(tensors: Array<Tensor4D|TensorLike>, axis: number): Tensor4D {
  return concat(tensors, axis);
}

export const concat4d = op({concat4d_});

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 */
import {KERNEL} from '../kernel';
import {getConv2DAttrs, Conv2DAttrs, Conv2DInputs} from '../kernel_names';
import {namedAttrMap} from '../kernel_registry';
import {NamedAttrMap} from '../kernel_registry';
import {Tensor3D, Tensor4D} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';
import * as util from '../util';

import * as conv_util from './conv_util';
import {op} from './operation';
import {reshape} from './reshape';

/**
 * Computes a 2D convolution over the input x.
 * @param x The input tensor, of rank 4 or rank 3, of shape
 *     `[batch, height, width, inChannels]`. If rank 3, batch of 1 is
 * assumed.
 * @param filter The filter, rank 4, of shape
 *     `[filterHeight, filterWidth, inDepth, outDepth]`.
 * @param strides The strides of the convolution: `[strideHeight,
 *     strideWidth]`.
 * @param padding The type of padding algorithm.
 * @param outputSize the output size.
 * @param filters the number of filters.
 * @param useBias the use bias flag.
 * @param filterType the type of filter.
 * @param filterStride the stride of the filter.
 * @param filterWidth the width of the filter.
 * @param filterHeight the height of the filter.
 * @param filterInDepth the in-depth of the filter.
 * @param filterOutDepth the out-depth of the filter.
 * @param strideHeight the stride height.
 * @param strideWidth the stride width.
 * @param valid padding.
 * @param same padding.
 * @param outputSize the output size.
 * @param filters the number of filters.
 * @param useBias the use bias flag.
 * @param filterType the type of filter.
 * @param filterStride the stride of the filter.
 * @param filterWidth the width of the filter.
 * @param filterHeight the height of the filter.
 * @param filterInDepth the in-depth of the filter.
 * @param filterOutDepth the out-depth of the filter.
 * @param strideHeight the stride height.
 * @param strideWidth the stride width.
 * @param valid padding.
 * @param same padding.
 * @param outputSize the output size.
 * @param filters the number of filters.
 * @param useBias the use bias flag.
 * @param filterType the type of filter.
 * @param filterStride the stride of the filter.
 * @param filterWidth the width of the filter.
 * @param filterHeight the height of the filter.
 * @param filterInDepth the in-depth of the filter.
 * @param filterOutDepth the out-depth of the filter.
 * @param strideHeight the stride height.
 * @param strideWidth the stride width.
 * @param valid padding.
 * @param same padding.
 * @param outputSize the output size.
 * @param filters the number of filters.
 * @param useBias the use bias flag.
 * @param filterType the type of filter.
 * @param filterStride the stride of the filter.
 * @param filterWidth the width of the filter.
 * @param filterHeight the height of the filter.
 * @param filterInDepth the in-depth of the filter.
 * @param filterOutDepth the out-depth of the filter.
 * @param strideHeight the stride height.
 * @param strideWidth the stride width.
 * @param valid padding.
 * @param same padding.
 * @param outputSize the output size.
 * @param filters the number of filters.
 * @param useBias the use bias flag.
 * @param filterType the type of filter.
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 "NHWC". Specify the data format of the input and output data. With the "NHWC" data format, the data is stored in the order of: [batch, height, width, channels].\n
* @param dilations: The dilation rates: [dilationHeight, dilationWidth].\n
  in which we sample input values across the height and width dimensions in atrous convolution. Defaults to [1, 1]. If the 'dilations' is a single number, then 'dilationHeight == dilationWidth'. If it is greater than 1, then all values of 'strides' must be 1.\n
  * @param dimRoundingMode: A string from: 'ceil', 'round', 'floor'. If none is provided, it will default to truncate.\n
  * @doc: heading: 'Operations', subheading: 'Convolution';\n
  @function: conv2d\n
  * @param dataFormat: An optional string from: "NHWC", "NCHW". Defaults to "NHWC". Specify the data format of the input and output data. With the "NHWC" data format, the data is stored in the order of: [batch, height, width, channels].\n
  * @param dilations: The dilation rates: [dilationHeight, dilationWidth].\n
  in which we sample input values across the height and width dimensions in atrous convolution. Defaults to [1, 1]. If the 'dilations' is a single number, then 'dilationHeight == dilationWidth'. If it is greater than 1, then all values of 'strides' must be 1.\n
  * @param dimRoundingMode: A string from: 'ceil', 'round', 'floor'. If none is provided, it will default to truncate.\n
  * @doc: heading: 'Operations', subheading: 'Convolution';\n
  @function: conv2d\n
  * @param dataFormat: An optional string from: "NHWC", "NCHW". Defaults to "NHWC". Specify the data format of the input and output data. With the "NHWC" data format, the data is stored in the order of: [batch, height, width, channels].\n

Only

* "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* @param dimRoundingMode A string from: 'ceil', 'round', 'floor'. If none is\n* provided, it will default to truncate.\n* @doc {heading: 'Operations', subheading: 'Convolution'}\n
*/

function conv1d_<T extends Tensor2D|Tensor3D>(\n    x: T|TensorLike, filter: Tensor3D|TensorLike, stride: number,\n    pad: 'valid'|'same'|'row'|'col'|number|conv_util.ExplicitPadding,\n    dataFormat: 'NWC'|'NCW'|'NWC'|'CINO' = 'NWC', dilation = 1,\n    dimRoundingMode?: 'floor'|'round'|'ceil'): T {
  const $x = convertToTensor(x, 'x', 'conv1d');
  const $filter = convertToTensor(filter, 'filter', 'conv1d');\n  let x3D = $x as Tensor3D;\n  let reshapedTo3D = false;\n  if (x.rank === 3) { \n    reshapedTo3D = true;\n    x3D = reshape($x, [1, $x.shape[0], $x.shape[1]]);\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
  util.assert(\n      x3D.shape[2] === $filter.shape[1],\n      () => `Error in conv1d: depth of input ` +\n          `($[x3D.shape[2]]) must match input depth for filter ` +\n          `$[$filter.shape[1]]`.`);\n  util.assert(\n      conv_util.eitherStridesOrDilationsAreOne(stride, dilation),\n      () => 'Error in conv1D: Either stride or dilation must be 1.');\n
  const filter4D = reshape($filter, [1, $filter.shape[0], $filter.shape[1], $filter.shape[2]]);\n  const input4D = reshape(x3D, [x3D.shape[0], 1, x3D.shape[1], x3D.shape[2]]);\n  const strides: [number, number] = [1, stride];\n
  const conv2dDataFormat = 'NHWC';\n
  const res = conv2d(\n      (input4D as Tensor4D), (filter4D as Tensor4D), strides, pad,\n      conv2dDataFormat, dilation,\n      dimRoundingMode);\n
  return reshape(res, [res.shape[0], res.shape[2], res.shape[3]]) as T;
}

export const conv1d = op({conv1d_});

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 * limitations under the License.
 */

============================================================================

import {ENGINE} from '../engine';
import {Conv2DBackpropInput, Conv2DBackpropInputAttrs,\n    Conv2DBackpropInputInputs} from '../kernel_names';\nimport {NamedAttrMap} from '../kernel_registry';\nimport {Tensor3D, Tensor4D} from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport * as util from '../util';
import * as conv_util from './conv_util';
import {op} from './operation';
import {reshape} from './reshape';

/**
 * Computes the derivative of the input of a 2D convolution.
 *
 * @param xShape The shape
 *    of the input: [batch, height, width, inDepth]. 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
 *    `[batch, outHeight, outWidth, outDepth]`. If rank 3, batch of 1 is
 * @param strides The type of
 *    padding algorithm used:\n *    - 'same' and stride 1: output will be of same size as input,\n *    - 'valid': output will be smaller than input if filter is larger\n *    - '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 * @doc {heading: 'Operations', subheading: 'Convolution'}\n */

function conv2DBackpropInput_<T extends Tensor3D|Tensor4D>(\n    xShape: [number, number, number, number], dy: T,\n    filter: Tensor4D, strides: [number,
number] number, \n  pad: \'valid\'|\'same\'|number, \n  convUtil: ExplicitPadding, \n  dataFormat: \'NHWC\'|\'NCHW\'
}

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============================================================================

import {ENGINE} from '../engine';
import {Conv3D, Conv3DAttrs, Conv3DInputs} from
'.//kernel_names';
import {NamedAttrMap} from './/kernel_registry';
import {Tensor4D, Tensor5D} from
'.//tensor';
import {NamedTensorMap} from './/tensor_types';
import {convertToTensor} from './/util';
import {eitherStridesOrDilationsAreOne} from './conv_util';
import {op} from './operation';
import {reshape} from './reshape';

/**
 * Computes a 3D convolution over the input x.
 * @param x The input tensor, of rank 5 or rank 4, of shape
 * [batch, depth, height, width, channels]. If rank 4, \n * batch of 1 is assumed. \n * @param filter The filter, rank 5, of shape
 * [filterDepth, filterHeight, filterWidth, inChannels, outChannels]. \n * inChannels must match between input and filter.
 * @param strides The strides of the convolution: \n * [strideDepth, strideHeight, strideWidth]. \n * @param pad The type of padding algorithm. \n * - 'same': \n *   output will be of same size as input, \n *   regardless of filter size.
 * - 'valid': output will be smaller than input if filter is \n *   larger, \n *   than 1x1. \n * @param dataFormat: \n *   An optional string from: \n *   'NDHWC', 'NCDHW'. \n *   Defaults to 'NDHWC'. \n *   Specify the data format of the input and output data. \n *   With the default format 'NDHWC', the data is stored in the order of: \n *   [batch, depth, height, width, channels]. Only 'NDHWC' is currently supported. \n *   @param dilations The dilation rates: \n *   [dilationDepth, dilationHeight, dilationWidth] in which we sample input values \n *   across the height and width dimensions in atrous convolution. \n *   Defaults to [1, 1, 1]. \n *   If 'dilations' is a single number, then \n *   'dilationDepth = dilationHeight = dilationWidth'. \n *   If it is greater than 1, then all values of 'strides' must be \n *   1. \n *   @doc {heading: 'Operations', subheading: 'Convolution'} \n */
function conv3d_<T extends Tensor4D|Tensor5D>(
    x: T|TensorLike, filter: Tensor5D|TensorLike,
    strides: \[number, number, number\]|number, pad: \'valid\'|\'same\',
    dataFormat: \'NDHWC'|\'NCDHW' = \'NDHWC',
    dilations: \[number, number, number\]|number = \[1, 1, 1\] {\n  const $x = convertToTensor(x, 'x', 'conv3d');
  const $filter = convertToTensor(filter, 'filter', 'conv3d');
  const $xD = x as Tensor5D;
  const reshapedTo5D = false;

  if ($x.rank === 4) {\n    reshapedTo5D = true;
    $xD = reshape($x, [1, $x.shape[0], $x.shape[1], $x.shape[2], $x.shape[3]]);\n  }\n  util.assert(\n      $xD.rank === 5,
      () => `Error in conv3d: input must be rank 5, but got \n      rank ${$xD.rank}.`);
  util.assert(\n      $filter.rank === 5,
      () => `Error in conv3d: filter must be rank 5, but got \n      rank ${{filter.rank}.}`);
  util.assert(\n      $xD.shape[4] === $filter.shape[3],
      () => `Error in conv3d: depth of input (${xD.shape[4]} must match \n      depth of filter ${{filter.shape[3]}.}`);
  util.assert(\n      eitherStridesOrDilationsAreOne(strides, dilations),
      () => `Error in conv3d: Either strides or dilations must be 1. \n      Got strides ${{strides}. and dilations ${{dilations}.}`);
  util.assert(\n      dataFormat === \'NDHWC',
      () => `Error in conv3d: got dataFormat of {$dataFormat} but only \n      NDHWC is currently supported.\n
  const inputs: Conv3DInputs = {x: $xD, filter: $filter};
  const attrs: Conv3DAttrs = {\n    strides, pad, dataFormat, dilations};
  const [res] = ENGINE.runKernel(\n    Conv3D, inputs as {}, as NamedTensorMap, \n    attrs as {} as NamedAttrMap) as T;

  return res;\n}
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=============================================================================
*/
import {ENGINE} from 'engine';
import {Conv3DBackpropInputV2, Conv3DBackpropInputV2Attrs, Conv3DBackpropInputV2Inputs} from 'kernel_names';
import {NamedAttrMap} from 'kernel_registry';
import {Tensor4D, Tensor5D} from 'tensor';
import {NamedTensorMap} from 'tensor_types';
import * as util from 'util';

import {op} from './operation';
import {reshape} from './reshape';

/**
 * Computes the derivative of the input of a 3D convolution.
 * @param xShape The shape of the input: [batch, depth, height, width, in_channels]. If length of 4, batch of 1 is assumed.
 * @param dy The derivative of the output, of rank 5 or rank 4 of shape:
 * [batch, outDepth, outHeight, outWidth, in_channels].
 * @param filter The filter, rank 5, of shape:
 * [filterDepth, filterHeight, filterWidth, inDepth, outDepth].
 */
function conv3DBackpropInput_<T extends Tensor4D|Tensor5D>(
    xShape:
    [number, number, number, number, number],
    dy: T, filter: Tensor5D,
    strides: [number, number, number],
    pad: 'valid'|'same'): T {
  util.assert(
      xShape.length === dy.rank,
      () => `Length of inShape ` +
          `(${xShape.length}) and rank of dy (${dy.rank}) must ` +
          `match.`);

  const inputs: Conv3DBackpropInputV2Inputs = {dy: dy, filter};

  const attrs:
  Conv3DBackpropInputV2Attrs = {strides, inputShape: xShape} as AttrMap;

  const res = ENGINE.runKernel(
                  Conv3DBackpropInputV2, inputs as {},
                  attrs as {}) as T;

  return res;
}

export const conv3DBackpropInput = op({conv3DBackpropInput_});

*/
import {Tensor4D, Tensor5D} from 'tensor';
import {convertToTensor} from 'tensor_util_env';
import {TensorLike} from 'types';

import {conv3DBackpropInput_} from './conv3d_backprop_input';

/**
 * Computes the transposed 3D convolution of a volume, also known as a
 * deconvolution.
 * @param x The input image, of rank 5 or rank 4, of shape:
 * [batch, depth, height, width, inDepth].
 */
function conv3dDerInput(x: TensorLike) {
  util.assert(x.rank === 5,
      () => `Input must be rank 5, but got ` +
          `rank ${x.rank}.`);

  const inShape = [x.shape[0], x.shape[1], x.shape[2], x.shape[3], x.shape[4]] as number[];
  const outputShape = [x.shape[0], x.shape[1], x.shape[2], x.shape[3], x.shape[4]] as number[];

  const inputs: Conv3DBackpropInputV2Inputs = {x: x, outputShape};

  const res = ENGINE.runKernel(
                  conv3DBackpropInputV2, inputs as {},
                  {} as AttrMap) as T;

  return res;
function cumsum_<T extends Tensor>(
    x: Tensor|TensorLike,
    axis = 0, exclusive = false, reverse = false): T {
  const $x = convertToTensor(x, 'x', 'cumsum');

  const inputs: CumsumInputs = {x: $x};
  const attrs: CumsumAttrs = {axis, exclusive, reverse};

  return 
  ENGINE.runKernel(
      Cumsum, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);
}

export
const cumsum = op({cumsum_});

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 */

export const
denseBincount = op({denseBincount_});

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 */
Rearranges data from depth into blocks of spatial data. More specifically, the output is a copy of the input tensor where values from the depth dimension are moved in spatial blocks to the height and width dimensions. The attr `blockSize` indicates the input block size and how the data is moved. - Chunks of data of size `blockSize * blockSize` from depth are rearranged into non-overlapping blocks of size `blockSize x blockSize` - The width the output tensor is `inputWidth * blockSize`, whereas the height is `inputHeight * blockSize` - The Y, X coordinates within each block of the output image are determined by the high order component of the input channel index

```js
const x = tf.tensor4d([1, 2, 3, 4], [1, 1, 1, 4]);
const blockSize = 2;
const dataFormat = "NHWC";

tf.depthToSpace(x, blockSize, dataFormat).print();
```

- The depth of the input tensor must be divisible by `blockSize x blockSize`. - The `dataFormat` attr specifies the layout of the input and output tensors with the following options: "NHWC": [batch, height, width, channels] "NCHW": [batch, channels, height, width]

```javascript
function depthToSpace_(x: Tensor4D|TensorLike4D, blockSize: number, dataFormat: 'NHWC'|'NCHW' = 'NHWC'): Tensor4D {
  const $x = convertToTensor(x, 'x', 'depthToSpace') as Tensor4D;

  const inputHeight = (dataFormat === 'NHWC') ? $x.shape[1] : $x.shape[2];
  const inputWidth = (dataFormat === 'NHWC') ? $x.shape[2] : $x.shape[3];
  const inputDepth = (dataFormat === 'NHWC') ? $x.shape[3] : $x.shape[1];

  util.assert(
      inputHeight * blockSize >= 0,
      () => `Negative dimension size caused by overflow when multiplying
        ${inputHeight} and ${blockSize} for depthToSpace with input shape
        ${$x.shape}`);

  util.assert(
      inputWidth * blockSize >= 0,
      () => `Negative dimension size caused by overflow when multiplying
        ${inputWidth} and ${blockSize} for depthToSpace with input shape
        ${$x.shape}`);

  util.assert(
      (inputDepth % (blockSize * blockSize) === 0),
      () => `Dimension size must be evenly divisible by
        ${blockSize * blockSize} but is ${inputDepth} for depthToSpace with input shape
        ${$x.shape}`);

  const inputs: DepthToSpaceInputs = {x: $x};
  const attrs: DepthToSpaceAttrs = {blockSize, dataFormat};

  return ENGINE.runKernel(
      DepthToSpace, inputs as {} as NamedTensorMap,
      attrs as {} as NamedAttrMap);
}
```

export const depthToSpace = op({depthToSpace_});
for more details. 
* @param x The input tensor, of rank 4 or rank 3, of shape `\[\text{batch, height, width, inChannels}\]`. If rank 3, batch of 1 is assumed.
* @param filter The filter tensor, rank 4, of shape `\[\text{filterHeight, filterWidth, inChannels, channelMultiplier}\]`.
* @param strides The strides of the convolution: `\[\text{strideHeight, strideWidth}\]`. If strides
  is a single number, then `\text{strideHeight == \text{strideWidth}}`.
* @param pad The type of padding algorithm.
  * `-same` and stride 1: output will be same size of input;
  * `valid`: output will be smaller than input if filter is larger than 1x1.
  * For more info, see this guide:

```
https://www.tensorflow.org/api_docs/python/tf/nn/depthwise_conv2d
```

* @param dataFormat: An optional string from: `\"NHWC\", `\"NCHW\"`. Defaults to `\"NHWC\"`. Specify the data format of the input and output data.

```
if ($x.rank === 3) {
  reshapedTo4D = true;
  x4D = reshape($x, [1, $x.shape[0], $x.shape[1], $x.shape[2]]);
}
```

```
util.assert(
    x4D.rank === 4,
    () => `Error in depthwiseConv2d: input must be rank 4, but got rank ${x4D.rank}.`);
util.assert(
    $filter.rank === 4,
    () => `Error in depthwiseConv2d: filter must be rank 4, but got rank ${$filter.rank}.`);
util.assert(
    x4D.shape[3] === $filter.shape[2],
    () =>
        `Error in depthwiseConv2d: number of input channels ` +
        `(${x4D.shape[3]}) must match the \text{inChannels}
        dimension in \text{filter ${$filter.shape[2]}.}`);
util.assert($filter.rank === 4,
    () => `Error in depthwiseConv2d: filter must be rank 4, but got rank ` +
    `$\text{filter.rank}$.`);
util.assert($x4D.shape[3] === $filter.shape[2],
    () =>
        `Error in depthwiseConv2d: number of input channels ` +
        `(${$x4D.shape[3]}) must match the \text{inChannels}
        dimension in \text{filter ${$filter.shape[2]}.}`);
```

```
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```javascript
const x = tf.tensor1d([1, 2, 3, 4]);

const diag = op((diag_));

const x = tf.tensor1d([1, 2, 3, 4, 5, 6, 6, 8], [4, 2]);

const diag = op((diag_));
```

```typescript
function diag_(x: Tensor): Tensor {
  const $x = convertToTensor(x, 'x', 'diag');

  const inputs: DiagInputs = {x: $x};

  return ENGINE.runKernel(Diag, inputs as {} as NamedTensorMap);
}

export const diag = op({diag_});
```

```
import {ENGINE} from '../engine';
import {Dilation2D, Dilation2DAttrs, Dilation2DInputs} from '../kernel_names';
import {NamedAttrMap} from '../kernel_registry';
import {Tensor3D, Tensor4D} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';
import * as util from '../util';

import {op} from './operation';
import {reshape} from './reshape';

/**
 * Computes the grayscale dilation over the input `x`.
 *
 * @param x The input tensor, rank 3 or rank 4 of shape `[batch, height, width, inChannels]`. If rank 3, batch of 1 is assumed.
 * @param filter The filter tensor, rank 3, of shape `[filterHeight, filterWidth, depth]`.
 * @param strides The strides of the sliding window for each dimension of the input tensor: `[strideHeight, strideWidth]`.
 * @param pad The type of padding algorithm:
 *    - `same`: output will be of same size as input,
 *    - `valid`: output will be smaller than input if filter is larger.
 *    - For more info, see this guide:
 *      https://www.tensorflow.org/api_guides/python/nn#Convolution
 * @param dataFormat Specify the data format of the input and output data.
 *      Defaults to 'NHWC'. Only 'NHWC' is currently supported. With the default format 'NHWC', the data is stored in the order of: `[batch, height, width, channels]`. If `dilations` is a single number, then `dilationHeight == dilationWidth`. If it is greater than 1, then all values of `strides` must be 1.
 *      `For more info, see this guide:`
 *      https://www.tensorflow.org/api_guides/python/nn#Convolution
 *      `@param dataFormat Specify the data format of the input and output data._defaults to 'NHWC'. Only 'NHWC' is currently supported. With the default format 'NHWC', the data is stored in the order of: `[batch, height, width, channels]`. If `dilations` is a single number, then `dilationHeight == dilationWidth`. If it is greater than 1, then all values of `strides` must be 1."
 * @param pad The type of padding algorithm:
 *    - `same`: output will be of same size as input,
 *    - `valid`: output will be smaller than input if filter is larger.
 *    - For more info, see this guide:
 *      `https://www.tensorflow.org/api_guides/python/nn#Convolution`
 */

function dilation2d_<T extends Tensor3D|Tensor4D>(
    x: T|TensorLike, filter: Tensor3D|TensorLike,
    strides: [number, number]|number,
    pad: 'valid'|'same',
    dilations: [number, number]|number = [1, 1],
    dataFormat: 'NHWC' = 'NHWC'): T {

  const $x = convertToTensor(x, 'x', 'dilation2d');
  const $filter = convertToTensor(filter, 'filter', 'dilation2d');

  util.assert(
      $x.rank === 3 || $x.rank === 4,
      () => 'Error in dilation2d: input must be rank 3 or 4, but got rank `' +
          `${$x.rank}.`);
  util.assert(
      $filter.rank === 3,
      () => 'Error in dilation2d: filter must be rank 3, but got rank `' +
          `${$filter.rank}.`);

  let x4D = $x as Tensor4D;
  let reshapedTo4D = false;

  if ($x.rank === 3) {
    x4D = reshape($x, [1, $x.shape[0], $x.shape[1], $x.shape[2]]);
    reshapedTo4D = true;
  }

  const inputs: Dilation2DInputs = {x: x4D, filter: $filter};
  const attrs: Dilation2DAttrs = {strides, pad, dilations};

  // tslint:disable-next-line: no-unnecessary-type-assertion
  const res = ENGINE.runKernel(
    'Dilation2D', inputs as {} as NamedTensorMap,
    attr as {} as NamedAttrMap)
```
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============================================================================
*/

/**
 * Returns the dimensions in the input shape that are broadcasted to
 * produce the provided output shape. The returned dimensions are 0-indexed
 * and sorted. An example:

 const inShape = [4, 1, 3];
 const outShape = [5, 4, 3];
 const result = [1].

 Dimension 1 (2nd dimension of input) gets broadcasted 1 => 3.

 */
export function getBroadcastDims(inShape: number[], outShape: number[]): number[] {
  const inRank = inShape.length;
  const dims: number[] = [];
  for (let i = 0; i < inRank; i++) {
    const dim = inRank - 1 - i;
    const a = inShape[dim] || 1;
    const b = outShape[outShape.length - 1 - i] || 1;
    if (b > 1 && a === 1) {
      dims.unshift(dim);
    }
  }
  return dims;
}

/**
 * Returns the axes in the output space that should be
 * reduced to produce the input space.

 */
export function getReductionAxes(inShape: number[], outShape: number[]): number[] {
  const result: number[] = [];
  for (let i = 0; i < outShape.length; i++) {
    const inDim = inShape[inShape.length - i - 1];
    const outAxis = outShape.length - i - 1;
    const outDim = outShape[outAxis];
    if (inDim == null || (inDim === 1 && outDim > 1)) {
      result.unshift(outAxis);
    }
  }
  return result;
}

export function assertAndGetBroadcastShape(shapeA: number[], shapeB: number[]): number[] {
  const result: number[] = [];
  const l = Math.max(shapeA.length, shapeB.length);
  for (let i = 0; i < l; i++) {
    let a = shapeA[shapeA.length - i - 1];
    if (a == null) {
      a = 1;
    }
    let b = shapeB[shapeB.length - i - 1];
    if (b == null) {
      b = 1;
    }
    if (a === 1) {
      result.unshift(b);
    }
    else if (b === 1) {
      result.unshift(a);
    }
    else if (a !== b) {
      const errMsg = `Operands could not be
      broadcast together with shapes ` +
      `${shapeA} and ${shapeB}.`;
      throw Error(errMsg);
    } else {
      result.unshift(a);
    }
  }
  return result;
}

*/

import {ENGINE} from '../engine';
import {Equal, EqualInputs} from '../kernel_names';
import {Tensor} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {makeTypesMatch} from '../tensor_util';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';
import {assertAndGetBroadcastShape} from './broadcast_util';
import {op} from './operation';

/**
 * Returns the truth value of (a == b) element-wise. Supports broadcasting.

 */
function equal_<T extends Tensor>(a: Tensor|TensorLike, b: Tensor|TensorLike): T {
  let $a = convertToTensor(a, 'a', 'equal');
  let $b = convertToTensor(b, 'b', 'equal');
  [$a, $b] = makeTypesMatch($a, $b);

  assertAndGetBroadcastShape($a.shape, $b.shape);

  const inputs: EqualInputs = {a: $a, b: $b};

  return ENGINE.runKernel(Equal, inputs as {} as NamedTensorMap);
}

export const equal = op({equal_});

*/

import {ENGINE} from './engine';
import {Equal, EqualInputs} from './kernel_names';
import {Tensor} from './tensor';
import {NamedTensorMap} from './tensor_types';
import './engine';
import {convertToTensor} from './tensor_util_env';
import {TensorLike} from './types';
import {assertAndGetBroadcastShape} from './broadcast_util';
import {op} from './operation';

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 *=============================================================================
*/

import {ENGINE} from './engine';
import {Equal, EqualInputs} from './kernel_names';
import {Tensor} from './tensor';
import {NamedTensorMap} from './tensor_types';
import './engine';
import {convertToTensor} from './tensor_util_env';
import {TensorLike} from './types';
import {assertAndGetBroadcastShape} from './broadcast_util';
import {op} from './operation';

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*/

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import {NamedTensorMap} from '../tensor';
import {convertToTensor} from '../tensor_types';
import {assert, assertShapesMatch} from '../util';
import {broadcastTo} from './broadcast_to';
import {assertAndGetBroadcastShape} from './broadcast_util';
import {TensorLike} from '../tensor';
import {divide} from './div';
import {equal} from './comparison';

/**
 * Returns the elements, either 'a' or 'b' depending on the condition.
 * If the condition is true, select from 'a', otherwise select from 'b'.
 * const cond = tf.tensor1d([false, false, true, 'bool']);
 * const a = tf.tensor1d([1, 2, 3]);
 * const b = tf.tensor1d([-1, -2, -3]);
 * const
 * a.where(cond, b);
 * @param condition The input condition. Must be of dtype bool. @param a A tensor with the same dtype as 'a' and with shape that is
 * compatible with 'a'.
 * @param b A tensor with the same dtype as 'a' and 'b', and shape that is broadcastable from 'a' and 'b'.
 *
 * @doc {heading: 'Operations', subheading: 'Logical'}
 */
function where_<T extends Tensor>(
    condition: Tensor|TensorLike,
    a: T|TensorLike,
    b: T|TensorLike): T {
  const $a = convertToTensor(a, 'a', 'where');
  const $b = convertToTensor(b, 'b', 'where');
  const $condition = convertToTensor(condition, 'condition', 'where', 'bool');

  // Find the broadcastable shape for $a and $b.
  const broadcastShape = assertAndGetBroadcastShape($a.shape, $b.shape);
  const $broadcastedA = broadcastTo($a, broadcastShape);
  const $broadcastedB = broadcastTo($b, broadcastShape);

  if ($condition.rank === 1) {
    // If condition rank is 1, then the first dimension must match the size of 'a'.
    assert($condition.shape[0] === $a.shape[0], () => 'The first dimension of `a` must match the size of `condition`.');
  }

  if ($condition.rank !== 1) {
    // A must have the same shape as condition.
    assertShapesMatch($condition.shape, $broadcastedB.shape, 'Error in where: ');
  }

  const inputs: SelectInputs = {
    condition: $condition,
    t: $broadcastedA,
    e: $broadcastedB
  };
  return ENGINE.runKernel(Select, inputs as unknown as NamedTensorMap);
}

export const where = op({where_});
```javascript
/**
 * Divides two `tf.Tensor`'s element-wise. A / B. Supports broadcasting. Return 0 if denominator is 0.
 * const a = tf.tensor1d([1, 4, 9, 16]); const b = tf.tensor1d([2, 3, 4, 5]);
 * const c = tf.tensor1d([0, 0, 0, 0]);
 * a.div(b).print(); // or tf.div(a, b)
 * a.divNaN(c).print(); // or tf.divNaN(a, b)
 * a.divNaN(c).print(); // or tf.divNaN(a, b)
 */
function divNoNan_(a, b) {
  let $a = convertToTensor(a, 'a', 'div');
  let $b = convertToTensor(b, 'b', 'div');
  [$a, $b] = makeTypesMatch($a, $b);

  const divResult = div($a, $b);
  const zeros = zerosLike(divResult);
  const bEqualsZero = equal($b, zeros);
  return where(bEqualsZero, zeros, divResult);
}

export const divNoNan = op({divNoNan_});
```

---

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 *
 *=============================================================================
 */

import {Tensor} from './tensor';
import {convertToTensor} from './tensor_util_env';
import {TensorLike} from './types';
import {matMul} from './mat_mul';
import {op} from './operation';
import {reshape} from './reshape';
import {util} from './util';
import * as ENGINE from '../engine';
import {Elu, EluInputs} from '../kernel_names';
import {Tensor} from '../types';
```
```javascript
import {NamedTensorMap} from '../tensor';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';

import {op} from './operation';

/**
 * Computes exponential linear element-wise: `x > 0 ? e^x - 1 : 0`.
 * @param x The input tensor.
 * @doc {heading: 'Operations', subheading: 'Basic math'}
 */
function elu_(x: TensorLike): TensorLike {
  const $x = convertToTensor(x, 'x', 'elu');

  const inputs = EluInputs({x: $x});

  return ENGINE.runKernel(Elu, inputs);
}
export const elu = op({elu_});

/**
 * Computes exponential function `e^x` element-wise.
 * @param x The input tensor.
 * @doc {heading: 'Operations', subheading: 'Basic math'}
 */
function exp_(x: TensorLike): TensorLike {
  const $x = convertToTensor(x, 'x', 'exp');

  const inputs = ExpInputs({x: $x});

  return ENGINE.runKernel(Exp, inputs);
}
export const exp = op({exp_});
```
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```javascript

import {convertToTensor} from './tensor_util_env';
import {TensorLike} from './types';
import * as util from '../util';

import {op} from './operation';

/**
 * Returns a
 `tf.Tensor` that has expanded rank, by inserting a dimension
 * into the tensor's shape.

 * ```js
 * const x = tf.tensor1d([1, 2, 3]);
 * const axis = 1;
 * x.expandDims(axis).print();
 * ```
 *
 * @param x The input tensor whose dimensions to be expanded.
 * @param axis The dimension index at which to insert shape of `1`.
 *
 * Defaults
 * to 0 (the first dimension).

 * @doc {heading: 'Tensors', subheading: 'Transformations'}
 */
function expandDims_<T extends Tensor>(x: Tensor|TensorLike, axis = 0): T {
  const $x = convertToTensor(x, 'x', 'expandDims', 'string_or_numeric');

  util.assert(axis <= $x.rank, () => 'Axis must be <= rank of the tensor');

  const inputs: ExpandDimsInputs = {input: $x};
  const attrs: ExpandDimsAttrs = {dim: axis};
  return ENGINE.runKernel(ExpandDims, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);
}

export const expandDims = op({expandDims_});

```
NamedAttrMap);";unexport const tile = op({tile_});";un";****un"; @license";un"; Copyright 2020 Google LLC. All Rights Reserved.";un"; * Licensed under the Apache License, Version 2.0 (the "License");";un"; you may not use this file except in compliance with the License.";un"; * You may obtain a copy of the License at
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";un"; * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.";un"; * See the License for the specific language
 governing permissions and limitations under the License.";un"; * 

=============================================================================

import {ENGINE} from '../engine';
import {Fill, FillAttrs} from '../kernel_names';
import {NamedAttrMap} from '../kernel_registry';
import {Tensor} from '../tensor';
import {DataType, Rank, ShapeMap} from

/**
 * Creates a `tf.Tensor` filled with a scalar value.
 *
 * ```js
 * tf.fill([2, 2], 4).print();
 * ```
 *
 * @param shape An array of integers defining the output tensor shape.
 * @param value The scalar value to fill the tensor with.
 * @param dtype The type of an element in the resulting tensor. Defaults to 'float'.
 *
 * @doc {heading: 'Tensors', subheading: 'Creation'}
 */
function fill<R extends Rank>(
    shape: ShapeMap[R],
    value: number|string, dtype?: DataType): Tensor<R> {
  const attrs: FillAttrs = {shape, value, dtype};

  return ENGINE.runKernel(Fill, {}, attrs as {} as NamedAttrMap);
}

export {fill};

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=============================================================================

*/

import {ENGINE} from '../engine';
import {Floor, FloorInputs} from '../kernel_names';
import {Tensor} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';

import {op} from './operation';

/**
 * Computes floor of input `tf.Tensor` element-wise: `floor(x)`.
 *
 * ```js
 * const x = tf.tensor1d([.6, 1.1, -3.3]);
 *
 * x.floor().print();  // or tf.floor(x)
 * ```
 * @param x The input tensor.
 * @doc {heading: 'Operations', subheading: 'Basic math'}
 */
function floor_<T extends Tensor>(x: T | TensorLike): T {
  const $x = convertToTensor(x, 'x', 'floor');

  const inputs: FloorInputs = {x: $x};
  return ENGINE.runKernel(Floor, inputs as {} as NamedTensorMap);
}

export const floor = op({floor_});

=============================================================================

*/

import {ENGINE} from '../engine';
import {GatherV2, GatherV2Attrs, GatherV2Inputs} from '../kernel_names';
import {NamedAttrMap} from '../kernel_registry';
import {Tensor} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';

import {op} from './operation';

/**
 * Gather slices from tensor `x`'s axis `axis` according to `indices`.
 *
 * ```js
 * const x = tf.tensor1d([1, 2, 3, 4]);
 * const indices = tf.tensor1d([1, 3, 3], 'int32');
 *
 * x.gather(indices).print();
 * ```
 *
 * ```js
 * const x = tf.tensor2d([1, 2, 3, 4], [2, 2]);
 * const indices = tf.tensor1d([1, 0, 1], 'int32');
 *
 * x.gather(indices).print();
 * ```
 * @param x The input tensor whose slices to be gathered.
 * @param indices The indices of the values to extract.
 * @param axis The axis over which to select values. Defaults to 0.
 * @param batchDims Optional. The number of batch dimensions. It must be less
 * than or equal to rank(indices). Defaults to 0.
 * @doc {heading: 'Tensors', subheading: 'Slicing and Joining'}
 */
function gather_<T extends Tensor>(x: T | TensorLike, indices: Tensor | TensorLike, axis = 0, batchDims = 0): T {
  const $x = convertToTensor(x, 'x', 'gather');
  const $indices = convertToTensor(indices, 'indices', 'gather', 'int32');

  const inputs: GatherV2Inputs = {x: $x, indices: $indices};
  const attrs: GatherV2Attrs = {axis, batchDims};

  return ENGINE.runKernel(GatherV2, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);
}

export const gather = op({gather_});

=============================================================================

*/

import {ENGINE} from '../engine';
import {Greater, GreaterInputs} from '../kernel_names';
import {Tensor} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {makeTypesMatch} from '../tensor_util';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';

import {assertAndGetBroadcastShape} from './broadcast_util';
import {op} from './operation';

/**
 * Returns the truth value of (a > b) element-wise. Supports broadcasting.
 *
 * ```js
 * const a = tf.tensor1d([1, 2, 3]);
 * const b = tf.tensor1d([2, 2, 2]);
 *
 * a.greater(b).print();
 * ```
 * @param a The first input tensor.
 * @param b The second input tensor.
 * @doc {heading: 'Operations', subheading: 'Logical'}
 */
*/

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=============================================================================

import {ENGINE} from '../engine';
import {Tensor} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';

// Returns the imaginary part of a complex (or real) tensor.
// Given a tensor input, this operation returns a tensor of type float
// that is the imaginary part of each element in input considered as a complex number.
// If input is real, a tensor of all zeros is returned.

function imag_<T extends Tensor>(input: T|TensorLike): T {
  const $input = convertToTensor(input, 'input', 'imag');

  const inputs: ImagInputs = {input: $input};
  return ENGINE.runKernel(Imag, inputs as {} as NamedTensorMap);
}

export const imag = op({imag_});

==============================================
import {ENGINE} from '../engine';
import {IsFinite, IsFiniteInputs} from './kernel_names';
import {Tensor} from './tensor';
import {NamedTensorMap} from './tensor_types';
import {convertToTensor} from './tensor_util_env';
import {TensorLike} from './types';
import {op} from './operation';

/*
 * Returns which elements of x are finite.
 * @param x The input Tensor.
 * @doc {heading: 'Operations', subheading: 'Basic math'}
 * @function isFinite
 * @signature isFinite(x)
 * @returns Tensor
 */
function isFinite_<T extends Tensor>(x: T|TensorLike): T {
  const $x = convertToTensor(x, 'x', 'isFinite');
  const inputs: IsFiniteInputs = {x: $x};
  return ENGINE.runKernel(IsFinite, inputs as {} as NamedTensorMap);
}
export const isFinite = op({isFinite_});

import {IsInf, IsInfInputs} from './kernel_names';
import {Tensor} from './tensor';
import {NamedTensorMap} from './tensor_types';
import {convertToTensor} from './tensor_util_env';
import {TensorLike} from './types';

/*
 * Returns which elements of x are Infinity or -Infinity.
 * @param x The input Tensor.
 * @doc {heading: 'Operations', subheading: 'Basic math'}
 * @function isInf
 * @signature isInf(x)
 * @returns Tensor
 */
function isInf_<T extends Tensor>(x: T|TensorLike): T {
  const $x = convertToTensor(x, 'x', 'isInf');
  const inputs: IsInfInputs = {x: $x};
  return ENGINE.runKernel(IsInf, inputs as {} as NamedTensorMap);
}
export const isInf = op({isInf_});

import {IsNan, IsNanInputs} from './kernel_names';
import {Tensor} from './tensor';
import {NamedTensorMap} from './tensor_types';
import {convertToTensor} from './tensor_util_env';
import {TensorLike} from './types';

/*
 * Returns which elements of x are NaN.
 * @param x The input Tensor.
 * @doc {heading: 'Operations', subheading: 'Basic math'}
 * @function isNaN
 * @signature isNaN(x)
 * @returns Tensor
 */
function isNaN_<T extends Tensor>(x: T|TensorLike): T {
  const $x = convertToTensor(x, 'x', 'isNaN');
  const inputs: IsNanInputs = {x: $x};
  return ENGINE.runKernel(IsNan, inputs as {} as NamedTensorMap);
}
export const isNaN = op({isNaN_});

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 */
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```typescript
import {NamedAttrMap} from '../kernel_registry';
import {Tensor} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensor} from '../tensor_util_env';
import {op} from './operation';

/**
 * Computes leaky rectified linear element-wise.
 *
 * See
 * 
 *
 * ```js
 * const x = tf.tensor1d([-1, 2, -3, 4]);
 * x.leakyRelu(0.1).print(); // or tf.leakyRelu(x, 0.1)
 * ```
 * @param x The input tensor.
 * @param alpha The scaling factor for negative values, defaults to 0.2.
 *
 * @doc {heading: 'Operations', subheading: 'Basic math'}
 */
function leakyRelu_<T extends Tensor>(x: T|TensorLike, alpha = 0.2): T {
  const $x = convertToTensor(x, 'x', 'leakyRelu');

  const inputs: LeakyReluInputs = {x: $x};
  const attrs: LeakyReluAttrs = {alpha};

  return ENGINE.runKernel(LeakyRelu, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);
}

export const leakyRelu = op({leakyRelu_});

```
import {ENGINE} from '../engine';
import {LinSpace, LinSpaceAttrs} from '../kernel_names';
import {NamedAttrMap} from '../kernel_registry';
import {Tensor1D} from '../tensor';

/**
 * Return an evenly spaced sequence of numbers over the given interval.
 * @param start The start value of the sequence.
 * @param stop The end value of the sequence.
 * @param num The number of values to generate.
 * @return
 */
export function linspace(start: number, stop: number, num: number): Tensor1D {
  if (num <= 0) {
    throw new Error('The number of values should be positive.');
  }

  const attrs: LinSpaceAttrs = {start, stop, num};
  return ENGINE.runKernel(LinSpace, {}, attrs as {} as NamedAttrMap);
}

/**
 * Normalizes the activation of a local neighborhood across or within
 * channels.
 * @param x The input tensor. The 4-D input tensor is treated as a 3-D array
 * of 1D vectors (along the last dimension), and each vector is normalized
 * independently.
 * @param depthRadius The number of adjacent channels in the 1D normalization
 * window.
 * @param bias A constant bias term for the basis.
 * @param alpha A scale factor, usually positive.
 * @param beta An exponent.
 * @return
 */
function localResponseNormalization_<T extends Tensor3D|Tensor4D>(
    x: T|TensorLike, depthRadius = 5, bias = 1, alpha = 1, beta = 0.5): T {
  const $x = convertToTensor(x, 'x', 'localResponseNormalization');
  util.assert(
      $x.rank === 4 || $x.rank === 3,
      () => `Error in localResponseNormalization: x must be rank 3 or 4 but got rank ${$x.rank}.`);
  util.assert(
      util.isInt(depthRadius),
      () => `Error in localResponseNormalization: depthRadius must be an integer but got depthRadius ${depthRadius}.`);

  let x4D = $x as Tensor4D;
  let reshapedTo4D = false;
  if ($x.rank === 3) {
    reshapedTo4D = true;
    x4D = reshape($x, [1, $x.shape[0], $x.shape[1], $x.shape[2]]);
  }

  const inputs: LRNInputs = {x: x4D};

  const attrs: LRNAttrs = {depthRadius, bias, alpha, beta};

  // tslint:disable-next-line: no-unnecessary-type-assertion
  const res = ENGINE.runKernel(LRN, inputs as {} as NamedTensorMap,
      attrs as {} as NamedAttrMap) as T;

  if (reshapedTo4D) {
    return reshape(res, [res.shape[1], res.shape[2], res.shape[3]]) as T;
  } else {
    return res;
  }
}

export const localResponseNormalization = op({localResponseNormalization_});
/**
 * Computes natural logarithm of the input `tf.Tensor` element-wise: `ln(x)`
 *
 * ```js
 * const x = tf.tensor1d([1, 2, Math.E]);
 * x.log().print();  // or tf.log(x)
 * ```
 * @param x The input tensor.
 *
 * @doc {heading: 'Operations', subheading: 'Basic math'}
 */
function log_({x: $x, 'log'}): $x {
  return ENGINE.runKernel(Log, {x: $x as {} as NamedTensorMap});
}

export const log = log_;
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 *

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const x = tf.tensor1d([1, 2]);

```javascript
const f = (x) => a * x^2 + b * x

const f = () =>
a.mul(x.square())
.add(b.mul(x)).sum();

/*
 * const df/da = 2 * a * x + b
 * df/db = a
 */
```

The function to execute. f() should return a scalar. The function to compute the gradients with respect to. Defaults to all trainable variables. An object with the following keys and values:

- `value`: The value of the function `f`. 
- `grads`: A map from the names of the variables to `null`. If the 'varList' argument is provided explicitly and contains a subset of non-trainable variables, this map in the return value will contain keys that map the names of the non-trainable variables to `null`. 
- `@doc`: A map from the names of the variables to scalar values.

The f passed in variableGrads(f) must be a function:

```javascript
util.assert(varList === null ||
varList instanceof Variable, () =>
"The varList passed in variableGrads(f, varList) must be an array of variables\n`null` or a function\n\n
```
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=============================================================================

*/

import {ENGINE} from '../engine';
import {Neg, NegInputs} from '../kernel_names';
import {Tensor} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';

import {op} from './operation';

/**
 * Computes `-1 * x` element-wise.
 *
 * ```js
 * const x = tf.tensor2d([[1, 2, -2, 0], [2, 2]]);
 * x.neg().print();  // or tf.neg(x)
 * ```
 *
 * @param x The input tensor.
 *
 * @doc {heading: 'Operations', subheading: 'Basic math'}
 */
function neg_<T extends Tensor>(x: T|TensorLike): T {
  const $x = convertToTensor(x, 'x', 'neg');

  const inputs: NegInputs = {x: $x};
  return ENGINE.runKernel(Neg, inputs as {} as NamedTensorMap);
}
export const neg = op({neg_});

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 *=============================================================================

import {customGrad} from '../gradients';
import {Tensor} from '../tensor';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';

import {mul} from './mul';
import {neg} from './neg';
import {op} from './operation';
import {sigmoid} from './sigmoid';
import {softplus} from './softplus';

/**
 * Computes log sigmoid of the input `tf.Tensor` element-wise:
 * `logSigmoid(x)`. For numerical stability, we use `-tf.softplus(-x)`.
 *
 * ```js
 * const x = tf.tensor1d([0, 1, -1, 0.7]);
 *
 * x.logSigmoid().print();  // or tf.logSigmoid(x)
 * ```
 * @param x The input tensor.
 *
 * @doc {heading: 'Operations', subheading: 'Basic math'}
 */
function logSigmoid_<T extends Tensor>(x: T|TensorLike): T {
  const $x = convertToTensor(x, 'x', 'logSigmoid');

  const customOp = customGrad((x: Tensor) => {
    // LogSoftplus is not available, so we use a custom
    // gradient that uses Softplus.
    const $softplus = convertToTensor(x, 'x', 'softplus');
    return $softplus;
  });

  return ENGINE.runKernel(customOp, inputs as {} as NamedTensorMap);
}

// There is no LogSigmoid kernel in TF so we can't use engine.runKernel
// directly

const customOp = customGrad(x => {
  // TODO(yassogba) we can remove the chained softplus call here
  // after backends have modularized softplus at which point we can call
  // engine.runKernel(..., Softplus,

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```javascript
const value = neg(softplus(neg(x)));

const gradFunc = (dy: T) => {
  const derX = mul(dy,
    sigmoid(neg(x)));
  return derX;
};

return {value, gradFunc};

return customOp($x) as T;

export const logSigmoid = op({logSigmoid_});
```

```javascript
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 */

import {ENGINE} from '../engine';
import {Max, MaxAttrs, MaxInputs} from '../kernel_names';
import {NamedAttrMap} from '../kernel_registry';
import {Tensor} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';

import {op} from './operation';

/**
 * Computes the maximum of elements across dimensions of a `tf.Tensor`.
 *
 * Reduces the input along the dimensions given in `axes`. Unless `keepDims` is true, the rank of the `tf.Tensor` is reduced by 1 for each entry in `axes`. If `keepDims` is true, the reduced dimensions are retained with length 1. If `axes` has no entries, all dimensions are reduced, and an * `tf.Tensor` with a single element is returned.
 *
 * ```js
 * const x = tf.tensor1d([1, 2, 3]);
 * x.max().print(); // or tf.max(x)
 * ```

 * ```js
 * const x = tf.tensor2d([[1, 2, 3], [4, 5, 6]]);
 * x.max(axis=0).print(); // or tf.max(x, axis=0)
 * ```

 * @param x The input tensor.
 * @param axis The dimension(s) to reduce. By default it reduces all dimensions.
 * @param keepDims If true, retains reduced dimensions with size 1.
 *
 * @doc {heading: 'Operations', subheading: 'Reduction'}
 */
function max_<T extends Tensor>(
    x: Tensor|TensorLike, axis: number|number[] = null, keepDims = false): T {
  const $x = convertToTensor(x, 'x', 'max');

  const inputs: MaxInputs = {x: $x};
  const attrs: MaxAttrs = {reductionIndices: axis, keepDims};

  return ENGINE.runKernel(
      Max, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);
}

export const max = op({max_});
```

```javascript
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 * See the License for the specific language governing permissions and limitations under the License.
 */

import {ENGINE} from '../engine';
import {Sub, SubInputs} from '../kernel_names';
import {Tensor} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {makeTypesMatch} from '../tensor_util';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';

import {op} from './operation';

/**
 * Subtracts two `tf.Tensor`s element-wise, A - B. Supports broadcasting.
 *
 * ```js
 * const a = tf.tensor1d([10, 20, 30, 40]);
 * const b = tf.tensor1d([1, 2, 3, 4]);
 *
 * a.sub(b).print(); // or tf.sub(a, b)
 * ```

 * ```js
 * // Broadcast subtract a with b.
 * const a = tf.tensor1d([10, 20, 30, 40]);
 * const b = tf.scalar(5);
 *
 * a.sub(b).print(); // or tf.sub(a, b)
 * ```

 * @param a The first `tf.Tensor` to subtract from.
 * @param b The second `tf.Tensor` to subtract. Must have the same dtype as.
 *
 * @doc {heading: 'Operations', subheading: 'Arithmetic'}
 */
function sub_<T extends Tensor>(a: Tensor|TensorLike, b: Tensor|TensorLike): T {
  let $a = convertToTensor(a, 'a', 'sub');
  let $b = convertToTensor(b, 'b', 'sub');

  [$a, $b] = makeTypesMatch($a, $b);

  const inputs: MaxInputs = {a: $a, b: $b};
  const attrs: MaxAttrs = {reductionIndices: [0], keepDims: false};

  return ENGINE.runKernel(
      Sub, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);
}

export const sub = op({sub_});
```

```javascript
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 */

*Animport [ENGINE] from './engine';
import {Max, MaxAttrs, MaxInputs} from './kernel_names';
import {NamedAttrMap} from './kernel_registry';
import {Tensor} from './tensor';
import {NamedTensorMap} from './tensor_types';
import {convertToTensor} from './tensor_util_env';
import {TensorLike} from './types';

import {op} from './operation';

/**
 * Computes the maximum of elements across dimensions of a `tf.Tensor`.
 *
 * Reduces the input along the dimensions given in `axes`. Unless `keepDims` is true, the rank of the `tf.Tensor` is reduced by 1 for each entry in `axes`. If `keepDims` is true, the reduced dimensions are retained with length 1. If `axes` has no entries, all dimensions are reduced, and an * `tf.Tensor` with a single element is returned.
 *
 * ```js
 * const x = tf.tensor1d([1, 2, 3]);
 * x.max().print(); // or tf.max(x)
 * ```

 * ```js
 * const x = tf.tensor2d([[1, 2, 3], [4, 5, 6]]);
 * x.max(axis=0).print(); // or tf.max(x, axis=0)
 * ```

 * @param x The input tensor.
 * @param axis The dimension(s) to reduce. By default it reduces all dimensions.
 * @param keepDims If true, retains reduced dimensions with size 1.
 *
 * @doc {heading: 'Operations', subheading: 'Reduction'}
 */
function max_<T extends Tensor>(
    x: Tensor|TensorLike, axis: number|number[] = null, keepDims = false): T {
  const $x = convertToTensor(x, 'x', 'max');

  const inputs: MaxInputs = {x: $x};
  const attrs: MaxAttrs = {reductionIndices: axis, keepDims};

  return ENGINE.runKernel(
      Max, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);
}

export const max = op({max_});
```

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 */

*Animport [ENGINE] from './engine';
import {Sub, SubInputs} from './kernel_names';
import {NamedTensorMap} from './kernel_registry';
import {Tensor} from './tensor';
import {NamedTensorMap} from './tensor_types';
import {convertToTensor} from './tensor_util_env';
import {TensorLike} from './types';

import {op} from './operation';

/**
 * Subtracts two `tf.Tensor`s element-wise, A - B. Supports broadcasting.
 *
 * ```js
 * const a = tf.tensor1d([10, 20, 30, 40]);
 * const b = tf.tensor1d([1, 2, 3, 4]);
 *
 * a.sub(b).print(); // or tf.sub(a, b)
 * ```

 * ```js
 * // Broadcast subtract a with b.
 * const a = tf.tensor1d([10, 20, 30, 40]);
 * const b = tf.scalar(5);
 *
 * a.sub(b).print(); // or tf.sub(a, b)
 * ```

 * @param a The first `tf.Tensor` to subtract from.
 * @param b The second `tf.Tensor` to subtract. Must have the same dtype as.
 *
 * @doc {heading: 'Operations', subheading: 'Arithmetic'}
 */
function sub_<T extends Tensor>(a: Tensor|TensorLike, b: Tensor|TensorLike): T {
  let $a = convertToTensor(a, 'a', 'sub');
  let $b = convertToTensor(b, 'b', 'sub');

  [$a, $b] = makeTypesMatch($a, $b);

  const inputs: MaxInputs = {a: $a, b: $b};
  const attrs: MaxAttrs = {reductionIndices: [0], keepDims: false};

  return ENGINE.runKernel(
      Sub, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);
}

export const sub = op({sub_});
```
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============================================================================

*/

import {ENGINE} from '../engine';
import {Sum, SumAttrs, SumInputs} from '../kernel_names';
import {NamedAttrMap} from '../kernel_registry';
import {Tensor} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from './types';

import {cast} from './cast';
import {op} from './operation';

/**
 * Computes the sum of elements across dimensions of a `tf.Tensor`.
 *
 * Reduces the input along the dimensions given in `axes`. Unless
 * `keepDims` is true, the reduced dimensions are retained with `n * length 1. If axes has no entries, all dimensions are reduced, and `n * `tf.Tensor` with a single element is returned.
 *
 * @param x The input tensor to compute the sum over. If the
dtype is `bool` it will be converted to `int32` and the output dtype will be `int32`.
 * @param axis The dimension(s) to reduce. By default it reduces all
dimensions. `n * @param keepDims If true, retains reduced dimensions with size 1;
 *     all dimensions.
 * @param keepDims The reduced dimensions are retained with `n * length 1. If axes has no entries, all dimensions are reduced, and `n * `tf.Tensor` with a single element is returned.
 *
 * @doc {heading: 'Operations', subheading: 'Reduction'}
 */

function sum_<T extends Tensor>(
    x: Tensor|TensorLike, axis: number|number[] = null, keepDims = false): T {
  let $x = convertToTensor(x, 'x', 'sum');
  if ($x.dtype === 'bool') {
    $x = cast($x, 'int32');
  }

  const inputs: SumInputs = {x: $x};
  const attrs: SumAttrs = {axis, keepDims};

  return ENGINE.runKernel(
      Sum,
      inputs as {} as NamedTensorMap,
      attrs as {} as NamedAttrMap);
}

export const sum = op({sum_});

============================================================================

import {customGrad} from '../gradients';

import {Tensor} from '../tensor';
import {GradSaveFunc} from '../tensor_types';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from './types';

import {cast} from './cast';
import {exp} from './exp';
import {log} from './log';
import {max} from './max';
import {mul} from './mul';
import {op} from './operation';
import {sub} from './sub';
import {sum} from './sum';

/**
 * Computes the log softmax.
 *
 * ```js
 * const a = tf.tensor1d([1, 2, 3]);
 *
 * a.logSoftmax().print();  // or tf.logSoftmax(a)
 * ```
 *
 * ```js
 * const a = tf.tensor2d([2, 4, 6, 1, 2, 3], [2, 3]);
 *
 * a.logSoftmax().print();  // or tf.logSoftmax(a)
 * ```
 *
 * @param logits The logits array.
 * @param axis
 *     The dimension softmax would be performed on. Defaults to `-1` which indicates the last dimension.
 *
 * @doc {heading: 'Operations', subheading: 'Normalization'}
 */

function logSoftmax_<T extends Tensor>(logits: T|TensorLike, axis = -1): T {
  const $logits = convertToTensor(logits, 'logits', 'logSoftmax');

  if (axis === -1) {
    axis = $logits.rank - 1;
  }
  if (axis !== $logits.rank - 1) {
    throw Error(`Log Softmax along a non-
    last dimension is not yet supported. ' +
    `Logits was rank ${$logits.rank} and axis was ${axis}`);
  }

  const forward: ForwardFunc<Tensor> = (backend, save) => {
    const keepDims = true;
    const xMax = max(logits, axis, true);
    const shifted = sub(logits, xMax);
    const value =
        sub(cast(shifted, 'float32'), log(sum(exp(shifted), axis, keepDims)));
    save([value]);

    const gradFunc = (dy: Tensor, saved: Tensor[]) => {
      const [value] = saved;
      const softmax = exp(value);
      return sub(dy, mul(sum(dy, axis, keepDims), softmax));
    }

    return function (logits: Tensor, axis: number) => {
      const output = sum(exp(shifted), axis, keepDims);
      const value = sub(dy, mul(output, softmax));
      save([value]);
      return value;
    };

  }

  return output;

}
```javascript
return {value, gradFunc};

    const inputs: LogSoftmaxInputs = {logits: $logits};
    const attrs: LogSoftmaxAttrs = {axis};
    // return ENGINE.runKernel(
    //      LogSoftmax, inputs as {} as NamedTensorMap,
    //      attrs as {} as NamedAttrMap);

    return customOp($logits) as T;

    // TODO Use Engine.runKernel when CPU/WebGL/WebAS backends implement this.
    // const inputs: LogSoftmaxInputs = {logits: Slogits};
    // const attrs: LogSoftmaxAttrs = {axis};
    // return ENGINE.runKernel($logits, axis as number);

    // const logSoftmax = op({logSoftmax_in: $logits}, * @license *
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    return axesAreInnerMostDims(axes, rank) {
      let outIdx = 0;
      let reduceIdx = 0;
      for (let dim = 0; dim < rank; dim++) {
        if (axes.indexOf(dim) === -1) {
          loc.push(outputLoc[outIdx++]);
        } else {
          loc.push(reduceLoc[reduceIdx++]);
        }
      }
    }
```

---

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// Import TensorFlow library

import {Tensor} from '../tensor';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';
import {parseAxisParam} from '../util';

import {add} from './add';
import {expandShapeToKeepDim} from './axis_util';
import {exp} from './exp';
import {log} from './log';
import {max} from './max';
import {op} from './operation';
import {reshape} from './reshape';
import {sub} from './sub';
import {sum} from './sum';

/**
 * Computes the log(sum(exp(elements across the reduction
```
Reduces the input along the dimensions given in `axis`. Unless `keepDims` is true, the rank of the array is reduced by 1 for each entry in `axis`. If `keepDims` is true, the reduced dimensions are retained with length 1. If `axis` has no entries, all dimensions are reduced, and an array with a `\n`  * single element is returned.

```
const x = tf.tensor1d([1, 2, 3]);
const y = tf.logSumExp(x).print(); // or tf.logSumExp(x)
```

```
const x = tf.tensor2d([1, 2, 3, 4], [2, 2]);
const y = tf.logSumExp(x, axis=0).print(); // or tf.logSumExp(x, axis=0)
```

```
const x = tf.tensor1d([false, false, true, true]);
const y = tf.logicalAnd(x, x).print();
```

```
const x = tf.tensor1d([false, true, false, true]);
const y = tf.logicalNot(x).print();
```

```js

```
`function maxPool_<T extends Tensor3D|Tensor4D>(x: T|TensorLike, filterSize: [number, number]|number, strides: [number, number]|number, pad: 'valid'|'same'|number, dimRoundingMode?: 'floor'|'round'|'ceil'): T {
  const $x = convertToTensor(x, 'x', 'maxPool');
  const dilations = 1;

  let x4D = $x as Tensor4D;
  let reshapedTo4D = false;
  if ($x.rank === 3) {
    reshapedTo4D = true;
    x4D = reshape($x, [1, $x.shape[0], $x.shape[1], $x.shape[2]]);
  }

  util.assert(
      x4D.rank === 4,
      () => `Error in maxPool: input must be rank 4 but got rank ${x4D.rank}.`);
  util.assert(
      conv_util.eitherStridesOrDilationsAreOne(strides, dilations),
      () => `Error in maxPool: Either strides or dilations must be 1. Got strides ${strides} and dilations ${dilations}.`);
  if (dimRoundingMode != null) {
    util.assert(
        util.isInt(pad as number),
        () => `Error in maxPool: pad must be an integer when using dimRoundingMode ${dimRoundingMode} but got pad ${pad}.`);
  }

  const inputs: MaxPoolInputs = {x: x4D};

  const attrs: MaxPoolAttrs = {filterSize, strides, pad, dimRoundingMode};

  // tslint:disable-next-line: no-unnecessary-type-assertion
  const res = ENGINE.runKernel(
      MaxPool, inputs as {} as NamedTensorMap,
      attrs as {} as NamedAttrMap) as T;

  if (reshapedTo4D) {
    return reshape(res, [res.shape[1], res.shape[2], res.shape[3]]) as T;
  }
  return res;
}

export const maxPool = op({maxPool_});

/**
 * Computes the 2D max pooling of an image.
 * @param x The input tensor, of rank 4 or rank 3 of shape [batch, height, width, inChannels]. If rank 3, batch of 1 is assumed.
 * @param filterSize The filter size: [filterHeight, filterWidth]. If `filterSize` is a single number, then `filterHeight == filterWidth`.
 * @param strides The strides of the pooling: [strideHeight, strideWidth]. If `strides` is a single number, then `strideHeight == strideWidth`. If it is greater than 1, then all values of `strides` must be 1.
 * @param pad The type of padding algorithm.
 * @param dimRoundingMode A string from: 'ceil', 'round', 'floor'. If none is provided, it will default to truncate.
 */

const x = tf.tensor([1, 2, 3, 4, 5, 6, 7, 8]);
const res = tf.maxPool(x, 2, 1, 'valid');
res.print();

*/

```
and stride 1: output will be of same size as input.

- `valid`: output will be smaller than input if filter is larger than 1x1.
- For more info, see this guide:

[https://www.tensorflow.org/api_guides/python/nn#Convolution](https://www.tensorflow.org/api_guides/python/nn#Convolution)

`@param dimRoundingMode A string from: 'ceil', 'round', 'floor'. If none is given, it will default to truncate.
`@param dataFormat An optional string from: '\NDHWC', '\NCDHW'. Defaults to '\NDHWC'. Specify the data format of the input and output data. With the default format \NDHWC, the data is stored in the order of: [batch, depth, height, width, channels]. Only \NDHWC is currently supported.
`@doc {heading: 'Operations', subheading: 'Convolution'}

```javascript
function maxPool3d_<T extends Tensor4D|Tensor5D>(
    x: T|TensorLike, filterSize: [number, number, number],
    strides: [number, number, number], pad:
    'valid'|'same'|number, dimRoundingMode?: number,
    dataFormat: 'NDHWC'|'NCDHW' = 'NDHWC'): T {
  const $x = convertToTensor(x, 'x', 'maxPool3d');

  let x5D = $x as Tensor5D;
  let reshapedTo5D = false;
  if ($x.rank === 4) {
    reshapedTo5D = true;
    x5D = reshape($x, [1, $x.shape[0], $x.shape[1], $x.shape[2], $x.shape[3]]);
  }

  util.assert(
      x5D.rank === 5,
      () => `Error in maxPool3d: x must be rank 5 but got rank ${x5D.rank}.`);
  util.assert(
      dataFormat === 'NDHWC',
      () => `Error in maxPool3d: Only NDHWC is currently supported, ` +
          `but got dataFormat of ${dataFormat}`);
  if (dimRoundingMode != null) {
    util.assert(
        util.isInt(pad as number),
        () => `Error in maxPool3d: pad must be an integer when using, ` +
            `dimRoundingMode ${dimRoundingMode} but got pad ${pad}.`);
  }

  const inputs: MaxPool3DInputs = {x: x5D};

  const attrs:
      MaxPool3DAttrs = {filterSize, strides, pad,
          dimRoundingMode, dataFormat};

  // tslint:disable-next-line: no-unnecessary-type-assertion
  const res = ENGINE.runKernel(
                  MaxPool3D, inputs as {} as NamedTensorMap,
                  attrs as {} as
          NamedAttrMap) as T;

  if (reshapedTo5D) {
    return reshape(
               res, [res.shape[1], res.shape[2], res.shape[3], res.shape[4]]) as
        T;
  }

  return res;
}

export const maxPool3d = op({maxPool3d_});
```

---

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* implied. See the License for the specific language governing permissions and limitations under the License.
*
```js
const x = tf.tensor1d([1, 2, 3]);

// or tf.mean(x)

const axis = 1;

const x = tf.tensor2d([[1, 2, 3], [4, 2, 1]]);

const axis = 1;

const x = param x

const x = tf.tensor1d([1, 2, 3]);

const x = tf.tensor2d([[1, 2, 3, 4], [2, 3]]);

const axis = 1;

```

```
b)\n
@doc {heading: 'Operations', subheading: 'Arithmetic'} \n*/function minimum_<T\ extends Tensor>(
    a: 
    Tensor|TensorLike, b: Tensor|TensorLike): T {
  let $a = convertToTensor(a, 'a', 'minimum');
  let $b = convertToTensor(b, 'b', 'minimum');
  [$a, $b] = makeTypesMatch($a, $b);
  if ($a.dtype === 'bool') {
    $a = cast($a, 'int32');
    $b = cast($b, 'int32');
  }
  assertAndGetBroadcastShape($a.shape, $b.shape);

  const inputs: MinimumInputs = {a: $a, b: $b};
  return ENGINE.runKernel(Minimum, inputs as {a: Tensor|TensorLike, b: Tensor|TensorLike});
}

export const minimum = op({minimum_});

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 */

import {ENGINE} from '../engine';
import {MirrorPad, MirrorPadAttrs, MirrorPadInputs} from '../kernel_names';
import {NamedAttrMap} from '../kernel_registry';
import {Tensor} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';
import * as util from '../util';

import {op} from './operation';

/**
 * Pads a `tf.Tensor` using mirror padding.
 *
 * This operation implements the `REFLECT` and `SYMMETRIC` modes of pad.
 *
 * ```js
 * const x = tf.range(0, 9).reshape([1, 1, 3, 3]);
 * x.mirrorPad([[0, 0], [0, 0], [2, 2], [2, 2]], 'reflect').print();
 * ```
 * @param x The tensor to pad.
 * @param paddings An array of length `R` (the rank of the tensor),
 * where each element is a length-2 tuple of ints `[padBefore, padAfter]`,
 * specifying how much to pad along each dimension of the tensor.
 * In `reflect` mode, the padded regions do not include the borders.
 * While in `symmetric` mode the padded regions do include the borders.
 * For example, if the input is `[1, 2, 3]` and paddings is `[0, 2],
 * then the output is `[1, 2, 3, 2, 1]` in `reflect` mode, and `[1, 2, 3, 2, 1]` in
 * `symmetric` mode.
 * @param mode String to specify padding mode. Can be `'reflect' | 'symmetric'`
 * @doc {heading: 'Tensors', subheading: 'Transformations'} */
/**
 * `mirrorPad(x, [0, 0, 0, 0])` is not defined. ' +
 * `Pas non-scalar to mirrorPad'\n */

const $x = convertToTensor(x, 'x', 'mirrorPad');
if ($x.rank == 0) { throw new Error('mirrorPad(scalar) is not defined. ' +
    'Pass non-scalar to mirrorPad');
}

util.assert($paddings.length == $x.rank, () => `Paddings don't match input. Must be $[$x.rank]. ` +
    `Got ${$paddings.length}.`);

const shapeOffset = mode === 'reflect' ? 1 : 0;

util.assert($paddings[i].length == 2, () => `Invalid number of paddings. Must be length of 2 each.`);

util.assert($paddings[i][0] >= 0 && $paddings[i][0] <= $x.shape[i] - shapeOffset &&
    $paddings[i][1] >= 0 && $paddings[i][1] <= $x.shape[i] - shapeOffset, () => `Padding in dimension $i cannot be greater than or equal to $[$x.shape[i] - shapeOffset] or less than 0 for input of ` +
    `shape $[$x.shape]`);

const attrs: MirrorPadAttrs = {paddings, mode};
const inputs: MirrorPadInputs = {x: $x};

const $output = ENGINE.runKernel($x, 'MirrorPad', inputs as {} as NamedTensorMap);
const $output = op((mirrorPad_\)),\n*/

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 */
import {ENGINE} from '../engine';
import {Mod, ModInputs} from '../kernel_names';
import {Tensor} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {makeTypesMatch} from '../tensor_util';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';

import {op} from './operation';

/**
 * Returns the mod of a and b element-wise.
 * `floor(x / y) * y + mod(x, y) = x`

 * Supports broadcasting.

 * @param {tf.Tensor} a - We also expose `tf.modStrict` which has the same signature as this op and
 * @param {tf.Tensor} b - asserts that `a` and `b` are the same shape (does not broadcast).
 * @return {tf.Tensor} return Tensor.
 * @param {number} axis The second tensor. Must have the same type as `a`.
 * @param {boolean} keepDims See the License for the specific language governing permissions and
 * 
 * @param {boolean} keepDims = false);```

import {ENGINE} from '../engine';
import {Tensor} from '../tensor';
import {parseAxisParam} from '../util';

import {expandShapeToKeepDim} from './axis_util';
import {cast} from './cast';
import {mean} from './mean';
import {op} from './operation';
import {reshape} from './reshape';
import {square} from './square';
import {sub} from './sub';

/**
 * Calculates the mean and variance of `x`. The mean and variance are calculated by aggregating the contents of `x` across `axes`.
 * If `x` is a 1-D and `axes = [0]` this is just the mean and variance of a vector.
 * @param {number} axis The input tensor.
 * @param {number} keepDims If true, the moments have the same dimensionality as the input.
 * @return An object with two keys: `mean` and `variance`.
 * @doc {heading: 'Operations', subheading: 'Normalization'}
 * @param {number} axis The input tensor.
 * @param {number} keepDims = false);```

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xMean.shape;
if (!keepDims) {xMean.keepDimsShape = expandShapeToKeepDim(xMean.shape, axes);}

const devSquared = square(sub(cast(x, 'float32'), reshape(xMean, keepDimsShape)));
const variance = mean(devSquared, axes, keepDims);
return {mean: xMean, variance};

export const moments = op({moments_});

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 */
import {Tensor2D} from '../tensor';
import {convertToTensor, convertToTensorArray} from '../tensor_util_env';
import {TensorLike} from '../types';
import {op} from './operation';

/**
 * @doc {heading: 'Operations', subheading: 'RNN'}
 */
function multiRNNCell_(lstmCells: LSTMCellFunc[], data: Tensor2D|TensorLike, c: Array<Tensor2D|TensorLike>, h: Array<Tensor2D|TensorLike>): [Tensor2D, Tensor2D] {
  const $data = convertToTensor(data, 'data', 'multiRNNCell');
  const $c = convertToTensorArray(c, 'c', 'multiRNNCell');
  const $h = convertToTensorArray(h, 'h', 'multiRNNCell');

  let input = $data;
  const newStates = [];
  for (let i = 0; i < lstmCells.length; i++) {
    const output = lstmCells[i](input, $c[i], $h[i]);
    newStates.push(output[0]);
    input = output[1];
  }
  const newC: Tensor2D[] = [];
  const newH: Tensor2D[] = [];
  for (let i = 0; i < newStates.length; i += 2) {
    newC.push(newStates[i]);
    newH.push(newStates[i + 1]);
  }
  return [newC, newH];
}
export const multiRNNCell = op({multiRNNCell_});

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 */
import {ENGINE} from '../engine';
import {Multinomial, MultinomialAttrs, MultinomialInputs} from '../kernel_names';
import {NamedAttrMap} from '../kernel_registry';
import {Tensor1D, Tensor2D} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';

import {op} from './operation';
import {reshape} from './reshape';

/**
 * Creates a `tf.Tensor` with values drawn from a multinomial distribution.
 * ```js
 * const probs = tf.tensor([.75, .25]);
 * tf.multinomial(probs, 3).print();
 * ```
 *
 * @param logits 1D array with unnormalized log-probabilities, or 2D array of shape `[[batchSize, numOutcomes]]`. See the `normalized` parameter.
 * @param numSamples Number of samples to draw for each row slice.
 * @param seed The seed number.
 * @param normalized Whether the provided `logits` are normalized true or not.
 * @return 1D array of shape `[[numSamples]]`, or 2D array of shape `[[batchSize, numSamples]]`, depending on the rank of the input.
 */
function multinomial_(logits: Tensor1D|Tensor2D, numSamples: number, seed?: number, normalized = false): Tensor1D|Tensor2D {
  const $logits = convertToTensor(logits, 'logits', 'multinomial');
  const $numSamples = convertToTensor(numSamples, 'numSamples', 'multinomial');
  const numOutcomes = $logits.size;
  const origRank = $logits.rank;
  const newRank = if (numOutcomes < 2) {throw new
Error(`Error in multinomial: you need at least 2 outcomes, but got ` +
        `$\{\text{numOutcomes}\}$`);\n} if  
        (origRank > 2) {\n        throw new Error(`Rank of probabilities must be 1 or 2, but is $\{\text{origRank}\}$`);\n} \n// TODO(lina128): Investigate correct seed behavior. The code seems not allow\n // setting see to 0 \n    // seed = seed \n    // Math.random();\n    // The kernel only accepts (and returns) rank 2 tensors;\n    const logits2D =\n        origRank === 1 ? reshape($logits, [1, -1]) : $logits as Tensor2D;\n    const inputs: MultinomialInputs = {\n        logits: logits2D;\n    } const attr: MultinomialAttrs = {\n        numSamples, seed, normalized;\n    } // tslint:disable-next-line: no-unnecessary-type-assertion
    const res = ENGINE.runKernel(true
        Multinomial, inputs as [ ] as NamedTensorMap,\n        as attr as [ ] as NamedAttrMap) as Tensor2D;\n
    return origRank === 1 ? reshape(res, [res.size]) as Tensor1D : res;\n}

export const
        multinomial = op({multinomial_});

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     *=============================================================================
     */

    import {ENGINE} from '../engine';
    import {NotEqual, NotEqualInputs} from '../kernel_names';
    import {Tensor} from '../tensor';
    import {DataType, Rank, ShapeMap} from '../types';
    import {makeZerosTypedArray, sizeFromShape} from '../util';

    import {complex} from './complex';

    /**
     * Creates a `tf.Tensor` with all elements set to 0.
     *
     * ```js
     * tf.zeros([2, 2]).print();
     * ```
     *
     * @param shape An array of integers defining the output tensor shape.
     * @param dtype The type of an element in the resulting tensor. Can be
     *     'float32', 'int32' or 'bool'. Defaults to 'float'.
     * @param shape: ShapeMap, dtype: DataType
     * @doc {heading: 'Tensors', subheading: 'Creation'}
     */
    export function zeros<R extends Rank>(
        shape: ShapeMap[R], dtype: DataType = 'float32'): Tensor<R> {
        if (dtype === 'complex64') {
            const real = zeros(shape, 'float32');\n            const imag = zeros(shape, 'float32');\n            return complex(real, imag);\n        } \n        const values =\n            makeZerosTypedArray(sizeFromShape(shape), dtype);\n        return ENGINE.makeTensor(values, shape, dtype) as
            Tensor<R>[
                if (dtype === 'complex64') \n                    const real = zeros(shape, 'float32');\n                    const imag = zeros(shape, 'float32');\n                    return complex(real, imag);\n                \n                const values =\n                    makeZerosTypedArray(sizeFromShape(shape), dtype);\n                \n                return ENGINE.makeTensor(values, shape, dtype) as
                    Tensor<R>[
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    */
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=============================================================================

*/

import {ENGINE} from '../engine';
import {Tensor} from '../tensor';
import {DataType, Rank, ShapeMap} from '../types';
import {makeOnesTypedArray, sizeFromShape} from '../util';

import {complex} from './complex';
import {zeros} from './zeros';

/**
 * Creates a `tf.Tensor` with all elements set to 1.
 *
 * ```js
 * tf.ones([2, 2]).print();
 * ```
 *
 * @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
 * @doc {heading: 'Tensors', subheading: 'Creation'}
 */
export function ones<R extends Rank>(shape: ShapeMap[R], dtype: DataType = 'float32'): Tensor<R> {
  if (dtype === 'complex64') {
    const real = ones(shape, 'float32');
    const imag = zeros(shape, 'float32');
    return complex(real, imag);
  }
  const values = makeOnesTypedArray(sizeFromShape(shape), dtype);
  return ENGINE.makeTensor(values, shape, dtype) as Tensor<R>;
}

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=============================================================================

*/

import {ENGINE} from '../engine';
import {OnesLike, OnesLikeInputs} from '../kernel_names';
import {Tensor} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';

import {op} from './operation';

/**
 * Creates a \n * \n * ```js
 * const x = tf.tensor([1, 2]);
 * tf.onesLike(x).print();
 * ```
 *
 * @param x A tensor.
 *
 * @doc {heading: 'Tensors', subheading: 'Creation'}
 */
function onesLike_<T extends Tensor>(x: T|TensorLike): T {
  const $x = convertToTensor(x, 'x', 'onesLike');

  const inputs: OnesLikeInputs = {x: $x};
  return

  ENGINE.runKernel(OnesLike, inputs as {} as NamedTensorMap);
}

export const onesLike =

op({onesLike_});

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 * License. \n * 

=============================================================================

*/
import {Tensor1D, Tensor2D} from '../tensor';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';
import * as util from '../util';

import {matMul} from './mat_mul';
import {op} from './operation';
import {reshape} from './reshape';

/**
 * Computes the outer product of two vectors, `v1`
 * and `v2`. \n * const a = tf.tensorId([1, 2, 3]);\n * const b = tf.tensorId([3, 4, 5]);\n * const
 * tf.outerProduct(a, b).print();\n * ```
 * @param v1 The first vector in the outer product operation.\n * @param v2 The second vector in the outer product operation.\n *
 * @doc {heading: 'Operations', subheading: 'Matrices'}
 */

function outerProduct_(\n    v1: Tensor1D|Tensor2D, v2: Tensor1D|Tensor2D): Tensor2D \n    \n    \n    const product = convertToTensor(v1, 'v1', 'outerProduct');\n    \n    const $v1 = convertToTensor(v1, 'v1');\n    \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        const v12D = reshape($v1, [-1, 1]);\n        const v22D = reshape($v2, [1, -
function matMul(v12D: TensorLike, v22D: TensorLike): Tensor
{
  return matMul(v12D, v22D);
}

export const outerProduct = op({outerProduct_});

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 */

import {ENGINE} from '../engine';
import {PadV2, PadV2Attrs, PadV2Inputs} from '../kernel_names';
import {NamedAttrMap} from '../kernel_registry';
import {Tensor} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';

import {op} from './operation';

/**
 * Pads a `tf.Tensor` with a given value and paddings.
 *
 * This operation implements 'CONSTANT' mode. For 'REFLECT' and 'SYMMETRIC', refer to `tf.mirrorPad`
 *
 * Also available are stricter rank-specific methods with the same signature as this method that assert that `paddings` is of given length.
 *
 * ```js
 * const x = tf.tensor1d([1, 2, 3, 4]);
 * x.pad([[1, 2]]).print();
 * ```
 * @param x The tensor to pad.
 * @param paddings An array of length `R` (the rank of the tensor), where each element is a length-2 tuple of ints `[padBefore, padAfter]` specifying how much to pad along each dimension of the tensor.
 * @param constantValue The pad value to use. Defaults to 0.
 *
 * @doc {heading: 'Tensors', subheading: 'Transformations'}
 */
function pad_<T extends Tensor>(
    x: T|TensorLike, paddings: Array<[number, number]>, constantValue = 0): T {
  const $x = convertToTensor(x, 'x', 'pad');
  if ($x.rank === 0) {
    throw new Error('pad(scalar) is not defined. Pass non-scalar to pad');
  }

  const attrs: PadV2Attrs = {paddings, constantValue};
  const inputs: PadV2Inputs = {x: $x};
  return ENGINE.runKernel(
      PadV2, inputs as unknown as NamedTensorMap,
      attrs as unknown as NamedAttrMap);
}

export const pad = op({pad_});

/**
 * Pads a `tf.Tensor1D` with a given value and paddings. See `pad` for details.
 */
function pad1d_(
    x: Tensor1D|TensorLike, paddings: [number, number],
    constantValue = 0): Tensor1D {
  assert(
      paddings.length === 2,
      () => 'Invalid number of paddings. Must be length of 2.');
  return pad(x, [paddings], constantValue);
}

export const pad1d = op({pad1d_});

/**
 * Pads a `tf.Tensor2D` with a given value and paddings. See `pad` for details.
 */
function pad2d_(
    x: Tensor2D|TensorLike, paddings: [[number, number],
    constantValue = 0]: Tensor2D {
  assert(paddings.length === 2, () => 'Invalid number of paddings. Must be length of 2.');
  return pad(x, [paddings], constantValue);
}

export const pad2d = op({pad2d_});
[number, number]],\n    constantValue = 0): Tensor2D {\n    assert(paddings.length === 2 &\n    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_});

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import {Tensor3D} from '../tensor';
import {TensorLike} from '../types';
import {assert} from '../util';
import {op} from './operation';
import {pad} from './pad';

/**
 * Pads a `tf.Tensor3D` with a given value and paddings. See `pad` for details.\n * @param x - A `tf.Tensor3D`.\n * @param paddings - The paddings as a `[[number, number], [number, number], [number, number]]`\n * array\n * @param constantValue - The padding value (default: 0)\n * @return A `tf.Tensor3D` with paddings applied\n */
function pad3d_(x: Tensor3D|TensorLike, paddings: [[number, number], [number, number], [number, number]], constantValue = 0): Tensor3D {
  assert(
    paddings.length === 3 && paddings[0].length === 2 &&
    paddings[1].length === 2 && paddings[2].length === 2,
    () => 'Invalid number of paddings. Must be length of 2 each.');\n  return pad(x, paddings, constantValue);
}

export const pad3d = op({pad3d_});

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import {Tensor4D} from '../tensor';
import {TensorLike} from '../types';
import {assert} from '../util';
import {op} from './operation';
import {pad} from './pad';

/**
 * Pads a `tf.Tensor4D` with a given value and paddings. See `pad` for details.\n */
function pad4d_(x: Tensor4D|TensorLike, paddings: [[number, number], [number, number], [number, number], [number, number]], constantValue = 0): Tensor4D {
  assert(
    paddings.length === 4 && paddings[0].length === 2 &&
    paddings[1].length === 2 && paddings[2].length === 2 &&
    paddings[3].length === 2,
    () => 'Invalid number of paddings. Must be length of 2 each.');\n  return pad(x, paddings, constantValue);
}

export const pad4d = op({pad4d_});

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import {ENGINE} from '../engine';
import {SpaceToBatchND, SpaceToBatchNDAttrs, SpaceToBatchNDInputs} from '../kernel_names';
import {NamedAttrMap} from '../kernel_registry';
import {Tensor} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';
import * as util from '../util';

import {op} from './operation';

/**
 * This operation divides "spatial" dimensions `[1, ..., M]` of the input into a grid of blocks of shape `blockShape`, and interleaves these blocks within the `\'batch\'` dimension (0) such that in the output, the spatial dimensions `[1, ..., M]` correspond to the position within the grid, and the batch dimension combines both the position within a spatial block and the original batch position. Prior to division into blocks, the spatial dimensions of the input are optionally zero padded according to `paddings`. See below for a precise
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in dilated pooling. Defaults to `[1, 1]`. If `dilationRate` is a single number, then `dilationHeight == dilationWidth`. If it is greater than 1, then all values of `strides` must be 1.

- `'avg'`: padding valid, pad: valid, same number. Defaults to all values of `strides` must be 1.
- `'max'`: padding valid, pad: valid, same number. Defaults to all values of `strides` must be 1.
- `'same'`: padding same, pad: same, number. Defaults to all values of `strides` must be 1.
- `'valid'`: padding valid, pad: valid, number. Defaults to all values of `strides` must be 1.

If `dilationRate` is a single number, then `dilationHeight == dilationWidth`. If it is greater than 1, then all values of `strides` must be 1.

- `'avg'`: padding valid, pad: valid, same number. Defaults to all values of `strides` must be 1.
- `'max'`: padding valid, pad: valid, same number. Defaults to all values of `strides` must be 1.
- `'same'`: padding same, pad: same, number. Defaults to all values of `strides` must be 1.
- `'valid'`: padding valid, pad: valid, number. Defaults to all values of `strides` must be 1.

If `dilationRate` is a single number, then `dilationHeight == dilationWidth`. If it is greater than 1, then all values of `strides` must be 1.

- `'avg'`: padding valid, pad: valid, same number. Defaults to all values of `strides` must be 1.
- `'max'`: padding valid, pad: valid, same number. Defaults to all values of `strides` must be 1.
- `'same'`: padding same, pad: same, number. Defaults to all values of `strides` must be 1.
- `'valid'`: padding valid, pad: valid, number. Defaults to all values of `strides` must be 1.
import {ENGINE} from '../engine';
import {Pow, PowInputs} from '../kernel_names';
import {Tensor} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {makeTypesMatch} from '../tensor_util';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';

import {op} from './operation';

/**
 * Computes the power of one `tf.Tensor` to another. Supports broadcasting.
 * Given a `tf.Tensor` x and a `tf.Tensor` y, this operation computes x^y for
 * corresponding elements in x and y.
 * The result's dtype will be the upcasted `*` of the `base` and `exp` dtypes.
 * Example:
 *
 * ```js
 * let a = tf.tensor([2, 3, 4]);
 * let b = tf.tensor([1, 1, 0]);
 *
 * a.pow(b).print();  // or tf.pow(a, b)
 * ```
 * We also expose `powStrict` which has the same signature as this op and
 * asserts that `base` and `exp` are the same shape (does not broadcast).
 */
function pow_<T extends Tensor>(
  base: Tensor|TensorLike, exp: Tensor|TensorLike): T {
  const $base = convertToTensor(base, 'base', 'pow');
  const $exp = convertToTensor(exp, 'exp', 'pow');

  const inputs: PowInputs = {a: $base, b: $exp};
  return ENGINE.runKernel(Pow, inputs as {} as NamedTensorMap);
}

export const pow = op({pow_});

import {ENGINE} from '../engine';
import {Prelu, PreluInputs} from '../kernel_names';
import {Tensor} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';

import {cast} from './cast';
import {op} from './operation';

/**
 * Computes leaky rectified linear element-wise with parametric alphas.
 * `x < 0 ? alpha * x : f(x) = x`
 * Example:
 *
 * ```js
 * const x = tf.tensor1d([-1, 2, -3, 4]);
 * const alpha = tf.scalar(0.1);
 *
 * x.prelu(alpha).print();  // or tf.prelu(x, alpha)
 * ```
 * We also expose `preluStrict` which has the same signature as this op and
 * asserts that `x` and `alpha` are the same shape (does not broadcast).
 */
function prelu_<T extends Tensor>(x: T|TensorLike, alpha: T|TensorLike): T {
  const $x = convertToTensor(x, 'x', 'prelu');
  const $alpha = convertToTensor(alpha, 'alpha', 'prelu');

  const inputs: PreluInputs = {x: $x, alpha: $alpha};
  return ENGINE.runKernel(Prelu, inputs as {} as NamedTensorMap);
}

export const prelu = op({prelu_});

import {ENGINE} from '../engine';
import {Prod, ProdAttrs, ProdInputs} from '../kernel_names';
import {NamedAttrMap} from '../kernel_registry';
import {Tensor} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';

import {cast} from './cast';
import {op} from './operation';

/**
 * Computes the product of elements across dimensions of a `tf.Tensor`.
 * Example:
 */
function prod_<T extends Tensor>(
  x: T|TensorLike, axes: number|number[] = -1): T {
  const $x = convertToTensor(x, 'x', 'prod');

  const inputs: ProdInputs = {x: $x, axes: axes};
  return ENGINE.runKernel(Prod, inputs as {} as NamedTensorMap);
}

export const prod = op({prod_});
keepDims in true, the rank of the `tf.Tensor` is reduced by 1 for each entry in `axes`. If `keepDims` is true, the reduced dimensions are retained with `length` 1. If `axes` has no entries, all dimensions are reduced, and `a @ broadcast @ x` with a single element is returned.

If `prod` is `bool` in it will be converted to `int32` and the output dtype will be `int32`.

```js
const x = tf.tensor1d([1, 2, 3]);
const y = tf.tensor1d([4, 5, 6]);
const z = tf.tensor1d([7, 8, 9]);
const prod = x.prod().print();
```

```js
const a = tf.tensor2d([[1, 2], [3, 4]]);
const axis = 1;
const prod = a.prod(axis).print();
```

@param x The input tensor to compute the product over.
If the dtype is `bool` it will be converted to `int32` and the output dtype will be `int32`.

```js
const x = tf.tensor1d([true, false, true]);
```
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

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The weyl generator is not advanced while warming up.

```javascript
    i = 127;
    for (j = 4 * 128; j > 0; --j) {
      v = X[(i + state before using it.
    // Factoring this as a function slows the main generator, so it is just
    // unrolled here.
    // Run the generator 512 times to further mix the
    // Result is the combination.
    return (v +
```

```
  };

  function init(me, seed) {
    var t, v, i, j, w, X = [], limit = 128;
    if (seed ===
// Seed state array using a 32-bit integer.
    X = X[0] = seed;
    if (seed == null) seed = +(new Date);
    var xg = new XorGen(seed),
      state = opts && opts.state,
      prng = function() { return (xg.next() >>> 0) / 0x100000000; };
    prng.double = function() { return (top + bot) / (1 << 21); };
    prng.int32 = xg.next;
    prng.quick = prng;
    if (state) {
      if (state.x) copy(state, xg);
      prng.state = function() {
```

```
  // A Javascript implementation of Richard Brent's Xorgens xor4096
  algorithm.\n// This fast non-cryptographic random number generator is designed for use in
Monte-Carlo algorithms. It combines a long-period xorshift4096 generator with a
Weyl generator, and it passes all common batteries\n// of statistical tests for randomness while consuming only a few
nanoseconds\n// for each prng generated.
For background on the generator, see Brent's paper: \"Some long-period random number
generators using shifts and
xors.\" [http://arxiv.org/pdf/1004.3115v1.pdf]\nUsage: \nvar xor4096 = require('xor4096');\n\nrandom = xor4096(1); // Seed with int32 or string\nassert.equal(random.int32(1), 1806534897); // signed int32, 32 bits.
assert.equal(random(), 0.1520436450538547); // (0, 1) range, 53 bits.
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```
```javascript
// A Javascript implementation of the "Tyche-i" prng algorithm by
// Samuel Neves and Filipe Araujo.
// See https://eden.dei.uc.pt/~sneves/pubs/2011-
// snfa2.pdf

(function(global, module, define)
{

function XorGen(seed) {
  var me = this, strseed = '';

  // Set up generator function.
  me.next = function() {
    var b = me.b, c = me.c, d = me.d, a = me.a;
    b = (b << 25) ^ (b >>> 7) ^ c;
    c = (c - d) | 0;
    d = (d << 24) ^ (d >>> 8) ^ a;
    a = (a - b) | 0;
    me.b = b = (b << 20) ^ (b >>> 12) ^ c;
    me.c = c = (c - d) | 0;
    me.d = (d << 16) ^ (c >>> 16) ^ a;
    return me.a = (a - b) | 0;
  };

  /* The following is non-inverted tyche, which has better internal
   * bit diffusion, but which is about 25% slower than tyche-i in JS.
   * me.next = function() {
   *   var a = me.a, b = me.b, c = me.c, d = me.d;
   *   a = (me.a + me.b) | 0;
   *   b = me.d ^ a ^ b;
   *   c = me.d ^ (b << 6) ^ d;
   *   d = (d << 15) ^ (d >>> 7) ^ c;
   *   return (x ^ (c >>> 16) ^ a);
   * }
   */

  me.a = 0;
  me.b = 0;
  me.c = 2654435769 | 0;
  me.d = 1367130551;

  if (seed === Math.floor(seed)) {
    // Integer seed.
    me.a = (seed / 0x100000000) | 0;
    me.b = seed | 0;
  } else {
    // String seed.
    strseed += seed;
  }

  // Mix in string seed, then discard an initial
  batch of 64 values.
  for (var k = 0; k < strseed.length + 20; k++) {
    me.b ^= strseed.charCodeAt(k) | 0;
    me.next();
  }
}

function copy(f, t) {
  t.a = f.a;
  t.b = f.b;
  t.c = f.c;
  t.d = f.d;
  return t;
};

function impl(seed, opts) {
  var xg = new XorGen(seed),
      state = opts && opts.state,
      prng = function() { return xg.next() >>> 0 };

  prng.int32 = xg.next;
  prng.quick = prng;
  if (state) {
    if (typeof(state) == 'object') copy(state, xg);
    prng.state = function() { return copy(xg, {}); }
  }
  return prng;
}

if (module && module.exports) {
  module.exports = impl;
} else if (define && define.amd) {
  define(function() { return impl; });
} else {
  this.tychei = impl;
}

})(
  this,
  (typeof module) == 'object' && module,    // present in node.js
  (typeof define) == 'function' && define   // present with an AMD loader
);

/*
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a copy of this software and
and associated documentation files (the"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\nto permit persons to whom the Software is furnished to do so, subject to\nthe following conditions:\n
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```

---

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34) & 127

35) = X[i = ((i + 1) & 127);

36) t = X[i = ((i + 1) & 127)];

37) v ^= v << 13;

38) t ^= t << 17;

39) v ^= v >>> 15;

40) t ^= t >>> 12;

41) X[i] = v ^ t;

42) // Storing state as object members is faster than using closure variables.

43) me.w = w;

44) me.X = X;

45) me.i = i;

46) init(me, seed);

47) //function f(seed, opts) {

48) if (seed == null) seed = +(new Date);

49) var xg = new XorGen(seed),

50) state = opts && opts.state,

51) prng = function() { return (xg.next() >>> 0) / 0x100000000; };

52) return prng;

53) prng.double = function() { return (xg.next() >>> 0) / 0x100000000; };

54) prng.int32 = xg.next;

55) prng.quick = prng;

56) prng.state = function() { return copy(xg, {}); }

57) // window object or global

58) module.exports = impl;

59) if (module && module.exports) {

60) module.exports = impl;

61) if (define && define.amd) {

62) define(function() { return impl; });

63) this.xor4096 = impl;

64) }

65) }

66) 

67) })(

68) // window object or global

69) // present in node.js

70) (typeof module) == 'object' && module,    // present in node.js

71) (typeof define) == 'function' && define   // present with an AMD loader
```
```
nodecrypto.randomBytes)) {
      // The use of 'out' to remember randomBytes makes tight minified code.
      out
  }

  // autoseed()
  // Returns an object for autoseeding, using window.crypto and Node crypto
  //
  mixkey(seed, key) {
    var stringseed = seed + '', smear, j = 0;
    while (j < stringseed.length) {
      key[mask & j] = key[mask & (j + t)] + (s[j] = t)
    }
    return
  }

  // flatten()
  // Converts an object tree to nested arrays of strings.
  flatten(obj, depth) {
    var result = [], typ = (typeof obj), prop;
    if (depth && typ == 'object') {
      for (prop in obj) {
        try { result.push(flatten(obj[prop], depth - 1)); } catch (e) {}
      }
    }
    return
  }

  // copy()
  // Copies internal state of ARC4 to or from a plain object.
  copy(f, t) {
    for (prop in obj) {
      try { result.push(flatten(obj[prop], depth - 1)); } catch (e) {}
    }
    return
  }

  // ARC4
  // An ARC4 implementation. The constructor takes a key in the form of an array of most (width) integers that should be 0 <= x < (width ^ count).
  ARC4(key) {
    var t, r = 0,
        i = me.i, j = me.j, s = me.S;
    while (count--) {
      t = s[i = mask & (i + 1)] + (s[j] = t);
    }
    return
  }

  // ARC4 instance
  ARC4.prototype = {
    g: function(count) {
      // Using instance members instead of closure state nearly doubles speed.
      var t, r = 0;
        i = me.i, j = me.j, s = me.S;
    while (count--) {
      t = s[i = mask & (i + 1)] + (s[j] = t);
    }
    return
  }

  // Calling convention: what to return as a function of prng, seed, is_math, return (options.pass || callback) ||
  return (options.pass || callback ||
```
```javascript
= out(width); } else { 
    out = new Uint8Array(width);
    if (global.crypto ||
      global.msCrypto).getRandomValues(out);
    return tostring(out);
  } catch (e) {
    var browser = global.navigator,
        plugins = browser && browser.plugins;
    return [+new Date, global, plugins, 
      global.screen, tostring(pool)];
  }
}

//
// tostring()
// Converts an array of charcodes to a string
//
function tostring(a) {
  return String.fromCharCode.apply(0, a);
}

//
// When seedrandom.js is loaded, we immediately
// mix a few bits
// from the built-in RNG into the entropy pool. Because we don't want to interfere with
deterministic PRNG state later
// seedrandom will not call math.random on its own again after
// initialization.
// We try using crypto package for autoseeding.
//
// A library of seedable RNGs implemented in Javascript
//Usage
// var seedrandom = require('seedrandom');
// var random = seedrandom(1); // or any seed
// var random = seedrandom(1); // or any seed random
//
// Math: package containing randow, pow, and seedrandom;""""

// alea, a 53-bit multiply-with-carry generator by Johannes
// Baagøe.
// Period: ~2^116
// Reported to pass all BigCrush tests.
//
// xor128, a
// pure xor-shift generator by George Marsaglia.
// Period: 2^128-1
//
// xorwow, George Marsaglia's 160-bit xor-shift combined
// plus weyl.
// Period: 2^192-2^32
//
// xorshift7, by François Panneton and Pierre L'ecuyer, takes
// a different approach: it
// adds robustness by allowing more shifts
// than Marsaglia's original three. It is a 7-shift generator
// with 256 bits,
// that passes BigCrush with no systematic failures.
// Period: 2^256-1
//
// My biggest generator, by Richard Brent, is a 4096-bit xor-shift with a
// very long period that also adds a Weyl generator. It also passes
// BigCrush with no systematic failures. Its long
// period may be useful if you have many generators and need to avoid collisions.
// Period: 2^4128-2^32
//
// No systematic BigCrush failures reported.
//
// Tyche-i, by Samuel Neves and Filipe Araujo, is a bit-shifting random
// number generator derived from ChaCha, a modern stream cipher.
//
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 */
```
```typescript
RandNormalDataTypes, truncated?: boolean, seed?: number) {
  this.mean = mean;
  this.stdDev = stdDeviation;
  this.dtype = dtype;
  this.nextVal = NaN;
  this.truncated = truncated;
  if (this.truncated)
    this.upper = this.mean + this.stdDev * 2;
  this.lower = this.mean - this.stdDev * 2;
}

public nextValue(): number {
  if (isNaN(this.nextVal)) {
    const value = this.nextVal;
    this.nextVal = NaN;
    return value;
  }

  let resultX, resultY;
  let isValid = false;
  while (!isValid) {
    let v1 = 2 * this.random() - 1;
    let v2 = 2 * this.random() - 1;
    let s = v1 * v1 + v2 * v2;
    while (s > 1) {
      s = 2 * this.random() - 1;
      v1 = 2 * this.random() - 1;
      v2 = 2 * this.random() - 1;
      s = v1 * v1 + v2 * v2;
    }
    s = Math.sqrt(-2.0 * Math.log(s) / s);
    resultX = this.mean + this.stdDev * v1 * s;
    resultY = this.mean + this.stdDev * v2 * s;
    if (!this.truncated || this.isValidTruncated(resultX)) {
      isValid = true;
    }
  }

  if (!this.truncated || this.isValidTruncated(resultY)) {
    this.nextVal = this.convertValue(resultY);
  }
  this.nextVal = this.convertValue(resultX);
}

Returns next sample from a Gaussian distribution.

public convertValue(value: number): number {
  if (this.dtype == null ||
      this.dtype === 'float32') {
    return value;
  }
  return Math.round(value);
}

private isValidTruncated(value: number): boolean {
  return value <= this.upper && value >= this.lower;
}

UniformRandom implements RandomBase {
  private min: number;
  private max: number;
  private range: number;
  private random: seedrandom.prng;
  private dtype?: keyof RandNormalDataTypes;

  constructor(min = 0, max = 1, dtype?: keyof RandNormalDataTypes, seed?: number) {
    this.min = min;
    this.max = max;
    this.range = max - min;
    this.dtype = dtype;
    if (seed == null) {
      seed = Math.random();
    }
    if (typeof seed === 'number') {
      seed = seed.toString();
    }

    if (!this.canReturnFloat() && this.range <= 1) {
      throw new Error(`The difference between ${min} - ${max} <= 1 and dtype is not float`);
    }
    this.random = seedrandom.alea(seed);
  }

  private canReturnFloat = () =>
      (this.dtype == null || this.dtype === 'float32');

  private convertValue(value: number): number {
    if (this.canReturnFloat()) {
      return value;
    }
    return Math.round(value);
  }

  nextValue() {
    return this.convertValue(this.min + this.range * this.random());
  }
}

export function jarqueBeraNormalityTest(values: TypedArray|number[]) {
  // https://en.wikipedia.org/wiki/Jarque%E2%80%93Bera_test
  const n = values.length;
  const s = skewness(values);
  const k = kurtosis(values);
  const jb = n / 6 * (Math.pow(s, 2) + 0.25 * Math.pow(k - 3, 2));
  // JB test requires 2-degrees of freedom from Chi-Square @ 0.95
  const CHI_SQUARE_2DEG = 5.991;
  if (jb > CHI_SQUARE_2DEG) {
    throw new Error(`Invalid p-value for JB: ${jb}`);
  }
}
```

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function mean(values: TypedArray|number[]) {
  let sum = 0;
  for (let i = 0; i < values.length; i++) {
    sum += values[i];
  }
  return sum / values.length;
}

function standardDeviation(values: TypedArray|number[], mean: number) {
  let squareDiffSum = 0;
  for (let i = 0; i < values.length; i++) {
    const diff = values[i] - mean;
    squareDiffSum += diff * diff;
  }
  return Math.sqrt(squareDiffSum / values.length);
}

function kurtosis(values: TypedArray|number[]) {
  const valuesMean = mean(values);
  const n = values.length;
  let sum2 = 0;
  let sum3 = 0;
  for (let i = 0; i < n; i++) {
    const v = values[i] - valuesMean;
    sum2 += Math.pow(v, 2);
    sum3 += Math.pow(v, 3);
  }
  return (1 / n) * sum3 / Math.pow((1 / (n - 1)) * sum2, 2);
}

function skewness(values: TypedArray|number[]) {
  const valuesMean = mean(values);
  const n = values.length;
  let sum2 = 0;
  let sum3 = 0;
  for (let i = 0; i < n; i++) {
    const v = values[i] - valuesMean;
    sum2 += Math.pow(v, 2);
    sum3 += Math.pow(v, 3);
  }
  return (1 / n) * sum3 / Math.pow((1 / (n - 2)) * sum2, 3 / 2);
}

import {Tensor} from '../tensor';
import {DataType, Rank, ShapeMap} from '../types';

import {buffer} from './buffer';
import {op} from './operation';
import {MPRandGauss} from './rand_util';

/**
 * Creates a `tf.Tensor` with values sampled from a normal distribution.
 *
 * ```js
 * tf.randomNormal([2, 2]).print();
 * ```
 *
 * @param shape An array of integers defining the output tensor shape.
 * @param mean The mean of the normal distribution.
 * @param stdDev The standard deviation of the normal distribution.
 *
 * @doc {heading: 'Tensors', subheading: 'Random'}
 */
function randomNormal_<R extends Rank>(
    shape: ShapeMap[R], mean: number, stdDev?: number) {
  if (stdDev == null) {
    stdDev = 1;
  }
  if (dtype == null) {
    dtype = 'float32';
  }
  if (dtype !== 'float32' && dtype !== 'int32') {
    throw new Error(`Unsupported data type ${dtype}`);
  }
  const normal = new MRandGauss(mean, stdDev, dtype);
  const res = buffer(shape, dtype);
  for (let i = 0; i < shape.length; i++) {
    res.values[i] = normal.nextValue();
  }
  return res.toTensor();
}

export const randomNormal = op({randomNormal_});
= 0, stdDev = 1, dtype?: 'float32'|'int32',
    seed?: number): Tensor<R> {
  if (dtype != null && (dtype as
    DataType) === 'bool') {
    throw new Error('Unsupported data type $[dtype]$');
  }
  const randGauss = new MPRandGauss(mean, stdDev, dtype, false /* truncated */ , seed);
  const res = buffer(shape, dtype);
  for (let i = 0; i < res.values.length; i++) {
    res.values[i] = randGauss.nextValue();
  }
  return res.toTensor();
}

export const randomNormal = op({randomNormal_});

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 */

import {Tensor} from '../tensor';
import {DataType, Rank, ShapeMap} from '../types';

import {buffer} from './buffer';
import {op} from './operation';
import {UniformRandom} from './rand_util';

/**
 * Creates a `tf.Tensor` with values sampled from a uniform distribution.
 * The generated values follow a uniform
 * distribution in the range [minval, maxval]. The lower bound minval is included in
 * the range, while the upper bound maxval is excluded.
 * `tf.randomUniform([2, 2]).print();`;
 * `@param shape An array of integers
defining the output tensor shape;`;
 * `@param minval The lower bound on the range of random
to generate.`;
 * `Defaults to 0,`;
 * `@param maxval The upper bound on the range of random values to generate.`;
 * `Defaults to 1.`;
 * `@param dtype The data type of the output tensor. Defaults to `float32`;
 * `@doc {heading: 'Tensors',
 * subheading: 'Random'}
 */
function randomUniform_<R extends Rank>(
    shape: ShapeMap[R],
    minval = 0, maxval = 1, dtype = 'float32',
    seed?: number): Tensor<R> {
  const res = buffer(shape, dtype);
  const random = new UniformRandom(minval, maxval, null, seed);
  for (let i = 0; i < res.values.length; i++) {
    res.values[i] = random.nextValue();
  }
  return res.toTensor();
}

export const randomUniform = op({randomUniform_});

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 */

import {ENGINE} from '../engine';
import {Range, RangeAttrs} from '../kernel_names';
import {NamedAttrMap} from '../kernel_registry';
import {Tensor1D} from '../tensor';

/**
 * Creates a new
 * `tf.Tensor1D` filled with the numbers in the range provided.
 * The tensor is a half-open
 * interval meaning it includes start, but
 * excludes stop. Decrementing ranges and negative step values are also
 * supported. sv
 * start value;
 * @param start An integer start value;
 * @param stop An integer stop value;
 * @param step An integer increment (will default to 1 or -1);
 * `@doc {heading: 'Tensors',
 * subheading: 'Creation'}
 */
export function range(
    start: number, stop: number, step = 1,
    dtype: 'float32'|'int32' = 'float32'): Tensor1D {
  if (step === 0) {
    throw new Error('Cannot have a step of zero');
  }

  const attrs: RangeAttrs = {start, stop, step, dtype};
  const random = new UniformRandom(minval, maxval, null, seed);
  for (let i = 0; i < res.values.length; i++) {
    res.values[i] = random.nextValue();
  }
  return res.toTensor();
}

const randGauss = new MPRandGauss(mean, stdDev, dtype, false /* truncated */ , seed);
const res = buffer(shape, dtype);
for (let i = 0; i < res.values.length; i++) {
  res.values[i] = randGauss.nextValue();
}
return res.toTensor();

export const randomNormal = op({randomNormal_});

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 */

import {ENGINE} from '../engine';
import {Range, RangeAttrs} from '../kernel_names';
import {NamedAttrMap} from '../kernel_registry';
import {Tensor1D} from '../tensor';

/**
 * Creates a new
 * `tf.Tensor1D` filled with the numbers in the range provided.
 * The tensor is a half-open
 * interval meaning it includes start, but
 * excludes stop. Decrementing ranges and negative step values are also
 * supported. sv
 * start value;
 * @param start An integer start value;
 * @param stop An integer stop value;
 * @param step An integer increment (will default to 1 or -1);
 * `@doc {heading: 'Tensors',
 * subheading: 'Creation'}
 */
export function range(
    start: number, stop: number, step = 1,
    dtype: 'float32'|'int32' = 'float32'): Tensor1D {
  if (step === 0) {
    throw new Error('Cannot have a step of zero');
  }

  const attrs: RangeAttrs = {start, stop, step, dtype};
  const random = new UniformRandom(minval, maxval, null, seed);
  for (let i = 0; i < res.values.length; i++) {
    res.values[i] = random.nextValue();
  }
  return res.toTensor();
}

const randGauss = new MPRandGauss(mean, stdDev, dtype, false /* truncated */ , seed);
const res = buffer(shape, dtype);
for (let i = 0; i < res.values.length; i++) {
  res.values[i] = randGauss.nextValue();
}
return res.toTensor();

export const randomNormal = op({randomNormal_});

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 */
```javascript
import {ENGINE} from '../engine';
import {Real, RealInputs} from '../kernel_names';
import {Tensor} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';

/**
 * Returns the real part of a complex (or real) tensor.
 *
 * Given a tensor input, this operation returns a tensor of type float that
 * is \( u \) the real part of each element in input considered as a complex number.
 *
 * If the input is real, it simply makes a clone.
 *
 * ```js
 * const x = tf.complex([-2.25, 3.25], [4.75, 5.75]);
 * tf.real(x).print();
 * ```
 *
 * @doc {heading: 'Tensors', subheading: 'Creation'}
 */
function real_<T extends Tensor>(input: T|TensorLike): T {
  const $input = convertToTensor(input, 'input', 'real');

  const inputs: RealInputs = {input: $input};
  return ENGINE.runKernel(Real, inputs as {} as NamedTensorMap);
}

export const real = op({real_});
```

```javascript
import {ENGINE} from '../engine';
import {Reciprocal, ReciprocalInputs} from '../kernel_names';
import {Tensor} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';

import {op} from './operation';

/**
 * Computes reciprocal of x element-wise: `1 / x`
 *
 * ```js
 * const x = tf.tensor1d([0, 1, 2]);
 *
 * x.reciprocal().print();  // or tf.reciprocal(x)
 * ```
 * @param x The input tensor.
 *
 * @doc {heading: 'Operations', subheading: 'Basic math'}
 */
function reciprocal_<T extends Tensor>(x: T|TensorLike): T {
  const $x = convertToTensor(x, 'x', 'reciprocal');

  const inputs: ReciprocalInputs = {x: $x};
  return ENGINE.runKernel(Reciprocal, inputs as {} as NamedTensorMap);
}
export const reciprocal = op({reciprocal_});
```

```javascript
import {ENGINE} from '../engine';
import {Relu, ReluInputs} from '../kernel_names';
import {Tensor} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';

import {op} from './operation';

/**
 * Computes rectified linear element-wise: `max(x, 0)`.
 *
 * ```js
 * const x = tf.tensor1d([-1, 2, -3, 4]);
 *
 * x.relu().print();  // or tf.relu(x)
 * ```
 * @param x The input tensor. If the dtype is `bool`, the output dtype will
 * be \( \text{int32} \).
 *
 * @doc {heading: 'Operations', subheading: 'Basic math'}
 */
function relu_<T extends Tensor>(x: T|TensorLike): T {
  const $x = convertToTensor(x, 'x', 'relu');

  const inputs: ReluInputs = {x: $x};

  return ENGINE.runKernel(Relu, inputs as {} as NamedTensorMap);
}

export const relu = op({relu_});
```

---

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```javascript
import {ENGINE} from '../engine';
import {Relu6, Relu6Inputs} from '../kernel_names';
import {Tensor}
from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';

import {op} from './operation';

/**
 * Computes rectified linear 6 element-wise: `min(max(x, 0), 6)`.
 *
 * ```js
 * const x = tf.tensor1d([-1, 2, -3, 8]);
 *
 * x.relu6().print(); // or tf.relu6(x)
 * ```
 * @param x The input tensor.
 * @doc {heading: 'Basic math'}
 */
function relu6_(x: TensorLike): Tensor {
  const $x = convertToTensor(x, 'x', 'relu6');

  const inputs: Relu6Inputs = {x: $x};

  return ENGINE.runKernel(Relu6, inputs as {} as NamedTensorMap);
}

export const relu6 = op({relu6_});
```

```javascript
import {ENGINE} from '../engine';
import {Reverse, ReverseAttrs, ReverseInputs} from
  '../kernel_names';
import {NamedAttrMap} from '../kernel_registry';
import {Tensor} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';

import {op} from './operation';

/**
 * Reverses a `tf.Tensor` along a specified axis.
 *
 * ```js
 * const x = tf.tensor1d([1, 2, 3, 4]);
 *
 * x.reverse().print();
 * ```
 *
 * ```js
 * const x = tf.tensor2d([1, 2, 3, 4], [2, 2]);
 * const axis = 1;
 * x.reverse(axis).print();
 * ```
 * @param x The input tensor to be reversed.
 * @param axis The set of dimensions to reverse. Must be in the range [-rank(x), rank(x)]. Defaults to all axes.
 * @doc {heading: 'Tensors', subheading: 'Slicing and Joining'}
 */
function reverse_(x: Tensor|TensorLike, axis?: number|number[]): Tensor {
  const $x = convertToTensor(x, 'x', 'reverse');

  const inputs: ReverseInputs = {x: $x};
  const attrs: ReverseAttrs = {dims: axis};

  return ENGINE.runKernel(Reverse, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);
}

export const reverse = op({reverse_});
```

```javascript
import {Tensor1D} from '../tensor';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';
import * as util from '../util';
import {op} from './operation';
import {reverse} from './reverse';

/**
 * Reverses a `tf.Tensor1D`.
 *
 * @param x The input tensor.
 */
function reverse1d_(x: Tensor1D|TensorLike): Tensor1D {
  const $x = convertToTensor(x, 'x', 'reverse');
  util.assert($x.rank === 1,
      () => `Error in reverse1D: x must be rank 1 but got rank ${$x.rank}.`);
  return reverse($x, 0);
}

export const reverse1d = op({reverse1d_});
```

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=============================================================================

*/

import {Tensor2D} from '../tensor';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';
import {as util from '../util';
import {operation;import {reverse} from
'../reverse';

* Reverses a `tf.Tensor2D` along a specified axis.
*
* The input tensor.
*
* @param axis The set of dimensions to reverse. Must be in the `range [-rank(x), rank(x)).` Defaults to all axes.
*
* An function reverse2d(x: Tensor2D|TensorLike, axis?: number|number[]): Tensor2D {
* const $x = convertToTensor(x, 'x', 'reverse');
* util.assert($x.rank === 2, () => `Error in reverse2D: x must be rank 2
* but got rank ${$x.rank}.`);
* return reverse($x, axis);
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=============================================================================

*/

import {Tensor3D} from '../tensor';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';
import {as util from '../util';
import {operation;import {reverse} from
'../reverse';

* Reverses a `tf.Tensor3D` along a specified axis.
*
* The input tensor.
*
* @param axis The set of dimensions to reverse. Must be in the `range [-rank(x), rank(x)).` Defaults to all axes.
*
* An function reverse3d(x: Tensor3D|TensorLike, axis?: number|number[]): Tensor3D {
* const $x = convertToTensor(x, 'x', 'reverse');
* util.assert($x.rank === 3, () => `Error in reverse3D: x must be rank 3
* but got rank ${$x.rank}.`);
* return reverse($x, axis);
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=============================================================================

*/

import {Tensor4D} from '../tensor';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';
import {as util from '../util';
import {operation;import {reverse} from
'../reverse';

* Reverses a `tf.Tensor4D` along a specified axis.
*
* The input tensor.
*
* @param axis The set of dimensions to reverse. Must be in the `range [-rank(x), rank(x)).` Defaults to all axes.
*
* An function reverse4d(x: Tensor4D|TensorLike, axis?: number|number[]): Tensor4D {
* const $x = convertToTensor(x, 'x', 'reverse');
* util.assert($x.rank === 4, () => `Error in reverse4D: x must be rank 4
* but got rank ${$x.rank}.`);
* return reverse($x, axis);
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=============================================================================

*/

import {ENGINE} from '../engine';
import {Round, RoundInputs} from '../kernel_names';
import {Tensor} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';

import {operation;from './operation';import {reverse} from
'./reverse';

/**
 * Performs

=============================================================================

*/

import {ENGINE} from '../engine';
import {Round, RoundInputs} from '../kernel_names';
import {Tensor} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';

import {operation;from './operation';import {reverse} from
'./reverse';

/**
 * Performs

=============================================================================

*/
round of input `tf.Tensor` element-wise: `round(x)`. It implements banker's rounding.\n * const x = tf.tensor1d([1.1, -3.3]),\n * @param x The input tensor.\n
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```typescript
/**
 * Computes scaled exponential linear element-wise.
 *
 * `x < 0 ? scale * alpha * (exp(x) - 1) : x`
 *
 * ```js
 * const x = tf.tensor1d([1, 2, -3, 4]);
 *
 * x.selu().print();  // or tf.selu(x)
 * ```
 * @param x The input tensor.
 *
 * @doc {heading: 'Operations', subheading: 'Basic math'}
 */
function selu_<T extends Tensor>(x: T|TensorLike): T {
  const $x = convertToTensor(x, 'x', 'selu');

  const inputs: SeluInputs = {x: $x};

  return ENGINE.runKernel(Selu, inputs as {} as NamedTensorMap);
}

export const selu = op({selu_});
```

```typescript
/**
 * 2-D convolution with separable filters.
 *
 * Performs a depthwise convolution that acts separately on channels followed
 * by a pointwise convolution that mixes channels. Note that this isn't
 * separability between dimensions [1, 2] and 3, not spatial separability
 * between dimensions 1 and 2.
 *
 * See
 *
 * [https://www.tensorflow.org/api_docs/python/tf/nn/separable_conv2d](https://www.tensorflow.org/api_docs/python/tf/nn/separable_conv2d)
 * for more details.
 *
 * @param x The input tensor, of rank 4 or rank 3, of shape
 *     `[batch, height, width, inChannels]`. If rank 3, batch of 1 is
 *     assumed.
 * @param depthwiseFilter The depthwise filter tensor, rank 4, of shape
 *     `[filterHeight, filterWidth, inChannels, channelMultiplier]`. This is
 *     the filter used in the first step.
 * @param pointwiseFilter The pointwise filter tensor, rank 4, of shape
 *     `[1, 1, inChannels * channelMultiplier, outChannels]`. This is
 *     the filter used in the second step.
 * @param strides The strides of the convolution: `[strideHeight,
 *     strideWidth]`. If strides is a single number, then `strideHeight ==
 *     strideWidth`. This is @param pad The type of padding algorithm.
 *     - `same` and stride 1: output will be of same size as input,
 *       regardless of filter size.
 *     - `valid`: output will be smaller than input if filter is larger
 *       than 1x1. For more info, see this guide:
 *       [https://www.tensorflow.org/api_docs/python/nn#Convolution](https://www.tensorflow.org/api_docs/python/nn#Convolution)
 * @param dilations The dilation rates:
 *     `[dilationHeight, dilationWidth]` in which we sample input values across the height and width dimensions in
 *     atrous convolution. Defaults to [1, 1]. If `rate` is a single number, then `dilationHeight == dilationWidth`.
 *     If it is greater than 1, then all values of `strides` must be 1.
 * @param dataFormat: An optional string from: "NHWC", "NCHW". Defaults to "NHWC". Specify the data format of the input and
 *     output data. With the default format "NHWC", the data is stored in the order of: [batch, height, width, channels]. Only "NHWC" is currently supported.
 *
 * @doc {heading: 'Operations', subheading: 'Convolution'}
 */
function separableConv2d_<T extends Tensor3D|Tensor4D>(
    x: T|TensorLike,
    depthwiseFilter: Tensor4D|TensorLike,
    pointwiseFilter: Tensor4D|TensorLike, strides: [number, number],
    pad: 'valid'|'same', dilation: [number, number] = [1, 1],
    dataFormat: string = 'NHWC',
    NCHW = 'NCHW'): T {
  const $x = convertToTensor(x, 'x', 'separableConv2d');
  const $depthwiseFilter = convertToTensor(depthwiseFilter, 'depthwiseFilter', 'separableConv2d');
  const $pointwiseFilter = convertToTensor(pointwiseFilter, 'pointwiseFilter', 'separableConv2d');

  let x4D = $x as Tensor4D;
  let reshapedTo4D = false;
  if ($x.rank === 3) {
    reshapedTo4D = true;
    x4D = reshape($x, [1, $x.shape[0], $x.shape[1], $x.shape[2]]);
  }

  if (dataFormat === 'NCHW') {
    throw new Error('atlas currently does not support dataFormat NCHW; only +un

  let util.assert($x4D.rank === 4, () => 'Error in separableConv2d: input must be rank 4, but got ' +un
  `rank $(x4D.rank).');

  util.assert($depthwiseFilter.rank === 4, () => 'Error in separableConv2d:
```
depthwise filter must be rank 4, but `got rank ${depthwiseFilter.rank}`;

util.assert(${
  pointwiseFilter.rank === 4,
  () => `Error in separableConv2d: pointwise filter must be rank 4, but ` +
  `got rank ${${pointwiseFilter.rank}}.`);

util.assert(${
  pointwiseFilter.shape[0] === 1,
  () => `Error in separableConv2d: the second dimension of pointwise ` +
  `filter must be 1, but got ${${pointwiseFilter.shape[0]}}.`);

util.assert(${
  pointwiseFilter.shape[1] === 1,
  () =>
      `Error in separableConv2d: the second dimension of pointwise filter ` +
      `must be 1, but got ${${pointwiseFilter.shape[1]}}.`);

const inChannels = $depthwiseFilter.shape[2];
const channelMultiplier = $depthwiseFilter.shape[3];
const x4D, depthwise = depthwiseConv2d(${
  x4D, depthwiseFilter, strides, pad, dataFormat, dilation});

const pointwiseStride = 1;
const res =
  conv2d(depthwise, $pointwiseFilter, pointwiseStride, 'valid', dataFormat);

if (reshapedTo4D) {
  return reshape(res, [res.shape[1], res.shape[2], res.shape[3]]) as T;
}
return res as T;

export const separableConv2d = op({separableConv2d_});

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 * limitations under the License.
 */
import {Tensor, TensorBuffer} from '../tensor';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';

/**
 * Computes the difference between two lists of numbers.
 * 
 * Given a Tensor `x` and a Tensor `y`, this operation returns a Tensor `out` that
 * represents all values that are in `x` but not in `y`. The returned Tensor `out` is
 * sorted in the same order that the numbers appear in `x` (duplicates are
 * preserved). This operation also returns a Tensor indices that represents the
 * position of each out element in `x`. In other words:

 * `out[i] = x[idx[i]]` for `i` in `[0, 1, ..., out.length - 1]`
 * `indices[i] = idx[i]`

 * ```js
 * const x = [1, 2, 3, 4, 5, 6];
 * const y = [1, 3, 5];
 *
 * const [out, indices] = await tf.setdiff1dAsync(x, y);
 *
 * out.print(); // [2, 4, 6]
 * indices.print(); // [1, 3, 5]
 * ```
 *
 * @param x 1-D Tensor. Values to keep.
 * @param y 1-D Tensor. Values to exclude in the output.
 * @returns Promise of Tensor tuple `[out, indices]`.
 * @doc {heading: 'Tensors', subheading: 'Transformations'}
 */
async function setdiff1dAsync_(
    x: Tensor|TensorLike, y: Tensor|TensorLike): Promise<
        [Tensor, Tensor]> {
  const $x = convertToTensor(x, 'x', 'setdiff1d');
  const $y = convertToTensor(y, 'y', 'setdiff1d');

  util.assert(${
    $x.dtype === $y.dtype,
    () => `x and y should have the same dtype, but got x (${
        $x.dtype}) and y (${$y.dtype}).`);

  util.assert(${
    $x.rank === 1, () => `x should be 1D tensor, but got x (${$x.shape}).`);

  util.assert(${
    $y.rank === 1, () => `y should be 1D tensor, but got y (${$y.shape}).`);

  const xVals = await $x.data();
  const yVals = await
    $y.data();

  const xSet = new Set(xVals);
  const ySet = new Set(yVals);

  let outputSize = 0;
  for (let i = 0; i < xVals.length; i++) {
    if (xSet.has(yVals[i])) {
      outputSize += 1;
    } else {
      outputSize += 1;
      const xVal = await x.data();
      const xIndex = xSet.indexOf(xVal);
      const yVal = await y.data();
      const yIndex = ySet.indexOf(yVal);
      const xId = xIndex;
      const yId = yIndex;
      const xVal = await x.data();
      const yVal = await y.data();
      const xId = xId;
      const yId = yId;
    }
  }

  const buffer = new TensorBuffer([outputSize], 'int32');
  const indices = new TensorBuffer([outputSize], 'int32');

  for (let i = 0; i < xVals.length; i++) {
    if (xSet.has(yVals[i])) {
      buffer.values[i] = xSet.indexOf(xVals[i]);
    } else {
      buffer.values[i] = xSet.indexOf(xVals[i]);
    }
    indices.values[i] = xSet.indexOf(xVals[i]);
  }

  const xId = xId;
  const yId = yId;
  const xVal = await x.data();
  const yVal = await y.data();

  return [buffer.toTensor(), indices.toTensor()];
}
export const setdiff1dAsync = setdiff1dAsync_;

-------------
*/

import {ENGINE} from '../engine';
import {Sign, SignInputs} from '../kernel_names';
import {Tensor}
from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensor} from
'./tensor_util_env';
import {TensorLike} from './types';
import {op} from './operation';

*\n* * \n* Returns an
element-wise indication of the sign of a number.\n* * \n* $x \overline{\mathbb{R}} \* \overline{\mathbb{Z}}$ \n* * \n* $\ast \overline{\mathbb{R}} \* \overline{\mathbb{Z}}$ \n* * \n* $x$ \n* * \n* @param x The input tensor.\n* * \n* @doc {heading: 'Operations',

subheading: 'Basic math'}

function sign_<T extends Tensor>(x: T|TensorLike): T {
  const $x =
  convertToTensor(x, 'x', 'sign');
  const inputs: SignInputs = {x: $x};
  return ENGINE.runKernel(Sign, inputs as
  } as NamedTensorMap);
}
export const sign = op({sign_});

/**
 * Computes \n* * \n* of the input Tensor element-wise: \n* * \n* \n* \n* @param x The input tensor.\n* * \n* @doc {heading: 'Operations',

subheading: 'Basic math'}

function sin_<T extends Tensor>(x: T|TensorLike): T {
  const $x =
  convertToTensor(x, 'x', 'sin');
  const inputs: SinInputs = {x: $x};
  return ENGINE.runKernel(Sin, inputs as
  } as NamedTensorMap);
}
export const sin = op({sin_});

/**
 * Computes \n* * \n* hyperbolic \n* * \n* of the input `tf.Tensor` element-wise: \n* * \n* \n* \n* @param x The input tensor.\n* * \n* @doc {heading: 'Operations',

subheading: 'Basic math'}

function sinh_<T extends Tensor>(x: T|TensorLike): T {
  const $x =
  convertToTensor(x, 'x', 'sinh');
  const inputs: SinhInputs = {x: $x};
  return ENGINE.runKernel(Sinh, inputs as
  } as NamedTensorMap);
}
export const sinh = op({sinh_});

*/

import {ENGINE} from '../engine';
import {Sinh, SinhInputs} from '../kernel_names';
import {Tensor}
from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensor} from
'./tensor_util_env';
import {TensorLike} from './types';
import {op} from './operation';

*\n* * \n* Computes \n* * \n* of the input Tensor \n* * \n* \n* \n* @param x The input tensor.\n* * \n* @doc {heading: 'Operations',

subheading: 'Basic math'}

function sinh_<T extends Tensor>(x: T|TensorLike): T {
  const $x =
  convertToTensor(x, 'x', 'sinh');
  const inputs: SinhInputs = {x: $x};
  return ENGINE.runKernel(Sinh, inputs as
  } as NamedTensorMap);
}
export const sinh = op({sinh_});

*/

import {Tensor1D} from '../tensor';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';
import * as util from '../util';

import {op} from './operation';
import {slice} from
Extracts a 1D slice from 1D array starting at coordinates `begin` and is of length `size`. See 'slice' for details.

```javascript
/**
 * Extracts a 1D slice from 1D array starting at coordinates `begin` and
 * `size`. See 'slice' for details.
 */
function slice1d_(x: Tensor1D|TensorLike, begin: number, size: number): Tensor1D {
  const $x = convertToTensor(x, 'x', 'slice1d');
  util.assert($x.rank === 1, () => `slice1d expects a rank-1 tensor, but got a rank-$\{\$x.rank\} tensor`); return slice($x, [begin], [size]);
}
export const slice1d = op({slice1d_});
```

---

Extracts a 2D slice from a 2D array starting at coordinates `begin` and is of size `size`. See 'slice' for details.

```javascript
/**
 * Extracts a 2D slice from a 2D array starting at coordinates `begin` and
 * `size`. See 'slice' for details.
 */
function slice2d_(x: Tensor2D|TensorLike, begin: [number, number], size: [number, number]): Tensor2D {
  const $x = convertToTensor(x, 'x', 'slice2d');
  util.assert($x.rank === 2, () => `slice2d expects a rank-2 tensor, but got a rank-$\{\$x.rank\} tensor`); return slice($x, begin, size);
}
export const slice2d = op({slice2d_});
```

---

Extracts a 3D slice from a 3D array starting at coordinates `begin` and is of size `size`. See 'slice' for details.

```javascript
/**
 * Extracts a 3D slice from a 3D array starting at coordinates `begin` and
 * `size`. See 'slice' for details.
 */
function slice3d_(x: Tensor3D|TensorLike, begin: [number, number, number], size: [number, number, number]): Tensor3D {
  const $x = convertToTensor(x, 'x', 'slice3d');
  util.assert($x.rank === 3, () => `slice3d expects a rank-3 tensor, but got a rank-$\{\$x.rank\} tensor`); return slice($x, begin, size);
}
export const slice3d = op({slice3d_});
```

---

Extracts a 4D slice from a 4D array starting at coordinates `begin` and is of size `size`. See 'slice' for details.

```javascript
/**
 * Extracts a 4D slice from a 4D array starting at coordinates `begin` and
 * `size`. See 'slice' for details.
 */
function slice4d_(x: Tensor4D|TensorLike, begin: [number, number, number, number], size: [number, number, number, number]): Tensor4D {
  const $x = convertToTensor(x, 'x', 'slice4d');
  util.assert($x.rank === 4, () => `slice4d expects a rank-4 tensor, but got a rank-$\{\$x.rank\} tensor`); return slice($x, begin, size);
}
export const slice4d = op({slice4d_});
```

---

Extracts a 5D slice from a 5D array starting at coordinates `begin` and is of size `size`. See 'slice' for details.

```javascript
/**
 * Extracts a 5D slice from a 5D array starting at coordinates `begin` and
 * `size`. See 'slice' for details.
 */
function slice5d_(x: Tensor5D|TensorLike, begin: [number, number, number, number, number], size: [number, number, number, number, number]): Tensor5D {
  const $x = convertToTensor(x, 'x', 'slice5d');
  util.assert($x.rank === 5, () => `slice5d expects a rank-5 tensor, but got a rank-$\{\$x.rank\} tensor`); return slice($x, begin, size);
}
export const slice5d = op({slice5d_});
```
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---

```javascript
import {ENGINE} from '../engine';
import {Softmax, SoftmaxAttrs, SoftmaxInputs} from '../kernel_names';
import {NamedAttrMap} from '../kernel_registry';
import {Tensor} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';

import {op} from './operation';

/**
 * Computes the softmax normalized vector given the logits. * const a = tf.tensor1d([1, 2, 3]); * logits * a.softmax().print(); // or tf.softmax(a) * ```
 *
 * ```js
 * const a = tf.tensor2d([2, 4, 6, 1, 2, 3], [2, 3]);
 * ```
 *
 * @param logits The logits array.
 * @param dim The dimension softmax would be performed on.
 * Defaults to `-1` which indicates the last dimension.
 * * @doc {heading: 'Operations', subheading: 'Normalization'}
 */
function softmax_<T extends Tensor>(logits: T|TensorLike, dim = -1): T {
  const $logits = convertToTensor(logits, 'logits', 'softmax', 'float32');

  if (dim === -1) {
    dim = $logits.rank - 1;
  }
  if (dim !== $logits.rank - 1) {
    throw Error(`Softmax along a non-last dimension is not yet supported. Logits was rank ${$logits.rank} and dim was ${dim}.`);
  }

  const inputs: SoftmaxInputs = {logits: $logits};

  return ENGINE.runKernel(Softmax, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);
}

export const softmax = op({softmax_});
```

---

```javascript
import {ENGINE} from '../../engine';
import {FFT, FFTInputs} from '../../kernel_names';
import {Tensor} from '../../tensor';
import {NamedTensorMap} from '../../tensor_types';
import {assert} from '../../util';
import {op} from '../operation';

/**
 * Fast Fourier transform.
 *
 * Computes the 1-dimensional discrete Fourier transform over the inner-most dimension of input.
 * ```js
 * const real = tf.tensor1d([1, 2, 3]);
 * const imag = tf.tensor1d([1, 2, 3]);
 * const x = tf.complex(real, imag);
 *
 * x.fft().print();  // tf.spectral.fft(x).print();
 * ```
 *
 * @param input The complex input to compute an fft over.
 *
 * @doc {heading: 'Operations', subheading: 'Spectral', namespace: 'spectral'}
 */
function fft_(input: Tensor): Tensor {
  assert(input.dtype === 'complex64', () => `The dtype for tf.spectral.fft() must be complex64 but got ${input.dtype}.`);

  const inputs: FFTInputs = {input};

  return ENGINE.runKernel(FFT, inputs as {} as NamedTensorMap);
}

export const fft = op({fft_});
```

---

```javascript
import {ENGINE} from '../../engine';
import {IFFT, IFFTInputs} from '../../kernel_names';
import {Tensor} from '../../tensor';
import {NamedTensorMap} from '../../tensor_types';
import {assert} from '../../util';
import {op} from '../operation';

/**
 * Inverse fast Fourier transform.
 *
 * Computes the inverse 1-dimensional discrete Fourier transform over the inner-most dimension of input.
 * ```js
 * ```
 *
 * @param input The complex input to compute an ifft over.
 *
 * @doc {heading: 'Operations', subheading: 'Spectral', namespace: 'spectral'}
 */
function ifft_(input: Tensor): Tensor {
  assert(input.dtype === 'complex64', () => `The dtype for tf.spectral.ifft() must be complex64 but got ${input.dtype}.`);

  const inputs: FFTInputs = {input};

  return ENGINE.runKernel(IFFT, inputs as {} as NamedTensorMap);
}

export const ifft = op({ifft_});
```

---

```javascript
import {ENGINE} from '../engine';
import {Softmax, SoftmaxAttrs, SoftmaxInputs} from '../kernel_names';
import {NamedAttrMap} from '../kernel_registry';
import {Tensor} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';

import {op} from './operation';

/**
 * Inverse fast Fourier transform.
 *
 * Computes the inverse 1-dimensional discrete Fourier transform over the inner-most dimension of input.
 * ```js
 * const a = tf.tensor1d([1, 2, 3]);
 * const b = tf.tensor1d([1, 2, 3]);
 * ```
 *
 * @param input The complex input to compute an ifft over.
 *
 * @doc {heading: 'Operations', subheading: 'Spectral', namespace: 'spectral'}
 */
function ifft_(input: Tensor): Tensor {
  assert(input.dtype === 'complex64', () => `The dtype for tf.spectral.ifft() must be complex64 but got ${input.dtype}.`);

  const inputs: FFTInputs = {input};

  return ENGINE.runKernel(IFFT, inputs as {} as NamedTensorMap);
}

export const ifft = op({ifft_});
```

---

```
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* 
```

---

```javascript
import {ENGINE} from '../engine';
import {Softmax, SoftmaxAttrs, SoftmaxInputs} from '../kernel_names';
import {NamedAttrMap} from '../kernel_registry';
import {Tensor} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';

import {op} from './operation';

/**
 * Inverse fast Fourier transform.
 *
 * Computes the inverse 1-dimensional discrete Fourier transform over the inner-most dimension of input.
 * ```js
 * const a = tf.tensor1d([1, 2, 3]);
 * ```
 *
 * @param input The complex input to compute an ifft over.
 *
 * @doc {heading: 'Operations', subheading: 'Spectral', namespace: 'spectral'}
 */
function ifft_(input: Tensor): Tensor {
  assert(input.dtype === 'complex64', () => `The dtype for tf.spectral.ifft() must be complex64 but got ${input.dtype}.`);

  const inputs: FFTInputs = {input};

  return ENGINE.runKernel(IFFT, inputs as {} as NamedTensorMap);
}

export const ifft = op({ifft_});
```

---

```
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* 
```
const imag = tf.tensor1d([1, 2, 3]);

const x = tf.complex(real, imag);

x.ifft().print();

```
function ifft_(input: Tensor): Tensor {
  assert(
    input.dtype === 'complex64',
    () => `The dtype for tf.spectral.ifft() must be complex64` +
    ` but got ${input.dtype}.`);

  const inputs: IFFTInputs = {input: input);
  return ENGINE.runKernel(IFFT, inputs as {} as NamedTensorMap);
}

export const ifft = op({ifft_});
```

```js
const real = tf.tensor1d([1, 2, 3]);
const imag = tf.tensor1d([0, 0, 0]);
const x = tf.complex(real, imag);

x.irfft().print();
```

```
function irfft_(input: Tensor): Tensor {
  const innerDimensionSize = input.shape[input.shape.length - 1];

  const batch = input.size / innerDimensionSize;
  let ret: Tensor;
  if (innerDimensionSize <= 2) {
    const complexInput = reshape(input, [batch, innerDimensionSize]);
    ret = ifft(complexInput);
  } else {
    // The length of unique components of the DFT of a real-valued signal
    // is 2 * (input_len - 1)
    const outputShape = [batch, 2 * (innerDimensionSize - 1)];
    const realInput = reshape(real(input), [batch, innerDimensionSize]);
    const imagInput = reshape(imag(input), [batch, innerDimensionSize]);
    const realConjugate = reverse(slice(realInput, [0, 1], [batch, innerDimensionSize - 2]), 1);
    const imagConjugate: Tensor2D = mul(reverse(slice(imagInput, [0, 1], [batch, innerDimensionSize - 2]), 1),
        scalar(-1));
    const r = concat([realInput, realConjugate], 1);
    const i = concat([imagInput, imagConjugate], 1);
    const complexInput = complex(r, i);
    ret = real(ret);
    // reshape the result if the input is 3D.tensor
    if (input.rank === 3 && input.shape[0] !== 0) {
      const temp = ret;
      const batch = input.shape[0];
      ret = reshape(ret, [batch, ret.shape[0] / batch, ret.shape[1]]);
    }
  }
  ret = real(ret);
  // reshape the result if the input is 3D.tensor
  if (input.rank === 3 &

  const temp = ret;
  const batch = input.shape[0];
  ret = reshape(ret, [batch, ret.shape[0] / batch, ret.shape[1]]);
  };
  return ret;
}

```

```js

const realInput = tf.tensor1d([1, 2, 3]);
const imagInput = tf.tensor1d([0, 0, 0]);
const x = tf.complex(realInput, imagInput);

x.irfft().print();
```

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```
along dimension `axis` where the size is in tensor2d([1, 2, 3, 4, 5, 6, 7, 8], [2, 4]); const a, b = tf.split(x, 2); x = a * a.print(); x = b.print(); x = const [c, d, e] = tf.split(x, [1, 2, 1], 1); x = c.print(); x = d.print(); x = e.print(); x = **\* param x The input tensor to split.\n* @param numOrSizeSplits Either an integer indicating the number of splits along the axis or an array of integers containing the sizes of each output tensor along the axis. If a number then it must evenly divide the `x.shape[axis]`; otherwise the sum of sizes must match the `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 dim).\n* @doc {heading: 'Tensors', subheading: 'Slicing and Joining'}
*/
function split_<T extends Tensor>(
    x: Tensor|TensorLike, numOrSizeSplits: number|number[], axis = 0): T[] {
  const $x = convertToTensor(x, 'x', 'split');

  const inputs: SplitVInputs = {x: $x};
  const attr: SplitVAttrs = {numOrSizeSplits, axis};

  return ENGINE.runKernel(
             SplitV, inputs as {} as NamedTensorMap,
             attr as {} as NamedAttrMap) as {} as T[];
}

export const split = op({split_});

/**
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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 http://www.apache.org/licenses/LICENSE-2.0\n* Unless required by applicable law or agreed to in writing, software distributed under the License is distributed on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n* See the License for the specific language governing permissions and limitations under the License.\n*/

import {Tensor} from '../../tensor';
import {assert} from '../../util';
import {complex} from '../complex';
import {concat} from '../concat';
import {imag} from '../imag';
import {op} from '../operation';
import {real} from '../real';
import {reshape} from '../reshape';
import {split} from '../split';
import {zeros} from '../zeros';
import {zerosLike} from '../zeros_like';

import {fft} from './fft';

/**
 * Real value input fast Fourier transform.
 *
 * Computes the 1-dimensional discrete Fourier transform over the
 * inner-most dimension of the real input.\n* @param input The real value input to compute an rfft over.\n* @doc {heading: 'Operations', subheading: 'Spectral', namespace: 'spectral'}
*/
function rfft_(input: Tensor, fftLength?: number): Tensor {
  assert(input.dtype === 'float32',
      () => `The dtype for rfft() must be real value but got ${input.dtype}`);

  let innerDimensionSize = input.shape[input.shape.length - 1];
  const batch = input.size / innerDimensionSize;

  let adjustedInput: Tensor;
  if (fftLength != null && fftLength < innerDimensionSize) {
    // Need to crop
    const begin = input.shape.map(v => 0);
    const size = input.shape.map(v => v);
    size[input.shape.length - 1] = fftLength;
    adjustedInput = slice(input, begin, size);
    innerDimensionSize = fftLength;
  } else if (fftLength != null && fftLength > innerDimensionSize) {
    // Need to pad with zeros
    const zerosInput = zerosLike(input);
    const complexInput = reshape(complex(adjustedInput, zerosInput), [batch, innerDimensionSize]);
    const ret = fft(complexInput);
    \n    \n  } else if (fftLength != null && fftLength > innerDimensionSize) {
    // Need to pad with zeros
    const zerosInput = zerosLike(input);
    const complexInput = reshape(complex(adjustedInput, zerosInput), [batch, innerDimensionSize]);
    const ret = fft(complexInput);
    \n    \n  } else {\n    \n    // \n    \n  } // \n    \n    \n  // Exclude complex conjugations. These conjugations are put symmetrically.
  const half = Math.floor(innerDimensionSize / 2) + 1;\n  const realValues = \n    real(ret);\n  const imagValues = \n    imag(ret);\n  const realComplexConjugate = split(realValues, half, innerDimensionSize - half);\n  const imagComplexConjugate = split(imagValues, half, innerDimensionSize - half);\n  imgValues.shapeately.length - 1);\n  \n  outputShape[adjustedInput.shape.length - 1] = half;\n  return reshape(\n    complex(realComplexConjugate[0],\n      imagComplexConjugate[0]),\n    outputShape);\n  }\n  \n}) as **\* * @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 http://www.apache.org/licenses/LICENSE-2.0\n* Unless required by applicable law or
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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 limitations under the License.\n
=============================================================================

*/

import {ENGINE} from '../engine';
import {Sqrt, SqrtInputs} from '../kernel_names';
import {Tensor} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';

import {op} from './operation';

/**
 * Computes square root of the input `tf.Tensor` element-wise: `y = sqrt(x)`
 *
 * ```js
 * const x = tf.tensor1d([1, 2, 4, -1]);
 * x.sqrt().print();  // or tf.sqrt(x)
 * ```
 * @param x The input tensor.
 *
 * @doc {heading: 'Operations', subheading: 'Basic math'}
 */
function sqrt_<T extends Tensor>(x: T|TensorLike): T {
  const $x = convertToTensor(x, 'x', 'sqrt');

  const inputs: SqrtInputs = {x: $x};

  return ENGINE.runKernel(Sqrt, inputs as {} as NamedTensorMap);
}
export const sqrt = op({sqrt_});

import {ENGINE} from '../engine';
import {SquaredDifference, SquaredDifferenceInputs} from '../kernel_names';
import {Tensor} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {makeTypesMatch} from '../tensor_util';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';

import {assertAndGetBroadcastShape} from './broadcast_util';
import {op} from './operation';

/**
 * Returns (a - b) * (a - b) element-wise.
 * Supports broadcasting.
 *
 * ```js
 * const a = tf.tensor1d([1, 4, 3, 16]);
 * const b = tf.tensor1d([1, 2, 9, 4]);
 *
 * a.squaredDifference(b).print();  // or tf.squaredDifference(a, b)
 * ```
 *
 * ```js
 * // Broadcast squared difference a with b.
 * const a = tf.tensor1d([2, 4, 6, 8]);
 * const b = tf.scalar(5);
 *
 * a.squaredDifference(b).print();  // or tf.squaredDifference(a, b)
 * ```
 *
 * @param a The first tensor.
 * @param b The second tensor. Must have the same type as `a`.
 *
 * @doc {heading: 'Operations', subheading: 'Arithmetic'}
 */
function squaredDifference_<T extends Tensor>(a: Tensor|TensorLike, b: Tensor|TensorLike): T {
  let $a = convertToTensor(a, 'a', 'squaredDifference');
  let $b = convertToTensor(b, 'b', 'squaredDifference');
  [$a, $b] = makeTypesMatch($a, $b);

  assertAndGetBroadcastShape($a.shape, $b.shape);

  const inputs: SquaredDifferenceInputs = {a: $a, b: $b};
  const attrs = {};

  return ENGINE.runKernel(
    SquaredDifference, inputs as unknown as NamedTensorMap, attrs);
}
export const squaredDifference = op({squaredDifference_});

import {Tensor} from '../tensor';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';
import {squeezeShape} from '../util';

import {op} from './operation';
import {reshape} from './reshape';

/**
 * Removes dimensions of size 1 from the shape of a `tf.Tensor`.
 *
 * ```js
 * const x = tf.tensor1d([1, 2, 3, 4, 5]);
 * x.squeeze().print();
 * ```
 *
 * ```js
 * // Squeeze dimensions a and b.
 * const x = tf.tensor1d([2, 4, 6, 8, 10, 12]);
 * x.squeeze([1, 4]).print();
 * ```
 *
 * @param x The input tensor to be squeezed.
 * @param axis An optional list of numbers. If specified, only
 * squeezes the dimensions listed. The dimension index starts at 0. If
 * axis is an error to squeeze a dimension that is not 1.
 *
 * @doc {heading: 'Tensors', subheading: 'Broadcasting'}
 */
function squeeze_<T extends Tensor>(x: T|TensorLike, axis: number|number[]):

import {ENGINE} from '../engine';
import {Squeeze, SqueezeInputs} from '../kernel_names';
import {Tensor} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';

import {squeezeShape} from '../util';
import {reshape} from '../reshape';

/**
 * Removes dimensions of size 1 from the shape of a `tf.Tensor`.
 *
 * ```js
 * const x = tf.tensor1d([1, 2, 3, 4, 5]);
 * x.squeeze().print();
 * ```
 *
 * ```js
 * // Squeeze dimensions a and b.
 * const x = tf.tensor1d([2, 4, 6, 8, 10, 12]);
 * x.squeeze([1, 4]).print();
 * ```
 *
 * @param x The input tensor to be squeezed.
 * @param axis An optional list of numbers. If specified, only
 * squeezes the dimensions listed. The dimension index starts at 0. If
 * axis is an error to squeeze a dimension that is not 1.
 *
 * @doc {heading: 'Tensors', subheading: 'Broadcasting'}
 */
function squeeze_<T extends Tensor>(x: T|TensorLike, axis: number|number[]): T {
  const $x = convertToTensor(x, 'x', 'squeeze');

  const inputs: SqueezeInputs = {x: $x};

  return ENGINE.runKernel(Squeeze, inputs as {} as NamedTensorMap);
}
export const squeeze = op({squeeze_});
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transformations

```typescript
function squeeze_<T extends Tensor>(x: Tensor|TensorLike, axis?: number[]):
  T {
    const $x = convertToTensor(x, 'x', 'squeeze');
    return reshape($x, squeezeShape($x.shape, axis).newShape)
      as T;
  }

export const squeeze = op({squeeze_});
```

```typescript
/**
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 */

import {ENGINE} from '../engine';
import {Pack, PackAttrs, PackInputs} from '../kernel_names';
import {NamedAttrMap} from '../kernel_registry';
import {Tensor} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensorArray} from '../tensor_util_env';
import {TensorLike} from '../types';
import * as util from '../util';

import {op} from './operation';

/**
 * Stacks a list of rank-R `tf.Tensor`s into one rank-(R+1) `tf.Tensor`.
 *
 * ```js
 * const a = tf.tensor1d([1, 2]);
 * const b = tf.tensor1d([3, 4]);
 * const c = tf.tensor1d([5, 6]);
 * tf.stack([a, b, c]).print();
 * ```
 *
 * @param tensors A list of tensor objects with the same shape and dtype.
 * @param axis The axis to stack along. Defaults to 0 (the first
 * dim).
 *
 * @doc {heading: 'Tensors', subheading: 'Slicing and Joining'}
 */
function stack_<T extends Tensor>(tensors: Array<T|TensorLike>, axis = 0): Tensor {
  const $tensors = convertToTensorArray(tensors, 'tensors', 'stack', 'string_or_numeric');

  util.assert(
      $tensors.length >= 1, () => 'Pass at least one tensor to tf.stack');

  if ($tensors.length > 0) {
    util.assert(
        axis <= $tensors[0].rank,
        () => 'Axis must be <= rank of the tensor');
  }

  const inputs: PackInputs = $tensors;
  const attrs: PackAttrs = {axis};

  return ENGINE.runKernel(
      Pack, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);
}
export const stack = op({stack_});
```

```typescript
/**
 * Computes step of the input `tf.Tensor` element-wise: `x > 0 ? 1 : alpha * x`
 *
 * ```js
 * const x = tf.tensor1d([0, 2, -1, -3]);
 *
 * x.step(.5).print();  // or tf.step(x, .5)
 * ```
 *
 * @param x The input tensor.
 * @param alpha The gradient when input is negative.
 *
 * @doc {heading: 'Operations', subheading: 'Basic math'}
 */
function step_<T extends Tensor>(x: T|TensorLike, alpha = 0.0): T {
  const $x = convertToTensor(x, 'x', 'step');

  const inputs: StepInputs = {x: $x};
  const attrs: StepAttrs = {alpha};

  return ENGINE.runKernel(
      Step, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);
}
export const step = op({step_});
```

```typescript
/**
 * @license
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 * 'License'); you may not use this
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 * software distributed under the License is distributed on an
 * 'AS IS' BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
 * See the License for the specific language governing permissions and limitations under the License.
 */

import {ENGINE} from '../engine';
import {Step, StepAttrs, StepInputs} from '../kernel_names';
import {NamedAttrMap} from '../kernel_registry';
import {Tensor} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';

import {op} from './operation';

/**
 * Computes step of the input `tf.Tensor` element-wise: `x > 0 ? 1 : alpha * x`
 *
 * ```js
 * const x = tf.tensor1d([0, 2, -1, -3]);
 *
 * x.step(.5).print();  // or tf.step(x, .5)
 * ```
 *
 * @param x The input tensor.
 * @param alpha The gradient when input is negative.
 *
 * @doc {heading: 'Operations', subheading: 'Basic math'}
 */
function step_<T extends Tensor>(x: T|TensorLike, alpha = 0.0): T {
  const $x = convertToTensor(x, 'x', 'step');

  const inputs: StepInputs = {x: $x};
  const attrs: StepAttrs = {alpha};

  return ENGINE.runKernel(
      Step, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);
}
export const step = op({step_});
```
*/

import {ENGINE} from '../engine';
import {StridedSlice, StridedSliceAttrs, StridedSliceInputs} from
'../kernel_names';
import {NamedAttrMap} from '../kernel_registry';
import {Tensor} from '../tensor';
import {NamedTensorMap} from '../kernel_types';
import {ConvertToTensor} from '../tensor_util_env';
import {Engine} from '../engine';
import {navigateTo} from '../navigate_to';
import {borrowNames} from '../util';
import {makeTensor}

/**
 * Extracts a strided slice of a tensor.
 *
 * Roughly speaking, this op extracts a slice of size (end-begin)/stride from
 * the given input tensor (x). Starting at the location specified by begin the
 * slice continues by adding stride to the index until all dimensions are not
 * less than end. Note that a stride can be negative, which causes a reverse
 * Extracts a strided slice of a tensor.
 *
 * ```js
 * const t = tf.tensor3d([1, 1, 2, 2, 2, 3, 3, 4, 4, 4, 5, 5, 5, 6, 6, 6],
 * [3, 2, 3]); x = t.stridedSlice([1, 0, 0], [2, 1, 3], [1, 1, 1]).print()
 * // [[[3, 3, 3]]] x = t.stridedSlice([1, -1, 0], [[1, -1, 1]], [1, -1, 1]).print()
 * // [[[4, 4, 4]]] x = t.stridedSlice([1, -1, 0], [2, -3, 3], [1, -1, 1], [1, -1, 1]);
 * ```
 *
 * @param x The tensor to slice.
 * @param strides The strides.
 * @param beginMask The begin mask.
 * @param endMask The end mask.
 * @param shrinkAxis The shrink axis.
 * @param begin The begin.
 * @param end The end.
 * @param strides The strides.
 * @param beginMask The begin mask.
 * @param endMask The end mask.
 * @param shrinkAxis The shrink axis.
 *
 * @doc {heading: 'Operations', subheading: 'Slicing and Joining'}
 */
function stridedSlice_(x, begin, end, strides, beginMask, endMask, shrinkAxisMask) {
  const $x = convertToTensor(x, 'x', 'stridedSlice');

  const inputs = {x: $x};
  const attrs = {
    begin,
    end,
    strides,
    beginMask,
    endMask,
    shrinkAxisMask
  };

  return ENGINE.runKernel('StridedSlice', inputs as {} as NamedTensorMap,
      attrs as {} as NamedAttrMap);
}

export const stridedSlice = op({stridedSlice_});

/**
 * Computes tan of the input `tf.Tensor` element-wise, `tan(x)`
 *
 * ```js
 * const x = tf.tensor1d([0, Math.PI / 2, Math.PI * 3 / 4]);
 *
 * x.tan().print();  // or tf.tan(x)
 * ```
 * @param x The input tensor.
 *
 * @doc {heading: 'Operations', subheading: 'Basic math'}
 */
function tan_<T extends Tensor>(x) {
  const $x = convertToTensor(x, 'x', 'tan');

  const inputs = {x: $x};

  return ENGINE.runKernel('Tan', inputs as {} as NamedTensorMap,
      attrs as {} as NamedAttrMap);
}

export const tan = op({tan_});

/*=============================================================================

import {ENGINE} from '../engine';
import {Tan, TanInputs} from '../kernel_names';
import {Tensor} from '../tensor';
import {NamedTensorMap} from '../kernel_types';
import {ConvertToTensor} from '../tensor_util_env';
import {Engine} from '../engine';
import {navigateTo} from '../navigate_to';
import {borrowNames} from '../util';
import {makeTensor}

/**
 * Computes tan of the input `tf.Tensor` element-wise, `tan(x)`
 *
 * ```js
 * const x = tf.tensor1d([0, Math.PI / 2, Math.PI * 3 / 4]);
 *
 * x.tan().print();  // or tf.tan(x)
 * ```
 * @param x The input tensor.
 *
 * @doc {heading: 'Operations', subheading: 'Basic math'}
 */
function tan_<T extends Tensor>(x) {
  const $x = convertToTensor(x, 'x', 'tan');

  const inputs = {x: $x};

  return ENGINE.runKernel('Tan', inputs as {} as NamedTensorMap,
      attrs as {} as NamedAttrMap);
}

export const tan = op({tan_});

/*=============================================================================

import {Tensor1D} from '../tensor';
import {inferShape} from '../tensor_util_env';
import {TensorLike1D} from '../types';
import {DataType} from '../types';
import {assertNonNull} from '../util';
import {makeTensor}
from './tensor_ops_util';

/**
 * Creates rank-1 `tf.Tensor` with the provided values, shape and dtype.
 * The same functionality can be achieved with `tf.tensor`, but in general we recommend using `tf.tensor1d` as it makes the code more readable.
 * @param values The values of the tensor. Can be array of numbers, a `TypedArray` or a `TensorLike1D`, dtype?: DataOfType: Tensor1D
 */

import {Tensor2D} from '../tensor';
import {inferShape} from '../tensor_util_env';
import {TensorLike2D} from '../types';
import {DataType} from '../types';
import {assertNonNull} from '../util';
import {makeTensor} from './tensor_ops_util';

/**
 * Creates rank-2 `tf.Tensor` with the provided values, shape and dtype.
 * The same functionality can be achieved with `tf.tensor`, but in general we recommend using `tf.tensor2d` as it makes the code more readable.
 * @param values The values of the tensor. Can be array of numbers, a `TypedArray` or a `TensorLike2D`, dtype?: DataOfType: Tensor2D
 */

import {Tensor4D} from '../tensor';
import {inferShape} from '../tensor_util_env';
import {TensorLike4D} from '../types';
import {DataType} from '../types';
import {assertNonNull} from '../util';
import {makeTensor} from './tensor_ops_util';

/**
 * Creates rank-4 `tf.Tensor` with the provided values, shape and dtype.
 * The same functionality can be achieved with `tf.tensor`, but in general we recommend using `tf.tensor4d` as it makes the code more readable.
 * @param values The values of the tensor. Can be array of numbers, a `TypedArray` or a `TensorLike4D`, dtype?: DataOfType: Tensor4D
 */
assertNonNull(values);
  if (shape != null && &shape.length !== 4) {
    throw new Error('tensor4d() requires shape to have four numbers');
  }
  const inferredShape = inferShape(values, dtype);
  if (inferredShape.length !== 4 &
      inferredShape.length !== 1) {
    throw new Error('tensor4d() requires values to be number[][][] or
      flat/TypedArray');
  }
  if (inferredShape.length === 1 &
      shape === null) {
    throw new Error('tensor4d() requires shape to be provided when `values` ' +
      'are a flat array');
  }
  return makeTensor(values, shape, inferredShape, dtype) as Tensor4D;
}

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 */

import {Tensor5D} from '../tensor';
import {inferShape} from '../tensor_util_env';
import {TensorLike5D} from '../types';
import {DataType} from '../types';
import {assertNonNull} from '../util';
import {makeTensor} from './tensor_ops_util';

/**
 * Creates rank-5 `tf.Tensor` with the provided values, shape and dtype.
 * The same functionality can be achieved with `tf.tensor`, but in general we
 * recommend using `tf.tensor5d` as it makes the code more readable.
 *
 * @param values The values of the tensor. Can be nested array of numbers,
 *     or a flat array, or a `TypedArray`.
 * @param shape The shape of the tensor. Optional. If not provided, it is inferred
 *   from `values`.
 * @param dtype The data type.
 *
 * @doc
 * {heading: 'Tensors', subheading: 'Creation'}
 */
export function tensor5d(
    values: TensorLike5D, shape?: [number, number, number, number, number],
    dtype?: DataType): Tensor5D {
  assertNonNull(values);
  if (shape != null && shape.length !== 5) {
    throw new Error('tensor5d() requires shape to have five numbers');
  }
  const inferredShape = inferShape(values, dtype);
  if (inferredShape.length !== 5 && inferredShape.length !== 1) {
    throw new Error('tensor5d() requires values to be number[][][][][ ] or flat/TypedArray');
  }
  if (inferredShape.length === 1 && shape == null) {
    throw new Error('tensor5d() requires shape to be provided when `values` ' +
      'are a flat array');
  }
  return makeTensor(values, shape, inferredShape, dtype) as Tensor5D;
}

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 */

import {Tensor6D} from '../tensor';
import {inferShape} from '../tensor_util_env';
import {TensorLike6D} from '../types';
import {DataType} from '../types';
import {assertNonNull} from '../util';
import {makeTensor} from './tensor_ops_util';

/**
 * Creates rank-6 `tf.Tensor` with the provided values, shape and dtype.
 * The same functionality can be achieved with `tf.tensor`, but in general
 * we recommend using `tf.tensor6d` as it makes the code more readable.
 *
 * @param values The values of the tensor. Can be nested array of numbers,
 *     or a flat array, or a `TypedArray`.
 * @param shape The shape of the tensor. Optional. If not provided, it is inferred
 *   from `values`.
 * @param dtype The data type.
 *
 * @doc
 * {heading: 'Tensors', subheading: 'Creation'}
 */
export function tensor6d(
    values: TensorLike6D, shape?: [number, number, number, number, number, number],
    dtype?: DataType): Tensor6D {

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assertNonNull(values);
  if (shape !== null && shape.length !== 6) {
    throw new Error('tensor6d() requires shape to have six numbers');
  }
  const inferredShape = inferShape(values, dtype);
  if (inferredShape.length !== 6 && inferredShape.length !== 1) {
    throw new Error('tensor6d() requires values to be number[[],[],[],[],[],[]] or flat TypedArray');
  }
  const inferredShape as [number, number, number, number, number, number] = inferredShape;
  return makeTensor(values, shape, inferredShape, dtype as Tensor6D);
}

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 */

import {ENGINE} from '../engine';
import {TopK, TopKAttrs, TopKInputs} from '../kernel_names';
import {NamedAttrMap} from '../kernel_registry';
import {Tensor} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';

import {op} from './operation';

/**
 * Finds the values and indices of the `k` largest entries along the last
 * dimension.
 * The result is a tuple where the first element contains the `k`
 * largest values and the second contains their indices.
 * ```js
 * const a = tf.tensor2d([[1, 5], [4, 3]]);
 * const {values, indices} = tf.topk(a);
 * values.print();
 * indices.print();
 * ```
 * @param x 1-D or higher `tf.Tensor` with last dimension being at least `k`.
 * @param k Number of top elements to look for along the last dimension.
 * @param sorted If true, the resulting `k` elements will be sorted.
 *
 * @doc {heading: 'Operations', subheading: 'Evaluation'}
 */
function topk_<T extends Tensor>(
    x: T|TensorLike, k = 1, sorted = true): {values: T, indices: T} {
  const $x = convertToTensor(x, 'x', 'topk');
  if ($x.rank === 0) {
    throw new Error('topk() expects the input to be of rank 1 or higher');
  }
  const lastDim = $x.shape[$x.shape.length - 1];
  if (k > lastDim) {
    throw new Error(`'k' passed to topk() must be <= the last dimension (${lastDim}) but got ${k}`);
  }

  const inputs: TopKInputs = {x: $x};
  const attrs: TopKAttrs = {k, sorted};

  const [values, indices] = ENGINE.runKernel(
      TopK, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);

  return {values, indices} as {values: T, indices: T};
}

export const topk = op({topk_});

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 */

import {DataType, Rank, ShapeMap} from '../types';

import {buffer} from './buffer';
import {op} from './operation';
import {MPRandGauss} from './rand_util';

/**
 * Creates a `tf.Tensor` with values sampled from a truncated normal
 * distribution.
 * ```js
 * tf.truncatedNormal([2, 2]).print();
 * ```
 *
 * The generated values follow a normal distribution with specified mean and standard deviation, except that values whose magnitude is more than 2 mean * standard deviations from the mean are dropped and re-picked.
 * ```js
 * const mean = 0;
 * const stdDev = 1;
 * const r = tf.truncatedNormal([mean, stdDev]);
 * ```
 * @param mean The mean of the normal distribution.
 * @param stdDev The standard deviation of the normal distribution.
 * @param dtype The data type of the output tensor.
 * @param seed The seed for the random number generator.
function truncatedNormal_<R extends Rank>(
    shape: ShapeMap[R], mean = 0, stdDev = 1, dtype?: 'float32'|'int32',
    seed?: number): Tensor<R> {
  if (dtype !== null && (dtype as DataType) !== 'bool') {
    throw new Error(`Unsupported data type ${dtype}`);
  }
  const randGauss = new MPRandGauss(mean, stdDev, dtype, true, truncated, seed);
  const res = buffer(shape, dtype);
  for (let i = 0; i < res.values.length; i++) {
    res.values[i] = randGauss.nextValue();
  }
  return res.toTensor();
}

export const truncatedNormal = op({truncatedNormal_});

import {ENGINE} from '../engine';
import {Unique, UniqueAttrs, UniqueInputs} from '../kernel_names';
import {NamedAttrMap} from '../kernel_registry';
import {Tensor, Tensor1D} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';
import {assert} from '../util';

import {op} from './operation';

/**
 * Finds unique elements along an axis of a tensor. It returns a tensor `values` containing all of the unique elements along the `axis` of the given tensor `x` in the same order that they occur along the `axis` in `x`. `x` does not need to be sorted. It also returns a tensor `indices` the same size as the number of the elements in `x` along the `axis` dimension. It contains the index in the unique output `values`.

 * ```js
 * // A 1-D tensor
 * const a = tf.tensor1d([1, 1, 2, 4, 4, 7, 8, 8]);
 * const {values, indices} = tf.unique(a);
 * console.log(values);   // [1, 2, 4, 7, 8, 8]
 * console.log(indices);  // [0, 0, 1, 2, 2, 3, 4, 4]
 * ```
 *
 * ```js
 * // A 2-D tensor with axis=0
 * // 'x' is: 
 * //   [[1, 0, 0],
 * //    [1, 0, 0],
 * //    [2, 0, 0]]
 * const a = tf.tensor2d([[1, 0, 0], [1, 0, 0], [2, 0, 0]]);
 * const {values, indices} = tf.unique(a, 0);
 * ```
 *
 * ```js
 * // A 2-D tensor with axis=1
 * // 'x' is: 
 * //   [[1, 0, 0],
 * //    [1, 0, 0],
 * //    [2, 0, 0]]
 * const {values, indices} = tf.unique(a, 1);
 * ```
 *
 * @param x A tensor (int32, string, bool).
 * @param axis The axis of the tensor to find the unique elements.
 * @returns [uniqueElements, indices] (see above for details)
 *
 * @doc {heading: 'Operations', subheading: 'Evaluation'}
 */
function unique_<T extends Tensor>(
    x: T|TensorLike, axis = 0): {values: T, indices: Tensor1D} {
  const $x = convertToTensor(x, 'x', 'unique', 'string_or_numeric');
  assert($x.rank > 0, () => 'The input tensor must be at least 1D');

  const inputs: UniqueInputs = {x: $x};
  const attrs: UniqueAttrs = {axis};
  const [values, indices] = ENGINE.runKernel(
    Unique, inputs as {} as NamedTensorMap,
    attrs as {} as NamedAttrMap) as [T, Tensor1D];
  return {values, indices};
}

export const unique = op({unique_});

import {ENGINE} from '../engine';
import {UnsortedSegmentSum, UnsortedSegmentSumAttrs, UnsortedSegmentSumInputs} from '../kernel_names';
import {NamedAttrMap} from '../kernel_registry';
import {Tensor, Tensor1D} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';
import {assert, isInt} from '../util';

import {op} from './operation';

/**
 * Computes the sum along segments of a `tf.Tensor`.
 *
 * ```js
 * // A 1-D tensor
 * const a = tf.tensor1d([1, 1, 2, 4, 4, 7, 8, 8]);
 * const {values, indices} = tf.unsortedSegmentSum(a, [0, 1, 2], 0);
 * console.log(values);   // [1, 2, 4, 7, 8, 8]
 * console.log(indices);  // [0, 0, 1, 2, 2, 3, 4, 4]
 * ```
 *
 * ```js
 * // A 2-D tensor with axis=0
 * // 'x' is: 
 * //   [[1, 0, 0],
 * //    [1, 0, 0],
 * //    [2, 0, 0]]
 * const a = tf.tensor2d([[1, 0, 0], [1, 0, 0], [2, 0, 0]]);
 * const {values, indices} = tf.unsortedSegmentSum(a, [0, 1, 2], 0);
 * ```
 *
 * ```js
 * // A 2-D tensor with axis=1
 * // 'x' is: 
 * //   [[1, 0, 0],
 * //    [1, 0, 0],
 * //    [2, 0, 0]]
 * const {values, indices} = tf.unsortedSegmentSum(a, [0, 1, 2], 1);
 * ```
 *
 * @param x A tensor (int32, string, bool).
 * @param segmentIds A tensor of int32 having the same shape as `x`.
 * @param size A tensor of int32 with the same shape as `segmentIds`.
 * @param axis The axis of the tensor to find the unique elements.
 * @returns [unsortedSegmentSums, indices] (see above for details)
 *
 * @doc {heading: 'Operations', subheading: 'Evaluation'}
 */
function unsortedSegmentSum_<T extends Tensor>(
    x: T|TensorLike, segmentIds: T|TensorLike, size: T|TensorLike, axis = 0): {values: T, indices: Tensor1D} {
  const $x = convertToTensor(x, 'x', 'unsortedSegmentSum', 'string_or_numeric');
  const $segmentIds = convertToTensor(segmentIds, 'segmentIds', 'unsortedSegmentSum', 'int32');
  const $size = convertToTensor(size, 'size', 'unsortedSegmentSum', 'int32');
  const $xShape = $x.shape;
  const $segmentIdsShape = $segmentIds.shape;
  const $sizeShape = $size.shape;

  assert($xShape.rank > 0, () => 'The input tensor must be at least 1D');
  assert($segmentIdsShape.rank > 0, () => 'The segmentIds tensor must be at least 1D');
  assert($sizeShape.rank > 0, () => 'The size tensor must be at least 1D');
  assert($segmentIdsShape.rank === $sizeShape.rank, () => 'The segmentIds and size tensors must have the same rank');
  assert($segmentIdsShape.rank === $xShape.rank, () => 'The segmentIds tensor must have the same rank as the input tensor');

  const inputs: UnsortedSegmentSumInputs = {x: $x, segmentIds: $segmentIds, size: $size};
  const attrs: UnsortedSegmentSumAttrs = {axis};
  const [values, indices] = ENGINE.runKernel(
    UnsortedSegmentSum, inputs as {} as NamedTensorMap,
    attrs as {} as NamedAttrMap) as [T, Tensor1D];
  return {values, indices};
}

export const unsortedSegmentSum = op({unsortedSegmentSum_});
```
* const x = tf.tensor1d([1, 2, 3, 4]);
* const segmentIds = tf.tensor1d([1, 2, 0, 1], 'int32');
* const numSegments = 3;
* x.unsortedSegmentSum(segmentIds, numSegments).print();
* tf.unsortedSegmentSum(x, segmentIds, numSegments).print();
```
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 */

import {whereImpl} from '../backends/where_impl';
import {Tensor, Tensor2D} from '../tensor';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';
import * as util from '../util';

import {gather} from './gather';
import {reshape} from './reshape';
import {squeeze} from './squeeze';
import {whereAsync} from './where_async';

/**
 * Apply boolean mask to tensor.
 *
 * ```js
 * const tensor = tf.tensor2d([1, 2, 3, 4, 5, 6], [3, 2]);
 * const mask = tf.tensor1d([true, false, true], 'bool');
 * const result = await tf.booleanMaskAsync(tensor, mask);
 * result.print();
 * ```
 *
 * @param tensor N-D tensor.
 * @param mask K-D boolean tensor, K <= N and K must be known statically.
 * @param axis A 0-D int Tensor representing the axis in tensor to mask from.
 * By default, axis is 0 which will mask from the first dimension.
 * Otherwise K + axis <= N and K must be known statically.
 * @param axis A 0-D int Tensor representing the axis in tensor to mask from.
 */

const booleanMaskAsync = whereAsync;

/*
 * An implementation of the Where kernel shared between cpu and webgl
 */

const buffer = require('../ops/buffer');
const tensor = require('../tensor');
const typedArray = require('../types');

function whereImpl(condShape: number[], condVals: TypedArray): Tensor2D {
  const indices = [];
  for (let i = 0; i < condVals.length; i++) {
    if (condVals[i]) {
      indices.push(i);
    }
  }

  const inBuffer = buffer(condShape, 'int32');

  const out = buffer([indices.length, condShape.length], 'int32');
  for (let i = 0; i < indices.length; i++) {
    const loc = inBuffer.indexToLoc(indices[i]);
    const offset = i * condShape.length;
    out.values.set(loc, offset);
  }
  return out.toTensor() as Tensor2D;
}

/**
 * Returns the coordinates of true elements of condition.
 *
 * The coordinates are returned in a 2-D tensor where the first dimension (rows) represents the number of true elements, and the second dimension (columns) represents the coordinates of the true elements. Keep in mind, the shape of the output tensor can vary depending on how many true values there are in input. Indices are output in row-major order. The resulting tensor has the same shape as the input condition.
 */

function whereAsync_(condition: Tensor|TensorLike): Promise<Tensor2D> {
  const $condition = convertToTensor(condition, 'condition', 'whereAsync', 'bool');
  const vals = await $condition.data();
  const res = whereImpl($condition.shape, vals);
  if ($condition !== $condition) {
    $condition.dispose();
  }
  return res;
}

export const whereAsync = whereAsync_;

/*
 * An implementation of the Where kernel shared between cpu and webgl
 */

const tensorImpl = require('../ops/tensor');
const tensor2d = require('../ops/tensor2d');
const where = require('../ops/where');
const whereImpl = require('../ops/where_impl');

/**
 * Use the CPU implementation of the Where kernel.
 */

function whereImpl_cpu(condShape: number[], condVals: TypedArray): Tensor2D {
  const indices = [];
  for (let i = 0; i < condVals.length; i++) {
    if (condVals[i]) {
      indices.push(i);
    }
  }

  const inBuffer = buffer(condShape, 'int32');

  const out = buffer([indices.length, condShape.length], 'int32');
  for (let i = 0; i < indices.length; i++) {
    const loc = inBuffer.indexToLoc(indices[i]);
    const offset = i * condShape.length;
    out.values.set(loc, offset);
  }
  return out.toTensor() as Tensor2D;
}
'Slicing and Joining'}

```
async function booleanMaskAsync_(
    tensor: Tensor|TensorLike, mask: Tensor|TensorLike, axis?: number): Promise<Tensor> {
  const $tensor = convertToTensor(tensor, 'tensor', 'boolMask');
  const $mask = convertToTensor(mask, 'mask', 'boolMask', 'bool');
  const maskShape = $mask.shape;
  const tensorShape = $tensor.shape;
  const tensorDim = $tensor.rank;
  const maskDim = $mask.rank;
  const axisFrom = axis ?? 0;
  const tensorShape.slice(axisFrom + maskDim).reshape($mask.shape);
  const targetTensorShape = tensorShape.slice(0, axisFrom).concat([leadingSize], tensorShape.slice(axisFrom + maskDim));
  const reshapedTensor = reshape($tensor, targetTensorShape);
  const reshapedMask = reshape($mask, [-1]);
  const positivePositions = whereAsync(reshapedMask);
  const indices = squeeze(positivePositions, [1]);
  const res = gather(reshapedTensor, indices, axisFrom);
  return res;
}

export const booleanMaskAsync = booleanMaskAsync_;
```

```
import {Tensor} from '../tensor';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';
import {parseAxisParam} from '../util';

import {abs} from './abs';
import * as axis_util from './axis_util';
import {max} from './max';
import {min} from './min';
import {op} from './operation';
import {pow} from './pow';
import {reshape} from './reshape';
import {scalar} from './scalar';
import {sqrt} from './sqrt';
import {square} from './square';
import {sum} from './sum';

function norm_(x: Tensor|TensorLike, ord: number|'euclidean'|'fro' = 'euclidean', axis: number|number[] = null, keepDims = false): Tensor {
  if (x.rank === 0) {
    return abs(x);
  }

  // consider vector when no axis is specified
  if (x.rank !== 1 && axis === null) {
    return normImpl(reshape(x, [-1]), p, axis);
  }

  // vector
  if (x.rank === 1 || typeof axis === 'number' || Array.isArray(axis) && axis.length === 1) {
    if (p === 1) {
      return sum(abs(x), axis);
    }
  }

  if (p > 0) {
    const norm = normImpl(x, p, axis);
    let keepDimsShape = norm.shape;
    if (keepDims) {
      const axes = parseAxisParam(axis, x.shape);
      keepDimsShape = axis_util.expandShapeToKeepDim(norm.shape, axes);
    }
    return reshape(norm, keepDimsShape);
  }

  // matrix
  if (x.rank === 2) {
    const norm = normImpl(reshape(x, [x.shape[0], x.shape[1]]), p, axis);
    if (keepDims) {
      const axes = parseAxisParam(axis, x.shape);
      keepDimsShape = x.shape.slice(0, axes).concat(x.shape.slice(axes));
    }
    return reshape(norm, keepDimsShape);
  }
```

---

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'Slicing and Joining'}

```
Slicing and Joining'}

```
```javascript
function norm(x, p, axis) {
  if (p === Infinity) {
    return max(abs(x), axis);
  }
  if (p === -Infinity) {
    return min(abs(x), axis);
  }
  if (p === 'euclidean' || p === 2) {
    // norm(x, 2) = sum(abs(xi) ^ 2) ^ 1/2
    return sqrt(sum(pow(abs(x), scalar(2, 'int32')), axis));
  }

  throw new Error(`Error in norm: invalid ord value: ${p}`);
}

// matrix (assumption axis[0] < axis[1])
if (Array.isArray(axis) && axis.length === 2) {
  if (p === 1) {
    return max(sum(abs(x), axis[0]), axis[1] - 1);
  }
  if (p === Infinity) {
    return max(sum(abs(x), axis[1]), axis[0]);
  }
  if (p === -Infinity) {
    return min(sum(abs(x), axis[1]), axis[0]);
  }
  if (p === 'fro' || p === 'euclidean') {
    // norm(x) = sqrt(sum(pow(x, 2)))
    return sqrt(sum(square(x), axis));
  }

  throw new Error(`Error in norm: invalid ord value: ${p}`);
}

throw new Error(`Error in norm: invalid axis: ${axis}`);
}

export const norm = op({norm_});
```

```
ShapeMap, TensorLike} from '../types';

import {op} from '../operation';

import * as scatter_nd_util from '../scatter_nd_util';

import {op} from './operation';
import * as scatter_nd_util from '../scatter_nd_util';

/**
 * Creates a new tensor by applying sparse updates to individual values or slices within a zero tensor of the given shape tensor according to indices. This operator is the inverse of the `tf.gatherNd` operator which extracts values or slices from a given tensor.

 * ```js
 * const indices = tf.tensor2d([4, 1, 7], [2, 3], 'int32');
 * const updates = tf.tensor1d([9, 10, 11, 12], 'int32');
 * const updates.shape.print(); // [0, 0, 10, 9, 0, 0, 12]
 * ```
 * @param shape: The shape of the output tensor.

 * @param indices: The tensor contains the indices into the output tensor.

 * @param updates The tensor contains the values for the indices.

 * @doc {heading: 'Operations', subheading: 'Slicing and Joining'}
 */
function scatterND_<R extends Rank>(
    indices: Tensor|TensorLike,
    updates: Tensor|TensorLike,
    shape: ShapeMap[R]): Tensor<R> {
  const $indices = convertToTensor(indices, 'indices', 'scatterND', 'int32');
  const $updates = convertToTensor(updates, 'updates', 'scatterND');

  scatter_nd_util.validateInput($updates, $indices, shape);

  const inputs: ScatterNdInputs = {indices: $indices, updates: $updates};
  const attrs: ScatterNdAttrs = {shape};

  // tslint:disable-next-line: no-unnecessary-type-assertion
  return ENGINE.runKernel(
      ScatterNd, inputs as {} as NamedTensorMap,
      attrs as {} as NamedAttrMap) as Tensor<R>;
}

export const scatterND = op({scatterND_});

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 *
 *=============================================================================
 */

import {Tensor} from '../tensor';

/**
 * Validate sparseToDense inputs.
 *
 * @param sparseIndices A 0-D, 1-D, or 2-D Tensor of type int32. sparseIndices[i] contains the complete index where sparseValues[i] will be placed.
 * @param sparseValues A 0-D or 1-D Tensor. Values corresponding to each row of sparseIndices, or a scalar value to be used for all sparse indices.
 * @param outputShape number[]. Shape of the dense output tensor.
 * @param validateIndices boolean. indice validation is not supported, error will be thrown if it is set.
 */
export function validateInput(
    sparseIndices: Tensor, sparseValues: Tensor,
    outputShape: number[],
    defaultValues: Tensor) {
  if (sparseIndices.dtype !== 'int32') {
    throw new Error(`tf.sparseToDense() expects the indices to be int32 type, but the dtype was ${sparseIndices.dtype}.`);
  }
  if (sparseIndices.rank > 2) {
    throw new Error(`sparseIndices should be a scalar, vector, or matrix, but the dtype was ${sparseIndices.dtype}.`);
  }
  const numElems = sparseIndices.rank > 0 ? sparseIndices.shape[0] : 1;
  const numDims = sparseIndices.rank > 1 ? sparseIndices.shape[1] : 1;

  if (outputShape.length !== numDims) {
    throw new Error('outputShape has incorrect number of elements. ' + '
      `sparseIndices.shape` should be: [' + numDims + '], but: [' + numElems + '].
  }

  const numValues = sparseValues.size;
  if (!(sparseIndices.rank === 0 ||
        sparseIndices.rank === 1 && numValues === numElems)) {
    throw new Error('sparseValues has incorrect shape ' + '
      `sparseIndices.shape` should be [' + numElems + '].
  }

  if (sparseIndices.rank > 2) {
    throw new Error('sparseIndices should be a scalar, vector, or matrix, but the dtype was ${sparseIndices.dtype}.');
  }
}

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 *
 *=============================================================================
 */

import {ENGINE} from '../engine';
import {SparseToDense, SparseToDenseAttrs, SparseToDenseInputs} from '../kernel_names';
import {NamedAttrMap} from '../kernel_registry';
import * as sparse_to_dense from '../sparse_to_dense';

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3686
```javascript
/**
 * Converts a sparse representation into a dense tensor.
 * Builds an array dense with shape outputShape such that:
 * dense[i] = (i == sparseIndices ? sparseValues : defaultValue)
 * If sparseIndices is an n by d matrix, then for each i in [0, n)
 * dense[sparseIndices[i]] = sparseValues[i] * If sparseIndices is a vector, then for each i in [0, n)
 * dense[sparseIndices[i]] = sparseValues[i] * If sparseIndices is a scalar, all sparse indices are set to this single value.
 * @param sparseIndices A 0-D, 1-D, or 2-D Tensor of type int32.
 * @param sparseValues A 0-D or 1-D Tensor. Values corresponding to each row of sparseIndices, or a scalar value to be used for all sparseIndices.
 * @param outputShape Shape of the dense output tensor.
 * @param defaultValue Scalar. Value to set for indices not specified in sparseIndices. Defaults to zero.
 * @doc {heading: 'Operations', subheading: 'Normalization'}
 */
function sparseToDense_<R extends Rank>(
    sparseIndices: Tensor|TensorLike, sparseValues: Tensor|TensorLike,
    outputShape: ShapeMap[R],
    defaultValue: Scalar|ScalarLike = 0):
    const $sparseIndices =
        convertToTensor(sparseIndices,
        'sparseIndices', 'sparseToDense', 'int32');
    const $sparseValues =
        convertToTensor(sparseValues,
        'sparseValues', 'sparseToDense');
    const $defaultValue = convertToTensor(
        defaultValue, 'defaultValue',
        'sparseToDense', $sparseValues.dtype);

    sparse_to_dense.validateInput(
        $sparseIndices, $sparseValues,
        outputShape, $defaultValue);

    const inputs: SparseToDenseInputs = {
        sparseIndices: $sparseIndices,
        sparseValues: $sparseValues,
        defaultValue: $defaultValue
    };

    const attrs: SparseToDenseAttrs = {outputShape};

    return ENGINE.runKernel(
        SparseToDense, inputs as {} as NamedTensorMap,
        attrs
        as {} as NamedAttrMap);
}

export const sparseToDense = op({sparseToDense_});
```

---

```javascript
/**
 * Gather slices from input tensor into a Tensor with shape specified by
 * `indices`.
 * `indices` is an K-dimensional integer tensor, best thought of as a (K-1)-dimensional tensor of indices into input, where each element defines an slice of input: output[i_0, ..., i_[K-2]] = input[indices[i_0, ..., i_[K-2]]] Wherein `tf.gather`, `indices` defines slices into the first dimension of input, in `tf.gatherND`, `indices` defines slices into the first N dimensions of input, where N = indices.shape[-1] * The last dimension of indices can be at most the rank of the input:
 * The last dimension of `indices` corresponds to elements of input: (if indices.shape[-1] < input.rank) or slices of input: (if indices.shape[-1] < input.rank) along dimension indices.shape[-1] of input.
 * The output tensor has shape: output.shape = indices.shape[:-1] + input.shape[indices.shape[-1]:] Note that on CPU, if an out of bound index is found, an error is returned. On GPU, if an out of bound index is found, a 0 is stored in the corresponding output: output[i_0, ..., i_[K-2]] = input[indices[i_0, ..., i_[K-2]]] * @param x The tensor from which to gather values. @param indices Index tensor.
 */
function gatherND_(x:
```
Tensor|TensorLike, indices: Tensor|TensorLike): Tensor {
  const $indices = convertToTensor(indices, 'indices', 'gatherND', 'int32');
  const $x = convertToTensor(x, 'x', 'gatherND');
  const inputs: GatherNdInputs = {params: $x, indices: $indices};
  return ENGINE.runKernel(GatherNd, inputs as {} as NamedTensorMap);
}

export const gatherND = op({gatherND_});

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 */

import {Tensor} from '../tensor';
import * as util from '../util';

/**
 * Normalize noise shape based on provided tensor and noise shape.
 * @param x Tensor.
 * @param noiseShape The shape for the randomly generated keep/drop flags, as
 * an array of numbers. Optional.
 * @returns Normalized noise shape.
 */
export function getNoiseShape(x: Tensor, noiseShape?: number[]): number[] {
  if (noiseShape == null) {
    return x.shape.slice();
  }
  if (util.arraysEqual(x.shape, noiseShape)) {
    return noiseShape;
  }
  if (x.shape.length === noiseShape.length) {
    const newDimension: number[] = [];
    for (let i = 0; i < x.shape.length; i++) {
      if (noiseShape[i] == null && x.shape[i] != null) {
        newDimension.push(x.shape[i]);
      } else {
        newDimension.push(noiseShape[i]);
      }
    }
    return newDimension;
  }
  return noiseShape;
}

/**
 * Computes dropout.
 * ```js
 * const x = tf.tensor1d([1, 2, 2, 1]);
 * const rate = 0.75;
 * const output = tf.dropout(x, rate);
 * output.print();
 * ```
 * @param x A floating point Tensor or TensorLike.
 * @param rate A float in the range [0, 1). The probability that each element
 * of x is discarded.
 * @param noiseShape An array of numbers of type int32, representing the
 * shape for randomly generated keep/drop flags. If the noiseShape has null
 * value, it will be automatically replaced with the x's relative dimension
 * size. Optional.
 * @param seed Used to create random seeds. Optional.
 * @returns A Tensor of the same shape of x.
 */
function dropout_(x: Tensor|TensorLike, rate: number, noiseShape?: number[], seed?: number|string): Tensor {
  const $x = convertToTensor(x, 'x', 'dropout');
  util.assert($x.dtype === 'float32', () => `x has to be a floating point tensor since it's going to be scaled, but got a ${$x.dtype} tensor instead.`);
  util.assert(rate >= 0 && rate < 1, () => `rate must be a float in the range [0, 1), but got ${rate}.`);
  if (rate === 0) {
    return x instanceof Tensor ? $x.clone() : $x;
  }
  const $noiseShape = getNoiseShape($x, noiseShape);
  const keepProb = 1 - rate;
  const multiplier = div(floor(add(randomUniform($noiseShape, 0, 1, 'float32', seed), keepProb)), keepProb);
  return mul($x, multiplier);
}

export const dropout = op({dropout_});

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 */

import {Tensor} from '../tensor';
import * as util from '../util';

import {add} from './add';
import {div} from './div';
import {getNoiseShape} from './dropout_util';
import {floor} from './floor';
import {mul} from './mul';
import {op} from './operation';
import {randomUniform} from './random_uniform';

/**
 * A floating point Tensor or TensorLike.
 * @param x Tensor.
 * @param rate Number.
 * @param seed Seed.
 * @returns A Tensor of the same shape as x.
 */
function dropout_(x: Tensor|TensorLike, rate: number, seed?: number|string): Tensor {
  const $x = convertToTensor(x, 'x', 'dropout');
  util.assert($x.dtype === 'float32', () => `x has to be a floating point tensor since it's going to be scaled, but got a ${$x.dtype} tensor instead.`);
  util.assert(rate >= 0 && rate < 1, () => `rate must be a float in the range [0, 1), but got ${rate}.`);
  if (rate === 0) {
    return x instanceof Tensor ? $x.clone() : $x;
  }
  const $noiseShape = getNoiseShape($x, noiseShape);
  const keepProb = 1 - rate;
  const multiplier = div($floor(add(randomUniform($noiseShape, 0, 1, 'float32', seed), keepProb)), keepProb);
  return mul($x, multiplier);
}

export const dropout = op({dropout_});
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=============================================================================

*/

import {Tensor1D} from '../tensor';
import {tensor1d} from './tensor1d';

export function enclosingPowerOfTwo(value: number) {
  // Return 2**N for integer N such that 2**N >= value.
  return Math.floor(Math.pow(2, Math.ceil(Math.log(value) / Math.log(2.0))));
}

export function cosineWindow(
  windowLength: number, a: number, b: number): Tensor1D {
  const even = 1 - windowLength % 2;
  const newValues = new Float32Array(windowLength);
  for (let i = 0; i < windowLength; ++i) {
    const cosArg = (2.0 * Math.PI * i) / (windowLength + even - 1);
    newValues[i] = a - b * Math.cos(cosArg);
  }
  return tensor1d(newValues, 'float32');
}

export function inTopKAsync_<T extends Tensor, U extends Tensor>(
  predictions: T|TensorLike, targets: U|TensorLike, k = 1): Promise<U> {
  return new Promise((resolve, reject) => {
    // Implement the inTopKAsync logic here...
    resolve(...); // Return the results...
  });
}

export const inTopKAsync = inTopKAsync_;

=============================================================================

*/

import {Tensor} from '../tensor';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';
import {assert, assertShapesMatch, getTypedArrayFromDType} from '../util';
import {tensor} from './tensor';

/**
 * Returns whether the targets are in the top K predictions.
 *
 * ```js
 * const predictions = tf.tensor2d([[20, 10, 40, 30], [30, 50, -20, 10]]);
 * const targets = tf.tensor1d([2, 0]);
 * const precision = await tf.inTopKAsync(predictions, targets);
 * precision.print();
 * ```
 * @param predictions 2-D or higher `tf.Tensor` with last dimension being K.
 * @param targets 1-D or higher `tf.Tensor`.
 * @param k Optional Number of top elements to look at for computing precision, default to 1.
 *
 * @doc {heading: 'Operations', subheading: 'Evaluation'}
 */
async function inTopKAsync_<T extends Tensor, U extends Tensor>(
  predictions: T|TensorLike, targets: U|TensorLike, k = 1): Promise<U> {
  const $predictions = convertToTensor(predictions, 'predictions', 'inTopK');
  const $targets = convertToTensor(targets, 'targets', 'inTopK');

  assert($predictions.rank > 1,
    () => 'inTopK() expects the predictions to be of rank 2 or higher, ' +
    `but got ${$predictions.rank}`);
  assert($predictions.rank - 1 === $targets.rank,
    () => `predictions rank should be 1 larger than targets rank, but got ` +
    `${$predictions.rank} and targets rank ${$targets.rank}`);
  assertShapesMatch($predictions.shape.slice(0,
    $predictions.shape.length - 1),
  $targets.shape,
    'predictions's shape should be align with the targets' shape, ' +
    `except the last dimension.`);
  const lastDim = $predictions.shape[$predictions.shape.length - 1];
  assert(k > 0 && k <= lastDim,
    () => `'k' passed to inTopK() must be > 0 && <= the predictions last ` +
    `dimension (${lastDim}), but got ${k}`);

  const predictionsVals = await $predictions.data();
  const targetsVals = await $targets.data();

  // Reshape predictions into a 2d tensor [batch, lastDim]
  // and look up topK along lastDim.
  const [batch, size] = [predictionsVals.length / lastDim, lastDim];
  const precision = await getTypedArrayFromDType('bool', [batch, size]);
  const vals = predictionsVals.subarray(0, size); // const vals = predictionsVals.slice();
  const targets = targetsVals;

  // Output precision has the same shape as targets.
  return tensor(precision, {batch, lastDim}, 'bool');
}

export const inTopKAsync = inTopKAsync_;

=============================================================================
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=============================================================================

*/

import {ENGINE} from '../engine';
import {Conv2DBackpropFilter, Conv2DBackpropFilterAttrs, Conv2DBackpropFilterInputs} from '../kernel_names';
import {NamedAttrMap} from '../kernel_registry';
import {Tensor3D, Tensor4D} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import * as util from '../util';

import * as conv_util from './conv_util';
import {op} from './operation';
import {reshape} from './reshape';

/**
 * Computes the derivative of the filter of a 2D convolution.
 * @param x The input tensor, of rank 4 or rank 3 of shape [batch, height, width, inChannels]. If rank 3, batch of 1 is assumed.
 * @param dy The dy image, of rank 4 or rank 3, of shape [batch, height, width, outDepth]. If rank 3, batch of 1 is assumed.
 * @param filterShape The shape of the filter, length 4, [filterHeight, filterWidth, inDepth, outDepth].
 * @param strides The strides of the convolution: [strideHeight, strideWidth].
 * @param pad A string from: 'same', 'valid'.
 * @param dimRoundingMode A string from: 'floor', 'round', 'ceil'. If none is provided, it will default to truncate.
 * @param dataFormat An optional string from: 'NHWC', 'NCHW'. Defaults to 'NHWC'.
 * Specify the data format of the input and output data. With the default format 'NHWC', the data is stored in the order of: [batch, height, width, channels].
 * @param inChannels The number of input channels.
 * @param outChannels The number of output channels.
 */
function conv2DBackpropFilter_<T extends Tensor3D|Tensor4D>(
    x: T, dy: T, filterShape: [number, number, number, number], strides: [number, number]|number, pad: 'valid'|'same'|number|conv_util.ExplicitPadding,
    dataFormat: 'NHWC'|'NCHW' = 'NHWC',
    dimRoundingMode?: 'floor'|'round'|'ceil'): Tensor4D {
  let x4D = x as Tensor4D;
  if (x.rank === 3) {
    x4D = reshape(x, [1, x.shape[0], x.shape[1], x.shape[2]]);
  }
  let dy4D = dy as Tensor4D;
  if (dy4D.rank === 3) {
    dy4D = reshape(dy, [1, dy.shape[0], dy.shape[1], dy.shape[2]]);
  }
  util.assert(
      x4D.rank === 4,
      () => `Error in conv2dDerFilter: input must be rank 4, but got shape [${x4D.shape}].`);
  util.assert(
      dy4D.rank === 4,
      () => `Error in conv2dDerFilter: dy must be rank 4, but got shape [${dy4D.shape}].`);
  util.assert(filterShape.length === 4,
      () => `Error in conv2dDerFilter: filterShape must be length 4, but got [${filterShape.length}].`);
  util.assert(filterShape.length === 4,
      () => `Error in conv2dDerFilter: filterShape must be length 4, but got [${filterShape.length}].`);
  const inDepth = dataFormat === 'NHWC' ? x4D.shape[3] : x4D.shape[1];
  util.assert(inDepth === filterShape[2],
      () => `Error in conv2dDerFilter: depth of input (${inDepth}) must match input depth in filter (${filterShape[2]}).`);
  util.assert(outDepth === filterShape[3],
      () => `Error in conv2dDerFilter: depth of output (${outDepth}) must match output depth for filter (${filterShape[3]}).`);
  if (dimRoundingMode != null) {
    util.assert(
        util.isInt(pad as number),
        () => `Error in conv2dDerFilter: pad must be an integer when using, but got pad ${pad}.`);
  }
  return ENGINE.runKernel(
      Conv2DBackpropFilter,
      {x: x4D, dy: dy4D, filterShape, strides, pad, dataFormat, dimRoundingMode, inChannels, outChannels} as {} as NamedTensorMap,
      {filterShape, strides, pad, dataFormat, dimRoundingMode, inChannels, outChannels} as {} as NamedAttrMap) as Tensor4D;
}

export const conv2DBackpropFilter = op({conv2DBackpropFilter_});

=============================================================================

*/

import {Tensor} from '../tensor';

import * as broadcast_util from './broadcast_util';
import {elu} from './elu';
import {Activation} from './fused_types';
import {leakyRelu} from './leaky_relu';
import {mul} from ...
import {prelu} from './prelu';
import {relu} from './relu';
import {relu6} from './relu6';
import {reshape} from './reshape';
import {step} from './step';
import {sum} from './sum';

// Returns gradient for fused activation.
export function getFusedDyActivation(
    dy: Tensor, y: Tensor, activation: Activation): Tensor {
  if (activation == null || activation === 'linear') {
    return dy;
  }
  if (activation === 'relu') {
    return mul(dy, step(y));
  }
  throw new Error(`Cannot compute gradient for fused activation $\{activation\}`);
}

// Returns gradient for fused bias.
export function getFusedBiasGradient(bias: Tensor, dyActivation: Tensor): Tensor {
  let res = dyActivation;
  const reduceAxes = broadcast_util.getReductionAxes(bias.shape, dyActivation.shape);
  if (reduceAxes.length > 0) {
    res = sum(res, reduceAxes);
  }
  return reshape(res, bias.shape);
}

export function applyActivation(x: Tensor, activation: Activation, preluActivationWeights?: Tensor, leakyreluAlpha?: number): Tensor {
  if (activation === 'linear') {
    return x;
  } else if (activation === 'relu') {
    return relu(x);
  } else if (activation === 'elu') {
    return elu(x);
  } else if (activation === 'relu6') {
    return relu6(x);
  } else if (activation === 'prelu') {
    return prelu(x, preluActivationWeights);
  } else if (activation === 'leakyrelu') {
    return leakyRelu(x, leakyreluAlpha);
  } else if (activation === 'linear') {
    return dy;
  } else if (activation === 'relu') {
    return mul(dy, step(y));
  }
  throw new Error(`Unknown fused activation $\{activation\}`);
}

// Whether we should call fused ops.
export const shouldFuse = (gradientDepth: number, activation: Activation) => {
  const gradientMode = gradientDepth > 0;
  return !gradientMode || activation === 'linear';
};

// Computes a 2D convolution over the input x, optionally fused with adding a bias and applying an activation.

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"NHWC" is currently supported.

```typescript
@param dilations The dilation rates: `[ dilationHeight, dilationWidth ]`

in which we sample input values across the height and width dimensions

in atrous convolution. Defaults to `[1, 1]`. If `dilations` is a single number, then `dilationHeight == dilationWidth`. If it is greater than 1, then all values of `strides` must be 1.

@param dimRoundingMode A string from: ‘ceil’, ‘round’, ‘floor’. If none is provided, it will default to truncate.

@param bias Tensor to be added to the result.

@param activation Name of activation kernel (defaults to ‘linear’) to be applied after biasAdd.

@param preluActivationWeights Tensor of prelu weights to be applied as part of a `prelu` activation, typically the same shape as `x`.

@param leakyreluAlpha Optional. Alpha to be applied as part of a `leakyrelu` activation.

/**
 * function fusedConv2d_<T extends Tensor3D|Tensor4D>({ x, filter, strides, pad, 
 *   dataFormat = 'NHWC', dilations = [1, 1], dimRoundingMode, bias, activation = 'linear', 
 *   preluActivationWeights, leakyreluAlpha }: {
 *   x: TensorLike, filter: Tensor4D|TensorLike, strides: [number, number], pad: valid|same|number, conv_util.ExplicitPadding, dataFormat: ?
 *   'NHWC'|
 *   'NCHW', dilations?: [number, number], dimRoundingMode?: 'floor'|'round'|'ceil', bias?: Tensor|TensorLike, 
 *   activation?: Activation, preluActivationWeights?: Tensor, leakyreluAlpha?: number
 * }): T {
 *   activation = activation || 'linear';

 *   if (shouldFuse(ENGINE.state.gradientDepth, activation) === false) {
 *     let result = unfusedConv2d(x, filter, strides, pad, dataFormat, dilations, dimRoundingMode);
 *     if (bias != null) {
 *       result = add(result, bias);
 *     }
 *     return applyActivation(result, activation, preluActivationWeights, leakyreluAlpha) as T;
 *   }

 *   const $x = convertToTensor(x, 'x', 'conv2d');
 *   const $filter = convertToTensor(filter, 'filter', 'conv2d');

 *   let x4D = $x as Tensor4D;
 *   let reshapedTo4D = false;

 *   if ($x.rank === 3) {
 *     reshapedTo4D = true;
 *     x4D = reshape(x, [1, x.shape[0], x.shape[1], x.shape[2]]);
 *   }

 *   const convInfo = conv_util.computeConv2DInfo(x4D.shape, $filter.shape, strides, dilations, pad, dimRoundingMode);

 *   const $bias: Tensor;
 *   if (bias != null) {
 *     $bias = convertToTensor(bias, 'bias', 'fused conv2d');
 *     $bias = makeTypesMatch($bias, x);
 *     broadcast_util.assertAndGetBroadcastShape(convInfo.outShape, $bias.shape);
 *   }

 *   const $preluActivationWeights: Tensor;
 *   if (preluActivationWeights != null) {
 *     $preluActivationWeights = convertToTensor(preluActivationWeights, 'prelu weights', 'fused conv2d');
 *   }

 *   const grad = (dy: Tensor4D, saved: Tensor[]): T => {
 *     let res: Tensor4D|Tensor3D =
```
// tslint:disable-next-line: no-unnecessary-type-assertion
ENGINE.runKernel
FusedConv2D, inputs as {} as NamedTensorMap, 
attrs as {} as NamedAttrMap, 
save([filter, x4D, res]);
if (reshapedTo4D) {
  return customOp(x4D, Sfilter) as T;
}
const
res = reshape(res, [res.shape[1], res.shape[2], res.shape[3]]) as
  Tensor3D;
return
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*=============================================================================

import {ENGINE} from '../engine';
import {DepthwiseConv2dNativeBackpropFilter, DepthwiseConv2dNativeBackpropFilterAttrs, DepthwiseConv2dNativeBackpropFilterInputs} from
'../kernel_names';
import {NamedAttrMap} from '../kernel_registry';
import {Tensor3D, Tensor4D} from
'../tensor';
import {NamedTensorMap} from '../tensor_types';

import {op} from './operation';
import {reshape} from './reshape';

function depthwiseConv2dNativeBackpropFilter_<T extends Tensor3D|Tensor4D>(
    x: T,
    dy: T, filterShape: [number, number, number, number], strides: [number, number],
    pad: 'valid'|'same',
    dilations: [number, number],
    dimRoundingMode?: 'floor'|'round'|'ceil'): Tensor4D {
  let x4D = x as Tensor4D;
  if (x.rank === 3) {
    x4D = reshape(x, [1, x.shape[0], x.shape[1], x.shape[2]]);
  }

  const inputs: DepthwiseConv2dNativeBackpropFilterInputs = {x: x4D, dy: dy, filterShape: [number, number]},
  const attrs: DepthwiseConv2dNativeBackpropFilterAttrs =
      {strides, pad, dimRoundingMode, dilations, filterShape};

  // tslint:disable-next-line: no-unnecessary-type-assertion
  return ENGINE.runKernel
    (op({depthwiseConv2dNativeBackpropFilter_}));
}

export const depthwiseConv2dNativeBackpropFilter =
    op({depthwiseConv2dNativeBackpropFilter_});

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T \( \text{let dy4D = dy as Tensor4D;} \) \( \text{let reshapedTo4D = false;} \) \( \text{if (dy.rank === 3) { } \text{reshapedTo4D = true;} \) \( \text{dy4D = reshape(dy, [1, dy.shape[0], dy.shape[1], dy.shape[2]]);} \) \n} \n\nconst inputs:

DepthwiseConv2dNativeBackpropInputInputs = \( \text{[dy: dy4D, filter]} ; \) \n\nconst atts:

DepthwiseConv2dNativeBackpropInputAttrs = \n\{ strides, pad, dimRoundingMode, dilations, inputShape: xShape \} ; \n\nconst res = \n\n// tslint:disable-next-line: no-unnecessary-type-assertion
ENGINE.runKernel(

DepdthwiseConv2dNativeBackpropInput, inputs as {} as NamedTensorMap, 
atts as {} as NamedAttrMap) as T;

op({depthwiseConv2dNativeBackpropInput_});

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* limitations under the License.
*/
channels]. Only "NHWC" is currently supported.

```typescript
@function
fusedDepthwiseConv2d_<T extends Tensor3D|Tensor4D>({ x, filter, strides, pad, dataFormat = 'NHWC', dilations = [1, 1], dimRoundingMode, bias, activation = 'linear', preluActivationWeights, leakyreluAlpha }: {
  x: TensorLike, filter: Tensor4D|TensorLike, strides: [number, number], pad: 'valid'|same|number, dataFormat?: string, activation?: Activation | Activation, preluActivationWeights?: Tensor, leakyreluAlpha?: number }) => {
  if (shouldFuse(ENGINE.state.gradientDepth, activation) === false) {
    let result = unfusedDepthwiseConv2d(x, filter, strides, pad, dataFormat = 'NHWC', dilations = [1, 1], dimRoundingMode, bias, activation = 'linear', preluActivationWeights, leakyreluAlpha); 
    if (bias != null) {
      result = add(result, bias);
    }
    return applyActivation(result, activation, preluActivationWeights, leakyreluAlpha) as T;
  }

  const x4D: Tensor4D = x as Tensor4D;
  const $filter = convertToTensor(filter, 'filter', 'depthwiseConv2d');

  let x4D, y, bias = null;
  let $filter, $bias = null;
  let conv_util;

  const grad = (dy: Tensor4D, saved: Tensor[]) => {
    const dyActivation = getFusedDyActivation(dy, y, activation) as Tensor4D;
    const xDer = depthwiseConv2dNativeBackpropInput(x4D as Tensor4D).shape, dyActivation, $filter as Tensor4D, strides, pad, dilations, dimRoundingMode, true /* depthwise */;
    let $bias: Tensor;
    if (bias != null) {
      $bias = convertToTensor(bias, 'bias', 'fused conv2d');
      makeTypesMatch($bias, x4D);
    }
    const $filter = convertToTensor($filter, 'filter', 'depthwiseConv2d');
    const dyActivation = getFusedDyActivation(dy, y, activation) as Tensor4D;
    const xDer = depthwiseConv2dNativeBackpropInput(x4D as Tensor4D).shape, dyActivation, $filter as Tensor4D, strides, pad, dilations, dimRoundingMode;
    const filterDer = depthwiseConv2dNativeBackpropFilter(x4D as Tensor4D, dyActivation, $filter as Tensor4D, strides, pad, dilations, dimRoundingMode);
    if (bias != null) {
      getFusedBiasGradient($bias, dyActivation);
    }
    return [xDer, filterDer, bias];
  };

  return [xDer, filterDer, bias];
};
```

---

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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 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: nounnecessary-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\n export const matMul = op({fusedMatMul_});\n","/**\n * @license\n * Copyright 2019
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=============================================================================\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
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=============================================================================

```javascript
import {Tensor1D} from '../../tensor';
import {op} from '../operation';
import {cosineWindow} from '../signal_ops_util';

/**
 * Generate a hamming window.
 *
 * See:
 * https://en.wikipedia.org/wiki/Window_function#Hann_and_Hamming_windows
 *
 * ```js
 * tf.signal.hammingWindow(10).print();
 * ```
 * @param The length of window
 *
 * @doc {heading: 'Operations', subheading: 'Signal', namespace: 'signal'}
 */
function hammingWindow_(windowLength: number): Tensor1D {
  return cosineWindow(windowLength, 0.54, 0.46);
}

export const hammingWindow = op({hammingWindow_});
```

---

```javascript
import {Tensor1D} from '../../tensor';
import {op} from '../operation';
import {cosineWindow} from '../signal_ops_util';

/**
 * Generate a Hann window.
 *
 * See:
 * https://en.wikipedia.org/wiki/Window_function#Hann_and_Hamming_windows
 *
 * ```js
 * tf.signal.hannWindow(10).print();
 * ```
 * @param The length of window
 *
 * @doc {heading: 'Operations', subheading: 'Signal', namespace: 'signal'}
 */
function hannWindow_(windowLength: number): Tensor1D {
  return cosineWindow(windowLength, 0.5, 0.5);
}

export const hannWindow = op({hannWindow_});
```

---

```javascript
import {Tensor, Tensor1D} from '../../tensor';
import {concat} from '../concat';
import {fill} from '../fill';
import {op} from '../operation';
import {reshape} from '../reshape';
import {tensor2d} from '../tensor2d';

/**
 * Expands input into frames of frameLength. Slides a window size with frameStep.
 * @param signal The input tensor to be expanded
 * @param frameLength Length of each frame
 * @param frameStep The frame hop size in samples.
 * @param padEnd Whether to pad the end of signal with padValue.
 * @param padValue An number to use where the input signal does not exist when padEnd is True.
 * @doc {heading: 'Operations', subheading: 'Signal'}
 */
function frame_(signal: Tensor1D, frameLength: number, frameStep: number, padEnd = false, padValue = 0): Tensor {
  let start = 0;
  const output: Tensor[] = [];
  while (start + frameLength <= signal.size) {
    output.push(slice(signal, start, frameLength));
    start += frameStep;
  }

  if (padEnd) {
    while (start < signal.size) {
      const padLen = (start + frameLength) - signal.size;
      const pad = concat([slice(signal, start, frameLength - padLen), fill([padLen], padValue)]);
      output.push(pad);
      start += frameStep;
    }
  }

  if (output.length === 0) {
    return tensor2d([], [0, frameLength]);
  }

  return reshape(concat(output), [output.length, frameLength]);
}
export const frame = op({frame_});
```

---
import {Tensor, Tensor1D} from '../../tensor';
import {concat} from '../concat';
import {mul} from '../mul';
import {op} from '../operation';
import {enclosingPowerOfTwo} from '../signal_ops_util';
import {slice} from '../slice';
import {rfft} from '../spectral/rfft';
import {frame} from '../frame';
import {hannWindow} from '../hann_window';

/**
 * Computes the Short-time Fourier Transform of signals
 * See:
 * https://en.wikipedia.org/wiki/Short-time_Fourier_transform
 *
 * ```js
 * const input = tf.tensor1d([1, 1, 1, 1, 1])
 * tf.signal.stft(input, 3, 1).print();
 * ```
 * @param signal 1-dimensional real value tensor.
 * @param frameLength The window length of samples.
 * @param frameStep The number of samples to step.
 * @param fftLength The size of the FFT to apply.
 * @param windowFn A callable that takes a window length and returns 1-
 * dimensional real value tensor.
 * @return A 4D tensor of the shape `\[batch, numFrames, frameLength, depth\]`.
 * @doc {heading: 'Operations', subheading: 'Signal', namespace: 'signal'}
 */
function stft_(signal: Tensor1D, frameLength: number, frameStep: number,
    fftLength?: number,
    windowFn: (length: number) => Tensor1D = hannWindow): Tensor {
  const signalTensor = convertToTensor(signal);
  const frameSize = enclosingPowerOfTwo(frameLength);
  const framedSignal = frame(signalTensor, frameSize, frameStep);
  const windowedSignal = mul(framedSignal, windowFn(frameSize));
  const output = new Tensor();
  for (let i = 0; i < framedSignal.shape[0]; i++) {
    output.push(rfft(slice(windowedSignal, [i, 0], [1, frameSize]),
        frameLength));
  }
  return output.concat();
}

export const stft = op({stft_});
const $boxInd = convertToTensor(boxInd, 'boxInd', 'cropAndResize', 'int32');

const numBoxes = $boxInd.shape[0];

util.assert($image.rank === 4, () => 'Error in cropAndResize: image must be rank 4; ' +
  'but got rank ' + $image.rank); util.assert($boxes.rank === 2 && $boxes.shape[1] === 4,
() => 'Error in cropAndResize: boxes must be have size [' + numBoxes + ',4] ' +
'but had shape ' + $boxes.shape.join(']'));

util.assert($boxInd.rank === 1 && $boxInd.shape[0] === numBoxes,
() => 'Error in cropAndResize: boxInd must be have size [' + numBoxes + '] ' +
'but had shape ' + $boxInd.shape.join(']'));

const numBoxes = $boxes.shape[0];

util.assert($image.rank === 4,
() => 'Error in cropAndResize: image must be rank 4,' +
'but got rank ' + $image.rank); util.assert($boxes.shape[0] > 1 && $boxes.shape[1] > 1,
() => 'cropSize must be atleast [1,1], but was [' + $cropSize.join(']') + ']');

util.assert(method === 'bilinear' || method === 'nearest',
() => 'method must be bilinear or nearest, but was ' + method);

const inputs: CropAndResizeInputs = {image: $image, boxes: $boxes, boxInd: $boxInd};

const attrs: CropAndResizeAttrs = {method, extrapolationValue, cropSize};

const res = ENGINE.runKernel(CropAndResize, inputs as {} as NamedTensorMap,
  attrs as {} as NamedAttrMap);

return res as Tensor4D;

export const cropAndResize = op({cropAndResize_});

/**
 * Flips the image left to right.
 */
/** @doc {heading: 'Operations', subheading: 'Images',
 namespace: 'image'} */
function flipLeftRight_(image: Tensor4D|TensorLike): Tensor4D {

  const $image = convertToTensor(image, 'image', 'flipLeftRight', 'float32');

  util.assert($image.rank === 4,
() => 'Error in flipLeftRight: image must be rank 4,' +
'but got rank ' + $image.rank); util.assert($image.shape[1] > 2,
() => 'Error in flipLeftRight: cropSize must be of length 2, but got ' +
'length ' + $image.shape[1] + ')');

  const inputs: FlipLeftRightInputs = {image: $image};

  const res =
      ENGINE.runKernel(FlipLeftRight, inputs as {} as NamedTensorMap,
        {});

  return res as Tensor4D;

export const flipLeftRight = op({flipLeftRight_});
array of three numbers `[red, green, blue]` specifying the red, green, and blue channels. Defaults to `0` (black).\n* @param center The center of rotation. Can be either a single value (0-1), or a \narray of two numbers `[centerX, centerY]`. Defaults to `0.5` (rotates around the image around its center).\n* @doc {heading: 'Operations', subheading: 'Images', namespace: 'image'}

```typescript
function rotateWithOffset_(
    image: Tensor4D|TensorLike, radians: number,
    fillValue: number|[number, number, number] = 0,
    center:
    number|[number, number] = 0.5): Tensor4D {
  const $image = convertToTensor(image, 'image',
                                  {rotateWithOffset, 'float32'});

  util.assert(
      $image.rank === 4,
      () => 'Error in rotateWithOffset: image must be rank 4,' +
          `but got rank ${$image.rank}.`);

  const inputs: RotateWithOffsetInputs = {image: $image};
  const attrs: RotateWithOffsetAttrs = {radians, fillValue, center};
  const res = ENGINE.runKernel($image, inputs as {} as NamedTensorMap,
                                   attrs as {} as NamedAttrMap);
  return res as Tensor4D;
}

export const rotateWithOffset = op({rotateWithOffset_});
```

```typescript
import {Tensor1D, Tensor2D} from '../tensor';

function nonMaxSuppSanityCheck(
    boxes: Tensor2D, scores: Tensor1D, maxOutputSize: number,
    iouThreshold: number, scoreThreshold: number, softNmsSigma?: number): {
  maxOutputSize: number,
  iouThreshold: number,
  scoreThreshold: number,
  softNmsSigma: number
} {
  if (iouThreshold == null) {
    iouThreshold = 0.5;
  }
  if (scoreThreshold == null) {
    scoreThreshold = Number.NEGATIVE_INFINITY;
  }
  if (softNmsSigma == null) {
    softNmsSigma = 0.0;
  }

  const numBoxes = boxes.shape[0];
  maxOutputSize = Math.min(maxOutputSize, numBoxes);
  util.assert(
      0 <= iouThreshold && iouThreshold <= 1,
      () => `iouThreshold must be in [0, 1], but was '${iouThreshold}'`);
  util.assert(boxes.rank === 2,
      () => `boxes must be a 2D tensor, but was of rank '${boxes.rank}'`);
  util.assert(boxes.shape[1] === 4,
      () =>
          `boxes must have 4 columns, but was ${boxes.shape[1]}`);
  util.assert(scores.rank === 1,
      () =>
          `scores must be a 1D tensor`);
  util.assert(scores.shape[0] === numBoxes, () => `scores has incompatible shape with boxes. Expected ${numBoxes}, but was ${scores.shape[0]}`);
  util.assert(0 <= softNmsSigma && softNmsSigma <= 1,
      () => `softNmsSigma must be in [0, 1], but was '${softNmsSigma}'`);
  return {maxOutputSize, iouThreshold, scoreThreshold, softNmsSigma};
}

export {nonMaxSuppSanityCheck};
```
respects to IOU. Must be between [0, 1].

\* Defaults to 0.5 (50% box overlap).

\* @param scoreThreshold A threshold for deciding when to remove boxes based on score. Defaults to -\inf, which means any score is accepted.

\* @return A 1D tensor with the selected box indices.

\* @doc {heading: 'Operations', subheading: 'Images', namespace: 'image'}

```javascript
function nonMaxSuppression_(
  boxes: Tensor2D|TensorLike, scores: Tensor1D|TensorLike,
  maxOutputSize: number, iouThreshold = 0.5, scoreThreshold = Number.NEGATIVE_INFINITY): Tensor1D {
  const $boxes = convertToTensor(boxes, 'boxes', 'nonMaxSuppression');
  const $scores = convertToTensor(scores, 'scores', 'nonMaxSuppression');
  const inputs = nonMaxSuppSanityCheck($boxes, $scores, maxOutputSize, iouThreshold, scoreThreshold);
  maxOutputSize = inputs.maxOutputSize;
  iouThreshold = inputs.iouThreshold;
  scoreThreshold = inputs.scoreThreshold;
  const attr$ = {maxOutputSize, iouThreshold, scoreThreshold};
  return ENGINE.runKernel($ NonMaxSuppressionV3, {boxes: $boxes, scores: $scores}, attr$);
}
```

```javascript
export const nonMaxSuppression = op({nonMaxSuppression_});
```

```javascript
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 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
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 * limitations under the License.
 *
 *=============================================================================
 */

```javascript
/**
 * Inserts a value into a sorted array. This method allows duplicate, meaning it allows inserting
duplicate value, in which case, the element will be inserted at the lowest index of the value.

\* @param arr The array to modify.

\* @param element The element to insert.

\* @param comparator Optional. If no comparator is specified, elements are compared using array_util.defaultComparator, which is suitable for Strings and Numbers in ascending arrays. If the array contains multiple instances of the target value, the left-most instance will be returned. To provide a comparator, it should take 2 arguments to compare and return a negative, or a positive number.

\* @return The lowest index of the target value if found, otherwise the insertion point where the target should be inserted, in the form of -insertionPoint - 1.

\* @doc {heading: 'Simple utilities', subheading: 'Arrays'}

```javascript
export function binaryInsert<T>(
  arr: T[], element: T, comparator?: (a: T, b: T) => number) {
  const index = binarySearch(arr, element, comparator);
  const insertionPoint = index < 0 ? -(index + 1) : index;
  arr.splice(insertionPoint, 0, element);
}
```

```javascript
/**
 * Searches the array for the target using binary search, returns the index
 * of the found element, or position to insert if element not found. If no comparator is specified, elements are compared using array_.util.defaultComparator, which is suitable for Strings and Numbers in ascending arrays. If the array contains multiple instances of the target value, the left-most instance will be returned.

\* @param arr The array to be searched in.

\* @param target The target to be searched for.

\* @param comparator Should take 2 arguments to compare and return a negative, or a positive number.

\* @return Lowest index of the target value if found, otherwise the insertion point where the target should be inserted, in the form of -insertionPoint - 1.

\* @doc {heading: 'Simple utilities', subheading: 'Arrays'}

```javascript
export function binarySearch<T>(
  arr: T[], target: T, comparator?: (a: T, b: T) => number) {
  return binarySearch_(arr, target, comparator || defaultComparator);
}
```

```javascript
/**
 * Compares its two arguments for order.

\* @param a The first element to be compared.

\* @param b The second element to be compared.

\* @return A negative number, zero, or a positive number as the first\* argument is less than, equal to, or greater than the second.

\* @doc {heading: 'Simple utilities', subheading: 'Arrays'}

```javascript
function defaultComparator<T>(a: T, b: T): number {
  return a > b ? 1 : a < b ? -1 : 0;
}
```
Software * distributed under the License is distributed on an "AS IS" BASIS, * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied. * See the License for the specific language governing permissions and limitations under the License.

============================================================================
 *
import {TypedArray} from '../types';
import {binaryInsert} from './non_max_suppression_util';

/**
 * Implementation of the NonMaxSuppression kernel shared between webgl and cpu.
 */
interface Candidate {
score: number;
  boxIndex: number;
  suppressBeginIndex: number;
}

interface NonMaxSuppressionResult {
  selectedIndices: number[];
  selectedScores?: number[];
  validOutputs?: number[];
}

export function nonMaxSuppressionV3Impl(
    boxes: TypedArray, scores: TypedArray, maxOutputSize: number,
    iouThreshold: number, scoreThreshold: number): NonMaxSuppressionResult {
  return nonMaxSuppressionImpl_(
      boxes, scores, maxOutputSize, iouThreshold, scoreThreshold,
      0 /* softNmsSigma */);
}

export function nonMaxSuppressionV4Impl(
    boxes: TypedArray, scores: TypedArray, maxOutputSize: number,
    iouThreshold: number, scoreThreshold: number, padToMaxOutputSize: boolean): NonMaxSuppressionResult {
  return nonMaxSuppressionImpl_(
      boxes, scores, maxOutputSize, iouThreshold, scoreThreshold,
      0 /* softNmsSigma */, false /* returnScoresTensor */, padToMaxOutputSize);
}

export function nonMaxSuppressionV5Impl(
    boxes: TypedArray, scores: TypedArray, maxOutputSize: number,
    iouThreshold: number, scoreThreshold: number, softNmsSigma: number): NonMaxSuppressionResult {
  return nonMaxSuppressionImpl_(
      boxes, scores, maxOutputSize, iouThreshold, scoreThreshold,
      softNmsSigma, true /* returnScoresTensor */);
}

function nonMaxSuppressionImpl_(
    boxes: TypedArray, scores: TypedArray, maxOutputSize: number,
    iouThreshold: number, scoreThreshold: number,
    softNmsSigma: number, returnScoresTensor = false, padToMaxOutputSize = false, returnValidOutputs = false): NonMaxSuppressionResult {
  // The list is sorted in ascending order, so that we can always pop the
  // candidate with the largest score in O(1) time.
  const candidates = [];

  for (let i = 0; i < scores.length; i++) {
    if (scores[i] > scoreThreshold) {
      candidates.push({score: scores[i], boxIndex: i, suppressBeginIndex: 0});
    }
  }

  candidates.sort(ascendingComparator);

  // If softNmsSigma is 0, the outcome of this algorithm is
  // exactly same as
  // candidate with the largest score in O(1) time.
  const scale = softNmsSigma > 0 ? (-0.5 / softNmsSigma) : 0.0;

  const selectedIndices: number[] = [];
  const selectedScores: number[] = [];

  while (selectedIndices.length < maxOutputSize && candidates.length > 0) {
    const candidate = candidates.pop();
    const {score: originalScore, boxIndex, suppressBeginIndex} = candidate;

    if (originalScore < scoreThreshold) {
      break;
    }

    // Overlapping boxes are likely to have similar scores, therefore we
    // work through the previously selected boxes backwards in order to
    // see if candidate's score should be suppressed. We use
    // suppressBeginIndex to track and ensure a candidate can be suppressed
    // by a selected box no more than once. Also, if the overlap exceeds
    // iouThreshold, we simply ignore the candidate.
    let ignoreCandidate = false;
    for (let j = selectedIndices.length - 1; j >= suppressBeginIndex; --j) {
      const iou = intersectionOverUnion(boxes, boxIndex, selectedIndices[j]);
      if (iou >= iouThreshold) {
        ignoreCandidate = true;
        break;
      }
    }

    // At this point, if `candidate.score` has not dropped below
    // `scoreThreshold`, then we know that we went through all of the
    // previous selections and can safely update
    // `candidate.score` to the new value, and can re-insert the candidate
    // with `ious` to the updated score and suppressBeginIndex back in the
    // candidate list.
    if (ignoreCandidate) {
      candidates.push(candidate);
    } else if (candidate.score > scoreThreshold) {
      // Candidate's score is suppressed but is still high enough to be
      // considered, so add back to the candidates list.
      binaryInsert(candidates, candidate, ascendingComparator);
    } else {
      candidates = candidates.filter(c => c.boxIndex !== boxIndex);
      candidates.push(candidate);
    }
  }

  return {selectedIndices, scoreThreshold: scale, iouThreshold: scoreThreshold};
}
const elemsToPad = maxOutputSize - validOutputs; if (padToMaxOutputSize && elemsToPad > 0) {
  const selectedIndices = new Array(elemsToPad).fill(0);
  const selectedScores = new Array(elemsToPad);
  const result = { selectedIndices, selectedScores; } if (returnScoresTensor) {
    result['selectedScores'] = selectedScores;
  } if (returnValidOutputs) {
    result['validOutputs'] = validOutputs;
  } return result;
}

function intersectionOverUnion(boxes: TypedArray, i: number, j: number) {
  const iCoord = boxes.subarray(i * 4, i * 4 + 4);
  const jCoord = boxes.subarray(j * 4, j * 4 + 4);
  const yminI = Math.min(iCoord[0], iCoord[2]);
  const xminI = Math.min(iCoord[1], iCoord[3]);
  const ymaxI = Math.max(iCoord[0], iCoord[2]);
  const xmaxI = Math.max(iCoord[1], iCoord[3]);
  const yminJ = Math.min(jCoord[0], jCoord[2]);
  const xminJ = Math.min(jCoord[1], jCoord[3]);
  const ymaxJ = Math.max(jCoord[0], jCoord[2]);
  const xmaxJ = Math.max(jCoord[1], jCoord[3]);
  const areaI = (ymaxI - yminI) * (xmaxI - xminI);
  const areaJ = (ymaxJ - yminJ) * (xmaxJ - xminJ);
  if (areaI <= 0 || areaJ <= 0) {
    return 0.0;
  }
  const intersectionYmin = Math.max(yminI, yminJ);
  const intersectionXmin = Math.max(xminI, xminJ);
  const intersectionYmax = Math.min(ymaxI, ymaxJ);
  const intersectionXmax = Math.min(xmaxI, xmaxJ);
  const intersectionArea = Math.max(intersectionYmax - intersectionYmin, 0.0) *
    Math.max(intersectionXmax - intersectionXmin, 0.0);
  return intersectionArea / (areaI + areaJ - intersectionArea);
}

/**
 * A Gaussian penalty function, this method always returns values in [0, 1].
 * The weight is a function of similarity, the more overlap two boxes are,
 * the smaller weight is, meaning highly overlapping box will be significantly
 * penalized. On the other hand,
 * a non-overlapping box will not be penalized.
 * @param iouThreshold A float representing the threshold for deciding whether
 * boxes overlap too much with respect to IOU. Must be between [0, 1].
 * @param scoreThreshold A threshold for deciding when to remove boxes
 * based on score. Defaults to -inf, which means any score is accepted.
 * @return A Gaussian penalty function that returns values in [0, 1].
 */

function suppressWeight(iouThreshold: number, scoreThreshold: number) {
  return (iou <= iouThreshold) ? Math.exp(scale * iou * iou) : 0.0;
}

function ascendingComparator(c1: Candidate, c2: Candidate) {
  // For objects with same scores, we make the object with the larger index go first.
  return (c1.score - c2.score) ||
    ((c1.score === c2.score) && (c2.boxIndex - c1.boxIndex));
}

async function nonMaxSuppressionAsync_(
    boxes: Tensor2D|TensorLike, scores: Tensor1D|TensorLike,
    maxOutputSize: number, iouThreshold = 0.5,
    scoreThreshold = Number.NEGATIVE_INFINITY): Promise<Tensor1D> {
  const $boxes = convertToTensor(boxes, 'boxes', 'nonMaxSuppressionAsync');
  const $scores = convertToTensor(scores, 'scores', 'nonMaxSuppressionAsync');

  const result = await nonMaxSuppressionV3Impl($boxes, $scores, maxOutputSize,
    iouThreshold, scoreThreshold);
```
nonMaxSuppSanityCheck($boxes, $scores, maxOutputSize, iouThreshold, scoreThreshold);\n maxOutputSize = inputs.maxOutputSize;\n iouThreshold = inputs.iouThreshold;\n scoreThreshold = inputs.scoreThreshold;\n const boxesAndScores = await Promise.all([$boxes.data(), $scores.data()]);\n const boxesVals = boxesAndScores[0];\n const scoresVals = boxesAndScores[1];\n // We call a cpu based impl directly with the typedarray data here rather\n // than a kernel because all kernels are synchronous (and thus cannot await\n // .data());\n const [selectedIndices] = nonMaxSuppressionV3Impl(boxesVals, scoresVals, maxOutputSize,\n iouThreshold, scoreThreshold);\n if ($boxes !== boxes) {\n   $boxes.dispose();\n }\n if ($scores !== scores) {\n   $scores.dispose();\n }\n return tensor1d(selectedIndices, 'int32');\n}

export const nonMaxSuppressionAsync = nonMaxSuppressionAsync_;

```

```
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 *
 *=============================================================================

```

```
import {ENGINE} from '../../engine';\nimport {NonMaxSuppressionV5, NonMaxSuppressionV5Attrs,\n 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';
import {nonMaxSuppSanityCheck} from '../nonmax_util';\nimport {op} from '../operation';\n
/**\n * Performs non maximum suppression of bounding boxes based on iou (intersection over union).\n * This op also supports a Soft-NMS mode (c.f. Bodla et al, https://arxiv.org/abs/1704.04503) where boxes reduce the score of other overlapping boxes, therefore favoring different regions of the image with high scores. To enable this Soft-NMS mode, set the `softNmsSigma` parameter to be larger than 0.\n * @param boxes a 2d tensor of shape `[numBoxes, 4]`. Each entry is `[y1, x1, y2, x2]`, where `(y1, x1)` and `(y2, x2)` are the corners of the bounding box.\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 boxes overlap too much with respect to IOU. Must be between [0, 1].\n * @param scoreThreshold A threshold for deciding when to remove boxes based on score. Defaults to 0.5 (50% box overlap).\n * @param softNmsSigma A float representing the sigma parameter for Soft NMS.\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 selected box.\n *
 * @doc {heading: 'Operations', subheading: 'Images', namespace: 'image'}
 */\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 {
  const $boxes = convertToTensor(boxes, 'boxes', 'nonMaxSuppression');\n  const $scores = convertToTensor(scores, 'scores', 'nonMaxSuppression');\n  const params = nonMaxSuppSanityCheck($boxes, $scores, maxOutputSize, iouThreshold, scoreThreshold, softNmsSigma);\n  const selectedIndices = nonMaxSuppressionV5Inputs(boxes: $boxes, scores: $scores, maxOutputSize, iouThreshold, scoreThreshold, softNmsSigma);\n  const selectedScores = nonMaxSuppressionV5Attrs = nonMaxSuppressionV5(boxes: $boxes, scores: $scores, maxOutputSize, iouThreshold, scoreThreshold, softNmsSigma);\n  if (tslint:disable-next-line:no-unnecessary-type-assertion)\n    const result = ENGINE.runKernel(\n      NonMaxSuppressionV5, inputs as {} as NamedTensorMap,\n      attr as {} as NamedAttrMap) as Tensor;\n    return {selectedIndices, result[0],\n      selectedScores: result[1]};\n  export const nonMaxSuppressionWithScore = op({\n    nonMaxSuppressionWithScore: ()\n  });
```

```
```
import {nonMaxSuppressionV5Impl} from '../../backends/non_max_suppression_impl';
import {Tensor1D, Tensor2D} from '../../tensor';
import {NamedTensorMap} from '../../tensor_types';
import {convertToTensor} from '../../tensor_util_env';
import {TensorLike} from '../../types';
import {nonMaxSuppSanityCheck} from '../nonmax_util';
import {tensor1d} from '../tensor1d';

/**
 * Asynchronously performs non maximum
 * suppression of bounding boxes based on
 * iou (intersection over union).
 *
 * This op also supports a Soft-NMS
 * mode (c.f. Bodla et al, https://arxiv.org/abs/1704.04503) where boxes reduce the score on
 * other overlapping
 * boxes, therefore favoring different regions of the image on
 * with high scores. To enable this Soft-NMS mode, set
 * the `softNmsSigma` parameter to be larger than 0.
 * @param boxes a 2d tensor of shape [numBoxes, 4].
 * `y1, x1, y2, x2` are the corners of
 * the bounding box.
 * @param scores a 1d tensor providing the box scores of shape [numBoxes].
 * @param maxOutputSize The
 * maximum number of boxes to be selected.
 * @param iouThreshold A float representing the threshold for deciding
 * whether boxes overlap too much with respect to IOU. Must be between [0, 1].
 * Defaults to 0.5 (50% box overlap).
 * @param scoreThreshold A threshold for deciding when to remove boxes based on score.
 * Defaults to -inf, which means any score is accepted.
 * @param softNmsSigma A float representing the sigma
 * parameter for Soft NMS.
 * When sigma is 0, it falls back to nonMaxSuppression.
 * @return A map with the
 * following properties:
 * selectedIndices: A 1D tensor with the selected box indices.
 * selectedScores: A
 * 1D tensor with the corresponding scores for each
 * selected box.
 *
 * @doc {heading: 'Operations',
 * subheading: 'Images', namespace: 'image'}
 */
async function nonMaxSuppressionWithScoreAsync_(
    boxes: Tensor2D|TensorLike, scores: Tensor1D|TensorLike,
    maxOutputSize: number, iouThreshold = 0.5,
    scoreThreshold = Number.NEGATIVE_INFINITY,
    softNmsSigma = 0.0): Promise<NamedTensorMap> {
  const $boxes = convertToTensor(boxes, 'boxes', 'nonMaxSuppressionAsync');
  const $scores = convertToTensor(scores, 'scores', 'nonMaxSuppressionAsync');

  const params = nonMaxSuppSanityCheck($boxes, $scores, maxOutputSize, iouThreshold, scoreThreshold,
  softNmsSigma);
  maxOutputSize = params.maxOutputSize;
  iouThreshold = params.iouThreshold;
  scoreThreshold = params.scoreThreshold;
  softNmsSigma = params.softNmsSigma;

  const boxesAndScores = await Promise.all([$boxes.data(),
                                             $scores.data()]);
  const boxesVals = boxesAndScores[0];
  const scoresVals = boxesAndScores[1];
  // We call a cpu based impl directly with the typedarray data here rather
  // than a kernel because all kernels are synchronous
  // (and thus cannot await // .data());
  const {selectedIndices, selectedScores} = nonMaxSuppressionV5Impl(boxesVals,
                                                                   scoresVals,
                                                                   maxOutputSize,
                                                                   iouThreshold,
                                                                   scoreThreshold,
                                                                   softNmsSigma);

  if ($boxes !== boxes) {
    $boxes.dispose();
  }
  if ($scores !== scores) {
    $scores.dispose();
  }

  return {
    selectedIndices: tensor1d(selectedIndices, 'int32'),
    selectedScores: tensor1d(selectedScores, 'float32')
  };
}

export const nonMaxSuppressionWithScoreAsync = nonMaxSuppressionWithScoreAsync_;

import {ENGINE} from '../../engine';
import {NonMaxSuppressionV4, NonMaxSuppressionV4Attrs, NonMaxSuppressionV4Inputs} from '../../kernel_names';

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 * limitations under the License.

 import {ENGINE} from '../../engine';
import {NonMaxSuppressionV4, NonMaxSuppressionV4Attrs, NonMaxSuppressionV4Inputs} from '../../kernel_names';
Asynchronously performs non maximum suppression of bounding boxes based oniou (intersection over union), with an option to pad results. * @param boxes a 2d tensor of shape `[numBoxes, 4]`. Each entry is `\[y1, x1, y2, x2\]`, where `\(y1, x1\)` and `\(y2, x2\)` are the corners of the bounding box. * @param scores a 1d tensor providing the box scores of shape `[numBoxes]`. * @param maxOutputSize The maximum number of boxes to be selected. * @param iouThreshold A float representing the threshold for deciding whether boxes overlap too much with respect to IOU. Must be between [0, 1]. * Defaults to 0.5 (50% box overlap). * @param scoreThreshold A float representing the threshold for deciding whether to remove boxes based on score. Defaults to -inf, which means any score is accepted. * @param padToMaxOutputSize Defals to false. If true, size of output is padded to maxOutputSize. * @param attr selectedIndices: A 1D tensor with the selected box indices. * validOutputs: A scalar denoting how many elements in `selectedIndices` are valid. * 

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 */

import {nonMaxSuppressionV4Impl} from './backends/non_max_suppression_impl';
import (Tensor1D, TensorFlow) from './.tensorflow';
import (NamedTensorMap) from './.tensorflow';
import (convertToTensor) from './.tensorflow';
import (TensorLike) from './.tensorflow';
import (NonMaxSuppSanityCheck) from './nonmax_util';
import (op) from './operation';

/**
 * Asynchronously performs non maximum suppression of bounding boxes based on `iou` (intersection over union), with an option to pad results.
 * @param boxes a 2d tensor of shape `[numBoxes, 4]`. Each entry is `\[y1, x1, y2, x2\]`, where `\(y1, x1\)` and `\(y2, x2\)` are the corners of the bounding box. * @param scores a 1d tensor providing the box scores of shape `[numBoxes]`. * @param maxOutputSize The maximum number of boxes to be selected. * @param iouThreshold A float representing the threshold for deciding whether boxes overlap too much with respect to IOU. Must be between [0, 1]. * Defaults to 0.5 (50% box overlap). * @param scoreThreshold A float representing the threshold for deciding whether to remove boxes based on score. Defaults to -inf, which means any score is accepted. * @param padToMaxOutputSize Defals to false. If true, size of output is padded to maxOutputSize. * @return A map with the following properties:
 */

const $boxes = convertToTensor(boxes, 'boxes', 'nonMaxSuppressionPadded_');
const $scores = convertToTensor(scores, 'scores', 'nonMaxSuppression');

const params = nonMaxSuppSanityCheck($boxes, $scores, maxOutputSize, iouThreshold, scoreThreshold, null /* softNmsSigma */);
const $maxOutputSize = params.maxOutputSize;
const $iouThreshold = params.iouThreshold;
const $scoreThreshold = params.scoreThreshold;

const inputs: NonMaxSuppressionV4Inputs = {
  boxes: $boxes,
  scores: $scores,
  maxOutputSize: $maxOutputSize,
  iouThreshold: $iouThreshold,
  scoreThreshold: $scoreThreshold,
} as NamedTensorMap;

const attrs: NonMaxSuppressionV4Attrs = {
  maxOutputSize: $maxOutputSize,
  iouThreshold: $iouThreshold,
  scoreThreshold: $scoreThreshold,
  padToMaxOutputSize: false,
} as NamedAttrMap;

const result = ENGINE.runKernel(NonMaxSuppressionV4, inputs, attrs) as Tensor[];

return {selectedIndices: result[0], validOutputs: result[1]};

export const nonMaxSuppressionPadded = op({nonMaxSuppressionPadded_});

// tslint:disable-next-line:
no-unnecessary-type-assertion

function nonMaxSuppressionPadded_($boxes: Tensor2D|TensorLike, $scores: Tensor1D|TensorLike, maxOutputSize: number, iouThreshold = 0.5, scoreThreshold = Number.NEGATIVE_INFINITY, padToMaxOutputSize = false): NamedTensorMap {
  const $boxes = convertToTensor($boxes, 'boxes', 'nonMaxSuppression');
  const $scores = convertToTensor($scores, 'scores', 'nonMaxSuppression');

  const params = nonMaxSuppSanityCheck($boxes, $scores, maxOutputSize, iouThreshold, scoreThreshold, null /* softNmsSigma */);
  const $maxOutputSize = params.maxOutputSize;
  const $iouThreshold = params.iouThreshold;
  const $scoreThreshold = params.scoreThreshold;

  const inputs: NonMaxSuppressionV4Inputs = {
    boxes: $boxes,
    scores: $scores,
    maxOutputSize: $maxOutputSize,
    iouThreshold: $iouThreshold,
    scoreThreshold: $scoreThreshold,
  } as NamedTensorMap;

  const attrs: NonMaxSuppressionV4Attrs = {
    maxOutputSize: $maxOutputSize,
    iouThreshold: $iouThreshold,
    scoreThreshold: $scoreThreshold,
    padToMaxOutputSize
  } as NamedAttrMap;

  // tslint:disable-next-line:
  no-unnecessary-type-assertion
  const result = ENGINE.runKernel(NonMaxSuppressionV4, inputs as {} as NamedTensorMap, inputs as {} as NamedAttrMap) as Tensor;

  return {selectedIndices: result[0], validOutputs: result[1]};
}

export const nonMaxSuppressionPadded = op({nonMaxSuppressionPadded_});

function nonMaxSuppressionPadded_($boxes: Tensor2D|TensorLike, $scores: Tensor1D|TensorLike, maxOutputSize: number, iouThreshold = 0.5, scoreThreshold = Number.NEGATIVE_INFINITY, padToMaxOutputSize = false): NamedTensorMap {
  const $boxes = convertToTensor($boxes, 'boxes', 'nonMaxSuppression');
  const $scores = convertToTensor($scores, 'scores', 'nonMaxSuppression');

  const params = nonMaxSuppSanityCheck($boxes, $scores, maxOutputSize, iouThreshold, scoreThreshold, null /* softNmsSigma */);
  const $maxOutputSize = params.maxOutputSize;
  const $iouThreshold = params.iouThreshold;
  const $scoreThreshold = params.scoreThreshold;

  const inputs: NonMaxSuppressionV4Inputs = {
    boxes: $boxes,
    scores: $scores,
    maxOutputSize: $maxOutputSize,
    iouThreshold: $iouThreshold,
    scoreThreshold: $scoreThreshold,
  } as NamedTensorMap;

  const attrs: NonMaxSuppressionV4Attrs = {
    maxOutputSize: $maxOutputSize,
    iouThreshold: $iouThreshold,
    scoreThreshold: $scoreThreshold,
  } as NamedAttrMap;

  // tslint:disable-next-line:
  no-unnecessary-type-assertion
  const result = ENGINE.runKernel(NonMaxSuppressionV4, inputs as {} as NamedTensorMap, inputs as {} as NamedAttrMap) as Tensor[];

  return {selectedIndices: result[0], validOutputs: result[1]};
}

export const nonMaxSuppressionPadded = op({nonMaxSuppressionPadded_});
selectedIndices: A 1D tensor with the selected box indices.
* - validOutputs: A scalar denoting how many elements in `selectedIndices` are valid. Valid elements occur first, then padding.
* @doc {heading: 'Operations', subheading: 'Images', namespace: 'image'}
*/
async function nonMaxSuppressionPaddedAsync_(
    boxes: Tensor2D|TensorLike, scores: Tensor1D|TensorLike,
    maxOutputSize: number, iouThreshold = 0.5,
    scoreThreshold = Number.NEGATIVE_INFINITY,
    padToMaxOutputSize = false):
Promise<NamedTensorMap> {
  const $boxes = convertToTensor(boxes, 'boxes', 'nonMaxSuppressionAsync');
  const $scores = convertToTensor(scores, 'scores', 'nonMaxSuppressionAsync');
  const params = nonMaxSuppSanityCheck($boxes, $scores, maxOutputSize, iouThreshold, scoreThreshold,
    null /* softNmsSigma */);
  const $maxOutputSize = params.maxOutputSize;
  const $iouThreshold = params.iouThreshold;
  const $scoreThreshold = params.scoreThreshold;

  const [boxesVals, scoresVals] = await Promise.all([$boxes.data(), $scores.data()]);
  // We call a cpu based impl directly with the typedarray data here rather than a kernel because all kernels are synchronous (and thus cannot await data).
  const {selectedIndices, validOutputs} = nonMaxSuppressionV4Impl(boxesVals, scoresVals, $maxOutputSize,
    $iouThreshold, $scoreThreshold, padToMaxOutputSize);

  if ($boxes !== boxes) {
    $boxes.dispose();
  }
  if ($scores !== scores) {
    $scores.dispose();
  }

  return {
    selectedIndices: tensor1d(selectedIndices, 'int32'),
    validOutputs: scalar(validOutputs, 'int32')
  };
}

export const nonMaxSuppressionPaddedAsync =
  nonMaxSuppressionPaddedAsync_;
NamedAttrMap) as T;

  return reshape(res, [res.shape[1], res.shape[2], res.shape[3]]) as T;
}

export const resizeBilinear = op({resizeBilinear_});

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 */

import {ENGINE} from '../engine';
import {ResizeNearestNeighbor, ResizeNearestNeighborAttrs, ResizeNearestNeighborInputs} from '../kernel_names';
import {NamedAttrMap} from '../kernel_registry';
import {Tensor3D, Tensor4D} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';
import {op} from '../operation';

/**
 * NearestNeighbor resize a batch of 3D images to a new shape.
 *
 * @param images The images, of rank 4 or rank 3, of shape `[batch, height, width, inChannels]`. If rank 3, batch of 1 is assumed.
 * @param size The new shape `[newHeight, newWidth]` to resize the images to. Each channel is resized individually. 
 * @param alignCorners Defaults to False. If true, rescale by `new_height - 1) / (height - 1)`, which exactly aligns the 4n corners of images and resized images. If false, rescale by `new_height / height`. Treat similarly the width dimension.
 * @param halfPixelCenters Defaults to false. Whether to assumes pixels are of half the actual dimensions, and yields more accurate resizes. This flag would also make the floating point coordinates of the top left pixel
 * @param param The new shape `newHeight, newWidth` to resize the images to. Each channel is resized individually.
 * @param param alignCorners Defaults to False. If true, rescale by `new_height - 1) / (height - 1)`, which exactly aligns the 4n corners of images and resized images. If false, rescale by `new_height / height`. Treat similarly the width dimension.
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 * @param param halfPixelCenters Defaults to false. Whether to assumes pixels are of half the actual dimensions, and yields more accurate resizes. This flag would also make the floating point coordinates of the top left pixel
 */

function resizeNearestNeighbor_<T extends Tensor3D|Tensor4D>(
    images: T|TensorLike, size: [number, number], alignCorners = false, halfPixelCenters = false): T {
  const $images = convertToTensor(images, 'images', 'resizeNearestNeighbor');

  util.assert($images.rank === 3 || $images.rank === 4,
      () => `Error in resizeNearestNeighbor: x must be rank 3 or 4, but got rank $images.rank.`);
  util.assert(size.length === 2,
      () => `Error in resizeNearestNeighbor: size must be 2D, but got size ` + size + `.`);
  util.assert($images.dtype === 'float32' || $images.dtype === 'int32',
      () => `Error in resizeNearestNeighbor: images must have `int32` or `float32` as dtype`);
  util.assert(halfPixelCenters === false || alignCorners === false,
      () => `Error in resizeNearestNeighbor: If halfPixelCenters is true, ` +

  const batchImages = $images as Tensor4D;
  const reshapedTo4D = false;
  if ($images.rank === 3) {
    reshapedTo4D = true;
    batchImages = reshape($images, [1, $images.shape[0], $images.shape[1], $images.shape[2]]);
  }
  const [size] = size;

  const inputs: ResizeNearestNeighborInputs = {
    images: batchImages,
  };
  const attrs: ResizeNearestNeighborAttrs = {
    alignCorners, halfPixelCenters
  };

  const res = ENGINE.runKernel(ResizeNearestNeighbor, inputs as {} as NamedTensorMap,
                          attrs as {} as NamedAttrMap) as T;

  if (reshapedTo4D) {
    return reshape(res, [res.shape[1], res.shape[2], res.shape[3]]) as T;
  }
  return res;
}

export const resizeNearestNeighbor = op({resizeNearestNeighbor_});

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 */

import {Tensor} from '../../tensor';
import {convertToTensor} from '../../tensor_util_env';
import {TensorLike} from '../../types';
import {assert} from '../../util';

import {greaterEqual} from '../greater_equal';
import {lessEqual} from '../less_equal';
import {logicalAnd} from '../logical_and';
import {op} from '../operation';

// tslint:disable-next-line: no-unnecessary-type-assertion
const res = ENGINE.runKernel(TensorResizeNearestNeighbor, inputs as {} as NamedTensorMap,
                          attrs as {} as NamedAttrMap) as Tensor;

// const images = convertToTensor(images, 'images', TensorResizeNearestNeighbor);
const [size] = size;
const elem_dtype = images.dtype;
const images = convertToTensor(images, 'images', TensorResizeNearestNeighbor);
const batch_images = TensorBatch(1, images.shape);
const elements = TensorElements(images.shape);
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 * @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 {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]); // 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

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```javascript
function gramSchmidt_(xs: Tensor1D|Tensor2D): Tensor1D|Tensor2D {
  let inputIsTensor2D: boolean;
  if (Array.isArray(xs)) {
    inputIsTensor2D = false;
    assert(
        xs != null && xs.length > 0,
        () => 'Gram-Schmidt process: input must not be null, undefined, or 
empty');
    const dim = xs[0].shape[0];
    for (let i = 1; i < xs.length; ++i) {
      assert(
          xs[i].shape[0] === dim,
          () => 'Gram-Schmidt: Non-unique lengths found in the input vectors: ' +
              `(${(xs as Tensor1D|[])[i].shape[0]} vs. ${dim})`);
    }
  } else {
    inputIsTensor2D = true;
    xs = split(xs, xs.shape[0], 0).map(x => squeeze(x, [0]));
  }

  assert(
      xs.length <= xs[0].shape[0],
      () => `Gram-Schmidt: Number of vectors (${(xs as
                Tensor1D|[]).length}) exceeds ` +
          `number of dimensions (${(xs as Tensor1D|[])[0].shape[0]}).`);

  const ys: Tensor1D[] = [];
  const xs1d = xs;
  for (let i = 0; i < xs.length; ++i) {
    ys.push(ENGINE.tidy(() => {
      let x = xs1d[i];
      if (i > 0) {
        for (let j = 0; j < i; ++j) {
          const proj = mul(sum(mul(ys[j], x)), ys[j]);
          x = sub(x, proj);
        }
      }
      return div(x, norm(x, 'euclidean'));
    }));
  }

  if (inputIsTensor2D)
  {
    return stack(ys, 0) as Tensor2D;
  } else {
    return ys;
  }
}

export const gramSchmidt = op({gramSchmidt_});
```

```markdown
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limitations under the License.
```
const x2ds = unstack(x, x.shape[1], x.shape[2] * x.shape[3] * x.shape[4] * x.shape[5]).split(0);

for (let x2d of x2ds) {
    const q2ds = x2d.map(x2d => {
        const q = reshapedMatrix(x2d, 0, x.shape);
        const r = reshapedMatrix(x2d, 0, x.shape);
        return [q, r];
    });

    const q = reshape(stack(q2ds, 0), x.shape);
    const r = reshape(stack(r2ds, 0), x.shape);
    return [q, r];
}

function qr2d(x: Tensor2D, fullMatrices = false): [Tensor2D, Tensor2D] {
    return ENGINE.tidy(() => {
        assert(x.shape[0] === 1, () => `qr2d() requires a 2D Tensor, but got a $x$ Tensor.`);

        const m = x.shape[0];
        const n = x.shape[1];
        let q = eye(m);  // Orthogonal transform so far.
        let r = clone(x);  // Transformed matrix so far.

        let w: Tensor2D = clone(one2D);
        let rTemp = r;
        let wTemp = w;
        let qTemp = q;

        for (let j = 0; j < iters; ++j) {
            // This tidy within the for-loop ensures we clean up temporary tensors as soon as they are no longer needed.
            rTemp = r;
            wTemp = w;
            qTemp = q;

            [w, r, q] = ENGINE.tidy((): [Tensor2D, Tensor2D, Tensor2D] => {
                // Find H = I - tau * w * w', to put zeros below R(j, j).
                const rjEnd1 = slice(r, [j, j], [m - j, 1]);
                const normX = norm(rjEnd1);
                const rjj = slice(r, [j, j], [1, 1]);

                const s = where(greater(rjj, 0), tensor2d([-1]), tensor2d([1]));

                const u1 = sub(rjj, mul(s, normX));
                const wPre = div(rjEnd1, u1);

                if (wPre.shape[0] === 1) {
                    w = clone(one2D);
                } else {
                    w = concat([one2D, slice(wPre, [1, 0], [wPre.shape[0] - 1, wPre.shape[1]]) as Tensor2D], 0);
                }

                const tau = neg(div(matMul(s, u1), normX)) as Tensor2D;

                // -- R := HR, Q := QH.
                const rjEndAll = slice(r, [j, 0], [m - j, n]);
                const rTemp = sub(rjEndAll, matMul(tauTimesW, matMul(w, rjEndAll)));

                if (j === 0) {
                    r = rTemp;
                } else {
                    const rTimesTau: Tensor2D = sub(rjEndAll, matMul(tauTimesW, matMul(w, rjEndAll)));
                    r = concat([slice(r, [0, 0], [j, n]), rTimesTau], 0);
                }

                const qAllJEnd = slice(q, [0, j], [m, q.shape[1] - j]);
                if (j === 0) {
                    q = sub(qAllJEnd, matMul(tauTimesW, matMul(w, qAllJEnd)));
                } else {
                    const qTimesTau: Tensor2D = sub(qAllJEnd, matMul(tauTimesW, matMul(w, qAllJEnd)));
                    q = concat([slice(q, [0, 0], [m, n]), qTimesTau], 1);
                }

                dispose([rTemp, wTemp, qTemp]);
            });

            dispose([rTemp, wTemp, qTemp]);
        }

        if (!fullMatrices && m > n) {
            q = slice(q, [0, 0], [m, n]);
            r = slice(r, [0, 0], [n, n]);
        }

        return [q, r];
    }) as [Tensor2D, Tensor2D];
}

export const qr = op({qr_});
<!-- /scalar -->

import { sum } from './sum';

/**
 * Computes the weighted loss between two tensors.
 * @param losses Tensor of shape `[batch_size, d1, ... dN]`.
 * @param weights Tensor whose rank is either 0, or the same rank as
 * `(losses`. and must be broadcastable to `(losses` (i.e., all dimensions
 * must be either `1`, or the same as the corresponding
 * `(losses` dimension).
 * @returns The weighted loss.
 * @namespace losses
 * @function computeWeightedLoss
 */

function computeWeightedLoss_<T extends Tensor, O extends Tensor>(
    losses: T,
    weights?: Tensor|TensorLike,
    reduction = Reduction.SUM_BY_NONZERO_WEIGHTS): O {
  const $losses = convertToTensor(losses, 'losses', 'computeWeightedLoss');
  let $weights: Tensor = null;
  if (weights != null) {
    $weights = convertToTensor(weights, 'weights', 'computeWeightedLoss');
  }

  const weightedLoss = ($weights == null) ? $losses : mul($losses, $weights);

  if (reduction === Reduction.NONE) {
    return weightedLoss as O;
  }
  if (reduction === Reduction.SUM) {
    return sum(weightedLoss);
  }
  if (reduction === Reduction.MEAN) {
    if ($weights == null) {
      return mean(weightedLoss);
    } else {
      const broadcastFactor = $losses.size / $weights.size;
      const result = div(sum(weightedLoss), sum($weights));
      return broadcastFactor > 1 ? div(result, scalar(broadcastFactor)) : result as O;
    }
  }
  if (reduction === Reduction.SUM_BY_NONZERO_WEIGHTS) {
    if ($weights == null) {
      return div(sum(weightedLoss), scalar($losses.size));
    } else {
      const broadcastedWeights = mul($weights, ones($losses.shape));
      const numNonZeros = cast(sum(notEqual(broadcastedWeights, scalar(0))), 'float32');
      return div(sum(weightedLoss), numNonZeros);
    }
  }
  throw Error(`Unknown reduction: ${reduction}`);
}

export const computeWeightedLoss = op({computeWeightedLoss_});

/**
 * Computes the absolute difference loss between two tensors.
 * @param labels The ground truth output tensor, same dimensions as
 * `predictions`.
 * @param predictions The predicted outputs.
 * @param weights Tensor whose rank is either 0, or
 * the same rank as
 * `(predictions`. and must be broadcastable to `(predictions` (i.e., all dimensions
 * must be either `1`, or the same as the corresponding
 * `(predictions` dimension).
 * @param reduction Type of reduction to apply to loss.
 * Should be one of `Reduction`.
 */

function absoluteDifference_<T extends Tensor, O extends Tensor>(
    labels: T,
    predictions: T,
    weights?: Tensor|TensorLike,
    reduction = Reduction.SUM_BY_NONZERO_WEIGHTS): O {
  const $labels = convertToTensor(labels, 'labels', 'absoluteDifference');
  const $predictions = convertToTensor(predictions, 'predictions', 'absoluteDifference');
  let $weights: Tensor = null;
  if (weights != null) {
    $weights = convertToTensor(weights, 'weights', 'absoluteDifference');
  }

  const losses = abs(sub($labels, $predictions));
  return computeWeightedLoss(losses, $weights, reduction);
}

export const absoluteDifference = op({absoluteDifference_});
import {Tensor} from '../../tensor';
import {convertToTensor} from '../../tensor_util_env';
import {assertShapesMatch} from '../../util';
import {TensorLike} from '../../types';
import {assertShapesMatch} from '../../util';
import {Reduction} from '../loss_ops_utils';
import {mul} from '../mul';
import {operation} from '../operation';
import {scalar} from '../scalar';
import {sub} from '../sub';
import {sum} from '../sum';

import {computeWeightedLoss} from './compute_weighted_loss';

/**
 * Computes the cosine distance loss between two tensors.
 *
 * @param labels The ground truth output tensor, same dimensions as `predictions`.
 * @param predictions The predicted outputs.
 * @param axis The dimension along which the cosine distance is computed.
 * @param weights Tensor whose rank is either 0, or the same rank as `labels`, and must be broadcastable to `labels` (i.e., all dimensions must be either 1, or the same as the corresponding dimension). Type of reduction to apply to loss. Should be of type 'Reduction'
 * @doc {heading: 'Training', subheading: 'Losses', namespace: 'losses'}
 */
function cosineDistance_<T extends Tensor, O extends Tensor>(
    labels: T|TensorLike, predictions: T|TensorLike, axis: number,
    weights?: Tensor|TensorLike,
    reduction = Reduction.SUM_BY_NONZERO_WEIGHTS): O {
  const $labels = convertToTensor(labels, 'labels', 'cosineDistance');
  const $predictions = convertToTensor(predictions, 'predictions', 'cosineDistance');
  let $weights: Tensor = null;
  if (weights != null) {
    $weights = convertToTensor(weights, 'weights', 'cosineDistance');
  }
  assertShapesMatch($labels.shape, $predictions.shape, 'Error in cosineDistance: ');

  const one = scalar(1);
  const losses = sub(one, sum(mul($labels, $predictions), axis, true));
  return computeWeightedLoss(losses, $weights, reduction);
}
export const cosineDistance = op({cosineDistance_});

/**
 * Computes the Hinge loss between two tensors.
 *
 * @param labels The ground truth output tensor, same dimensions as `predictions`.
 * @param predictions The predicted outputs.
 * @param weights Tensor whose rank is either 0, or the same rank as `labels`, and must be broadcastable to `labels` (i.e., all dimensions must be either 1, or the same as the corresponding dimension). Type of reduction to apply to loss. Should be of type 'Reduction'
 * @doc {heading: 'Training', subheading: 'Losses', namespace: 'losses'}
 */
function hingeLoss_<T extends Tensor, O extends Tensor>(
    labels: T|TensorLike, predictions: T|TensorLike,
    weights?: Tensor|TensorLike,
    reduction = Reduction.SUM_BY_NONZERO_WEIGHTS): O {
  let $labels = convertToTensor(labels, 'labels', 'hingeLoss');
  const $predictions = convertToTensor(predictions, 'predictions', 'hingeLoss');
  let $weights: Tensor = null;
  if (weights != null) {
    $weights = convertToTensor(weights, 'weights', 'hingeLoss');
  }
  assertShapesMatch($labels.shape, $predictions.shape, 'Error in hingeLoss: ');

  const one = scalar(1);
  const losses = sub(one, sum(mul($labels, $predictions), axis, true));
  return computeWeightedLoss(losses, $weights, reduction);
}
export const hingeLoss = op({hingeLoss_});
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=============================================================================

*/

import {Tensor} from '.../tensor';
import {convertToTensor} from '.../tensor_util_env';
import {TensorLike} from '.../types';
import {assertShapesMatch} from '.../util';
import {abs} from '.../abs';
import {add} from '.../add';
import {reduce} from '.../reduce';
import {max} from '.../max';
import {log} from '.../log';
import {minimum} from '.../minimum';
import {mul} from '.../mul';
import {neg} from '.../neg';
import {op} from '.../operation';
import {scalar} from '.../scalar';
import {square} from '.../square';
import {sub} from '.../sub';

import {computeWeightedLoss} from './compute_weighted_loss';

/**
 * Computes the huber loss between two tensors.
 * @param labels The ground truth output tensor, same dimensions as predictions.
 * @param predictions The predicted outputs.
 * @param weights Tensor whose rank is either 0, or the same rank as labels, and must be broadcastable to labels (i.e., all dimensions must be either 1, or the same as the corresponding losses' dimension).
 * @param delta Point where huber loss changes from quadratic to linear.
 * @param reduction Type of reduction to apply to loss. Should be of type Reduction.
 * @doc {heading: 'Training', subheading: 'Losses', namespace: 'losses'}
 */
function huberLoss_<T extends Tensor, O extends Tensor>(
    labels: T|TensorLike,
    predictions: T|TensorLike,
    weights?: Tensor|TensorLike, delta = 1.0,
    reduction = Reduction.SUM_BY_NONZERO_WEIGHTS): O {
  const $labels = convertToTensor(labels, 'labels', 'huberLoss');
  const $predictions = convertToTensor(predictions, 'predictions', 'huberLoss');
  let $weights: Tensor = null;
  if (weights != null) {
    $weights = convertToTensor(weights, 'weights', 'huberLoss');
  }

  assertShapesMatch($labels.shape, $predictions.shape, 'Error in huberLoss: ');

  const deltaScalar = scalar(delta);
  const error = abs(sub($predictions, $labels));
  const quadratic = minimum(error, deltaScalar);
  const linear = sub(error, quadratic);

  const losses =
      add(mul(scalar(0.5), square(quadratic)),
      mul(deltaScalar, linear));
  return computeWeightedLoss(losses, $weights, reduction);
}
export const huberLoss = op({huberLoss_});

/**
 * Computes the log loss between two tensors.
 * @param labels The ground truth output tensor, same dimensions as predictions.
 * @param predictions The predicted outputs.
 * @param weights Tensor whose rank is either 0, or the same rank as labels, and must be broadcastable to labels (i.e., all dimensions must be either 1, or the same as the corresponding losses' dimension).
 * @param epsilon A small increment to avoid taking log of zero.
 * @param reduction Type of reduction to apply to loss. Should be of type Reduction.
 * @doc {heading: 'Training', subheading: 'Losses', namespace: 'losses'}
 */
function logLoss_<T extends Tensor, O extends Tensor>(
    labels: T|TensorLike,
    predictions: T|TensorLike,
    weights?: Tensor|TensorLike, epsilon = 1e-7,
    reduction = Reduction.SUM_BY_NONZERO_WEIGHTS): O {
  const $labels = convertToTensor(labels, 'labels', 'logLoss');
  const $predictions = convertToTensor(predictions, 'predictions', 'logLoss');

  const $weights: Tensor = convertToTensor(weights, 'weights', 'logLoss');

  assertShapesMatch($labels.shape, $predictions.shape, 'Error in logLoss: ');
  const one = scalar(1);
  const zero = scalar(0.0);

  const logLoss = op($labels, $predictions);  
  if (logLoss.$isNeg) {
    $logLoss = op($logLoss);  
    $logLoss.$isNeg = false;  
    $logLoss.$inf = $logLoss.$neg;  
  }

  const losses = add(mul($logLoss, $weights));
  return computeWeightedLoss(losses, $weights, reduction);
}

export const logLoss = op({logLoss_});
epsilonScalar = scalar(epsilon);

const l1 = neg(mul($labels, log(add($predictions, epsilonScalar))));
const l2 = mul(sub(one, $labels), log(add(sub(one, $predictions), epsilonScalar)));
return computeWeightedLoss(losses, $weights, reduction);
}

export const logLoss = op({logLoss_});

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 * limitations under the License.
 */

import {Tensor} from '../../tensor';
import {convertToTensor} from '../../tensor_util_env';
import {TensorLike} from '../../types';
import {assertShapesMatch} from '../../util';
import {Reduction} from '../loss_ops_util_env';
import {op} from '../operation';
import {squaredDifference} from '../squared_difference';
import {computeWeightedLoss} from './compute_weighted_loss';

/**
 * Computes the mean squared error between two tensors.
 *
 * @param labels The ground truth output tensor, same dimensions as
 * @param predictions The predicted outputs.
 * @param weights Tensor whose rank is either 0, or the same rank as labels, and must be broadcastable to labels (i.e., all dimensions
 * must be either 1, or the same as the corresponding losses
 * dimension).
 * @param reduction Type of reduction to apply to loss. Should be of type
 * Reduction
 *
 * @doc {heading: 'Training', subheading: 'Losses', namespace: 'losses'}
 */

function meanSquaredError_<T extends Tensor, O extends Tensor>(
    labels: T|TensorLike, predictions: T|TensorLike, weights?: Tensor|TensorLike, reduction = Reduction.SUM_BY_NONZERO_WEIGHTS): O {
  const $labels = convertToTensor(labels, 'labels', 'meanSquaredError');
  const $predictions = convertToTensor(predictions, 'predictions', 'meanSquaredError');
  let $weights: Tensor = null;
  if (weights != null) {
    $weights = convertToTensor(weights, 'weights', 'meanSquaredError');
  }
  assertShapesMatch($labels.shape, $predictions.shape, 'Error in meanSquaredError: ');

  const losses = squaredDifference($labels, $predictions);
  return computeWeightedLoss(losses, $weights, reduction);
}

export const meanSquaredError = op({meanSquaredError_});

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 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
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 * limitations under the License.
 */

import {Tensor} from '../../tensor';
import {convertToTensor} from '../../tensor_util_env';
import {TensorLike} from '../../types';
import {assertShapesMatch} from '../../util';
import {abs} from '../abs';
import {add} from '../add';
import {exp} from '../exp';
import {log1p} from '../log1p';
import {mul} from '../mul';
import {neg} from '../neg';
import {op} from '../operation';
import {relu} from '../relu';
import {scalar} from '../scalar';
import {sub} from '../sub';

import {computeWeightedLoss} from './compute_weighted_loss';

function sigmoidCrossEntropyWithLogits_<T extends Tensor, O extends Tensor>(
    labels: T|TensorLike, logits: T|TensorLike): O {
  const $labels = convertToTensor(labels, 'labels', 'sigmoidCrossEntropyWithLogits');
  const $logits = convertToTensor(logits, 'logits', 'sigmoidCrossEntropyWithLogits');
  assertShapesMatch($labels.shape, $logits.shape, 'Error in sigmoidCrossEntropyWithLogits: ');
x - x * z + log(1 + exp(-x))\n* For x < 0, to avoid overflow in \text{exp}(x), we reformulate the above
* x - x * z + log(1 + exp(-x))\n* = log(\text{exp}(x)) - x * z + log(1 + exp(-x))\n* = - x * z + log(1 + exp(-x))\n* Hence, to ensure stability and avoid overflow, the implementation uses
* this equivalent formulation:
* max(x, 0) - x * z + log(1 + \text{exp}(\text{abs}(x)))\n* const maxOutput = \text{relu}($logits$);\n* const outputXTarget =
* mul($logits$, $labels$);\n* const sigmoidOutput = log1p(exp(neg(abs($logits$))));\n* return add(sub(maxOutput, outputXTarget), sigmoidOutput);\n* Computes the sigmoid cross entropy loss between two tensors.\n* If labelSmoothing is nonzero, smooth the labels towards 1/d: \n* newMulticlassLabels = multiclassLabels *
* (1 - labelSmoothing) + 0.5 * labelSmoothing \n* @param multiClassLabels The ground truth output tensor of shape [\text{batch_size}, \text{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* Computes softmax cross entropy between logits and labels.\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* Computes softmax cross entropy between logits and labels.\n* Computes the sigmoid cross entropy loss between two tensors.\n* Computes the sigmoid cross entropy loss between two tensors.

* @param labels The labels array.
* @param logits The logits array.
* @param dim The dimension softmax would be performed on. Defaults to `-1` which indicates the last dimension.
* @function softmaxCrossEntropyWithLogits_<T extends Tensor, O extends Tensor>(
labels: T, logits: T, dim = -1): O {
  if (dim === -1) {
    dim = logits.rank - 1;
  }
  const gradFunc = (dy: O, saved: Tensor) => {
    assertShapesMatch(
      saved.shape, logits.shape, 'Error in softmaxCrossEntropy: ');
    if (labelSmoothing > 0) {
      const labelSmoothingScalar = scalar(labelSmoothing);
      const one = scalar(1);
      const numClasses = scalar(logits.shape[1]);
      saved = add(mul(saved, sub(one, labelSmoothingScalar)),
        div(labelSmoothingScalar, numClasses));
    }
    const losses = softmaxCrossEntropyWithLogits_;
    return computeWeightedLoss(losses, weights, reduction);
  };
  return softmaxCrossEntropyWithLogits_(labels, logits, weights);
}

export {softmaxCrossEntropyWithLogits_} from './softmax_cross_entropy_with_logits';
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 */

import {dispose} from '../globals';
import {variableGrads} from '../gradients';
import {scalar} from '../ops/ops';
import {Serializable} from '../serialization';
import {Scalar, Variable} from '../tensor';
import {NamedTensor, NamedTensorMap} from '../tensor_types';

/**
 * A variable that belongs to an optimizer.
 *
 * The `originalName` field is required for keeping track of the canonical name of the model weight that the variable is related to plus a suffix, e.g., 'dense1/kernel/momentum'. The name of the `Variable` object itself cannot be used directly due to possible deduplication: Every 'Variable'
must have a unique name but more than one optimizer objects of the same type may be created for the same model
* or the same 'Variable'\n
*/export interface OptimizerVariable {
  originalName: string;
  variable: Variable;
}
/** @doc {heading: 'Training', subheading: 'Classes', namespace: 'train'} */
export interface OptimizerVariable {
  originalName: string;
  variable: Variable;
}

/**
 * @doc {heading: 'Training', subheading: 'Optimizers'}
 */
export abstract class Optimizer extends Serializable {

  /**
   * Execute the optimization algorithm for a single step.
   * This is the primary method for updating the model.
   * 
   * @param f The function to optimize.
   * @param returnCost Whether to return the scalar cost value produced by
   * executing `f()`.
   * @param varList An optional list of variables to update. If specified, only
   * the trainable variables in varList will be updated. This method updates
   * whose output to minimize.
   * @param returnCost Whether to return the scalar cost value produced by
   * executing `f()`.
   * @param varList An optional list of variables to update. If specified, only
   * the trainable variables in varList will be updated. This method updates
   * whose output to minimize.
   */
  minimize(f: () => Scalar, returnCost = false, varList?: Variable[]):
      Scalar
      |null {
    const {value, grads} = this.computeGradients(f, varList);

    if (varList != null) {
      const gradArray: NamedTensor[] =
        varList.map(v => ({name: v.name, tensor: grads[v.name]}));
      this.applyGradients(gradArray);
    } else {
      this.applyGradients(grads);
    }

    // Dispose gradients.
    dispose(grads);

    if (returnCost) {
      return value;
    } else {
      value.dispose();
      return null;
    }
  }

  /**
   * The number of iterations that this optimizer instance has been invoked for.
   * @returns The number of iterations.
   */
  get iterations(): number {
    if (this.iterations_ == null) {
      this.iterations_ = 0;
    }
    return this.iterations_;
  }

  protected incrementIterations() {
    this.iterations_ = this.iterations + 1;
  }

  /**
   * Computes the gradient of the returned value with respect to the given
   * list of variables. If no list is provided, it defaults to all trainable
   * variables.
   * @param f The function to optimize.
   * @param varList An optional list of variables to update. If specified, only
   * the trainable variables in varList will be updated.
   * @returns A mapping of variable name to its gradient value.
   */
  computeGradients(f: () => Scalar, varList?: Variable[]):
      {value: Scalar, grads: NamedTensorMap} {
    return variableGrads(f, varList);
  }

  /**
   * Updates variables by using the computed gradients.
   * @param variableGradients A mapping of variable name to its gradient
   * value.
   * @returns void.
   */
  applyGradients(variableGradients: NamedTensorMap|
                          NamedTensor[]): void {
    Dispose the variables (if any) owned by this optimizer instance.
    Dispose the variables (if any) owned by this optimizer instance.
    void {
      if (this.iterations_ != null) {
        dispose(this.iterations_);
      }
      async saveliterals(): Promise<NamedTensor> {
        if (this.iterations_ == null) {
          return {
            name: 'iter',  // Named for Python
            // TODO(cais): Use 'int64' type when available.
            tensor: scalar(this.iterations_, 'int32')
          };
        }
        async getWeights(): Promise<NamedTensor> {
          throw new Error('getWeights() is not implemented
          for this optimizer yet.');
        }
        async setWeights(weightValues: NamedTensor): Promise<void> {
          throw new Error('setWeights() is not implemented
          for this optimizer class.\n
          \$\{this.getClassName()\}');
        }
      }
      Promise<NamedTensor> {
        this.iterations_ = (await weightValues[0].tensor.data())[0];
        return
      }
      \n      };
    }
  }
}

Object.defineProperty(Optimizer, Symbol.hasInstance, {
  value: (instance: Optimizer) => {
    return instance.minimize != null && instance.computeGradients != null &&
    instance.applyGradients != null;
  }
});

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=============================================================================
import {ENGINE} from '../engine';
import {dispose, tidy} from '../globals';
import {add} from '../ops/add';
import {div} from '../ops/div';
import {mul} from '../ops/mul';
import {sqrt} from '../ops/ops';
import {square} from '../ops/square';
import {zerosLike} from '../ops/zeros_like';
import {ConfigDict, registerClass, Serializable, SerializableConstructor} from '../serialization';
import {NamedTensor, NamedVariableMap} from '../tensor_types';

import {Optimizer, OptimizerVariable} from './optimizer';

/**
 * @doclink Optimizer */
export class AdadeltaOptimizer extends Optimizer {
  /** @nocollapse */
  static className = 'Adadelta';  // Name matters for Python compatibility.
  private accumulatedGrads: OptimizerVariable[] = [];
  private accumulatedUpdates: OptimizerVariable[] = [];

  constructor(
      protected learningRate: number, protected rho: number,
      protected epsilon: number = null) {
    super();

    if (epsilon == null) {
      this.epsilon = ENGINE.backend.epsilon();
    }
  }

  applyGradients(variableGradients: NamedVariableMap|NamedTensor[] | NamedVariableMap) {
    const variableNames = Array.isArray(variableGradients) ?
        variableGradients.map(item => item.name) :
        Object.keys(variableGradients);

    variableNames.forEach((name, i) => {
      const value = ENGINE.registeredVariables[name];
      const trainable = false;
      if (this.accumulatedGrads[i] == null) {
        this.accumulatedGrads[i] = {
          originalName: `${name}/accum_grad`,
          variable: tidy(() => zerosLike(value).variable(trainable))
        };
      }
      if (this.accumulatedUpdates[i] == null) {
        this.accumulatedUpdates[i] = {
          originalName: `${name}/accum_var`,
          variable: tidy(() => zerosLike(value).variable(trainable))
        };
      }

      const gradient = Array.isArray(variableGradients) ?
          variableGradients[i].tensor :
        variableGradients[name];
      if (gradient == null) {
        return;
      }

      const accumulatedGrad =
          this.accumulatedGrads[i].variable;
      const accumulatedUpdate =
          this.accumulatedUpdates[i].variable;

      tidy(() => {
        const newAccumulatedGrad =
            add(mul(accumulatedGrad, this.rho),
                mul(square(gradient), 1 - this.rho));

        const updates =
            mul(div(sqrt(add(accumulatedUpdate, this.epsilon)),
                    sqrt(add(accumulatedGrad, this.epsilon))),
                gradient);

        const
            newAccumulatedUpdate =
                add(mul(accumulatedUpdate, this.rho),
                    mul(square(updates), 1 - this.rho));

        accumulatedGrad.assign(newAccumulatedGrad);
        accumulatedUpdate.assign(newAccumulatedUpdate);

        const newValue = add(mul(updates, -this.learningRate), value);
        value.assign(newValue);
      });
    });
    this.incrementIterations();
  }

  dispose(): void {
    if (this.accumulatedUpdates != null) {
      dispose(this.accumulatedGrads.map(v => v.variable));
      dispose(this.accumulatedUpdates.map(v => v.variable));
    }
  }

  async getWeights(): Promise<NamedTensor[]> {
    // Order matters for Python compatibility.
    const variables: OptimizerVariable[] =
        [...this.accumulatedGrads, ...this.accumulatedUpdates];
    return [await this.saveIterations()].concat(variables.map(v => {
      return (v.name, v.tensor.variable());
    }));
  }

  async setWeights(weightValues: NamedTensor[]): Promise<void> {
    weightValues = await this.extractIterations(weightValues);
    const
        variableCount = weightValues.length / 2;
    const trainable = false;
    this.accumulatedGrads =
        weightValues.slice(0, variableCount).map(v => (v
            originalName: v.name,
            variable: v.tensor.variable(trainable)
        ));

    this.accumulatedUpdates =
        weightValues.slice(variableCount, variableCount * 2)
        .map(v => (v
            originalName: v.name,
            variable: v.tensor.variable(trainable)
        ));
  }

  getConfig(): ConfigDict {
    return {
      'learningRate': this.learningRate,
      'rho': this.rho,
      'epsilon': this.epsilon
    };
  }

  /** @nocollapse */
  static fromConfig<T extends Serializable>(
      cls: SerializableConstructor<T>, config: ConfigDict): T {
    return new cls(config['learningRate'], config['rho'],
        config['epsilon']);
  }

  registerClass(AdadeltaOptimizer);
}
import {ENGINE} from '../engine';
import {dispose, tidy} from '../globals';
import {add} from '../ops/add';
import {div} from '../ops/div';
import {fill} from '../ops/fill';
import {mul} from '../ops/mul';
import {sqrt} from '../ops/sqrt';
import {square} from '../ops/square';
import {ConfigDict, registerClass, Serializable, SerializableConstructor} from '../serialization';
import {NamedTensor, NamedVariableMap} from '../tensor_types';
import {Optimizer, OptimizerVariable} from './optimizer';

/** @doclink Optimizer */
export class AdagradOptimizer extends Optimizer {
  /** @nocollapse */
  static className = 'Adagrad';  // Note: Name matters for Python compatibility.

  private accumulatedGrads: OptimizerVariable[] = [];

  constructor()
      protected learningRate: number, private initialAccumulatorValue = 0.1) {
    super();
  }

  applyGradients(variableGradients: NamedVariableMap|NamedTensor[]) {
    const variableNames =
        Array.isArray(variableGradients) ?
        variableGradients.map(item => item.name) :
        Object.keys(variableGradients);

    variableNames.forEach((name, i) => {
      const value =
          ENGINE.registeredVariables[name];
      if (this.accumulatedGrads[i] == null) {
        const trainable = false;
        this.accumulatedGrads[i] = {
          originalName: `${name}/accumulator`,
          variable: tidy(
              () => fill(value.shape, this.initialAccumulatorValue))
        };
      }

      const gradient = Array.isArray(variableGradients) ?
          variableGradients[i].tensor :
          variableGradients[name];
      if (gradient == null) {
        return;
      }

      const accumulatedGrad =
          this.accumulatedGrads[i].variable;

      tidy(() => {
        const newAccumulatedGrad = add(accumulatedGrad,
            square(gradient));
        accumulatedGrad.assign(newAccumulatedGrad);

        const newValue = add(
            mul(div(gradient,
                sqrt(add(newAccumulatedGrad, ENGINE.backend.epsilon()))),
                -this.learningRate),
            value);
        value.assign(newValue);
      });
    });
    this.incrementIterations();
  }

  dispose(): void {
    if (this.accumulatedGrads != null) {
      dispose(this.accumulatedGrads.map(v =>
          v.variable));
    }
  }

  async getWeights(): Promise<NamedTensor[]> {
    // Order matters for Python compatibility.
    return 
        [await this.saveIterations()].concat(this.accumulatedGrads.map(v =>
            ({name: v.originalName, tensor: v.variable}));
  }

  async setWeights(weightValues: NamedTensor[]): Promise<void> {
    weightValues = await this.extractIterations(weightValues);
    const trainable = false;
    this.accumulatedGrads = weightValues.map(v =>
        ({originalName: v.name, variable: v.tensor.variable(trainable)}));
  }

  getConfig(): ConfigDict {
    return {
      'learningRate': this.learningRate,
      'initialAccumulatorValue': this.initialAccumulatorValue,
    };
  }

  /** @nocollapse */
  static fromConfig<T extends Serializable>(
      cls: SerializableConstructor<T>, config: ConfigDict): T {
    return new cls(config['learningRate'], config['initialAccumulatorValue']);
  }
}
registerClass(AdagradOptimizer);

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 */

import {ENGINE} from '../engine';
import {dispose, tidy} from '../globals';
import {add} from '../ops/add';
import {div} from '../ops/div';
import {mul} from '../ops/mul';
import {pow} from '../ops/pow';
import {scalar} from '../ops/scalar';
import {sqrt} from '../ops/sqrt';
import {square} from '../ops/square';
import {sub} from '../ops/sub';
import {zerosLike} from '../ops/zeros_like';
import {ConfigDict, registerClass, Serializable, SerializableConstructor} from '../serialization';
import {Variable} from '../tensor';
import {NamedTensor, NamedVariableMap} from '../tensor_types';
import {Optimizer, OptimizerVariable} from './optimizer';

export class AdamOptimizer extends Optimizer {
  /** @nocollapse */
  static className = 'Adam';  // Note: Name matters for Python compatibility.
  private accBeta1: Variable;
  private accBeta2: Variable;

  private accumulatedFirstMoment: OptimizerVariable[] = [];
  private accumulatedSecondMoment: OptimizerVariable[] = [];

  constructor()
      protected learningRate: number, private initialAccumulatorValue = 0.1) {
    super();
  }

  applyGradients(variableGradients: NamedVariableMap|NamedTensor[]) {
    const variableNames =
        Array.isArray(variableGradients) ?
        variableGradients.map(item => item.name) :
        Object.keys(variableGradients);

    variableNames.forEach((name, i) => {
      const value =
          ENGINE.registeredVariables[name];
      if (this.accumulatedFirstMoment[i] == null) {
        const trainable = false;
        this.accumulatedFirstMoment[i] = {
          originalName: `${name}/first_moment`,
          variable: tidy(
              () => fill(value.shape, this.initialAccumulatorValue))
        };
      }

      const gradient = Array.isArray(variableGradients) ?
          variableGradients[i].tensor :
          variableGradients[name];
      if (gradient == null) {
        return;
      }

      const firstMoment =
          this.accumulatedFirstMoment[i].variable;

      tidy(() => {
        const newFirstMoment = add(firstMoment,
            square(gradient));
        firstMoment.assign(newFirstMoment);

        const newValue = add(
            mul(div(gradient,
                sqrt(add(newFirstMoment, ENGINE.backend.epsilon()))),
                -this.learningRate),
            value);
        value.assign(newValue);
      });
    });
    this.incrementIterations();
  }

  dispose(): void {
    if (this.accumulatedFirstMoment != null) {
      dispose(this.accumulatedFirstMoment.map(v =>
          v.variable));
    }
  }

  async getWeights(): Promise<NamedTensor[]> {
    // Order matters for Python compatibility.
    return 
        [await this.saveIterations()].concat(this.accumulatedFirstMoment.map(v =>
            ({name: v.originalName, tensor: v.variable}));
  }

  async setWeights(weightValues: NamedTensor[]): Promise<void> {
    weightValues = await this.extractIterations(weightValues);
    const trainable = false;
    this.accumulatedFirstMoment = weightValues.map(v =>
        ({originalName: v.name, variable: v.tensor.variable(trainable)}));
  }

  getConfig(): ConfigDict {
    return {
      'learningRate': this.learningRate,
      'initialAccumulatorValue': this.initialAccumulatorValue,
    };
  }

  /** @nocollapse */
  static fromConfig<T extends Serializable>(
      cls: SerializableConstructor<T>, config: ConfigDict): T {
    return new cls(config['learningRate'], config['initialAccumulatorValue']);
  }
}
registerClass(AdamOptimizer);

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 */
function accumulatedSecondMoment: OptimizerVariable[] = []

    constructor(
        protected learningRate: number,
        protected beta1: number, protected beta2: number,
        protected epsilon: number = null) {
      super();
      tidy(() => {
        // accB* will be updated by batch.
        this.accBeta1 = scalar(beta1).variable();
        this.accBeta2 = scalar(beta2).variable();
      });
    }

    applyGradients(variableGradients: NamedVariableMap|NamedTensor[]) {
      const varNames = Array.isArray(variableGradients) ?
          variableGradients.map(v => v.name) :
          Object.keys(variableGradients);
      tidy(() => {
        const oneMinusAccBeta1 = sub(1, this.accBeta1);
        const oneMinusAccBeta2 = sub(1, this.accBeta2);
        const firstMoment = add(mul(firstMoment,
            this.beta1), mul(gradient, 1 - this.beta1));
        const secondMoment = add(mul(secondMoment, this.beta2),
            mul(square(gradient), 1 - this.beta2));

        const newValue =
            add(mul(div(biasCorrectedFirstMoment,
                        add(sqrt(biasCorrectedSecondMoment), this.epsilon)),
                -this.learningRate),
                value);
        value.assign(newValue);
      });
    }

    async setWeights(weightValues: NamedTensor[]): Promise<void> {
      weightValues = await this.extractIterations(weightValues);
      tidy(() => {
        this.accBeta1.assign(pow(this.beta1, this.iterations_ + 1));
        this.accBeta2.assign(pow(this.beta2, this.iterations_ + 1));
      });

      const variableCount = weightValues.length / 2;
      const trainable = false;
      this.accumulatedFirstMoment = weightValues.slice(0, variableCount).
          map(v => ({
            originalName: v.name,
            variable: v.tensor.variable(trainable)
          }));
      this.accumulatedSecondMoment = weightValues.slice(variableCount, variableCount * 2).
          map(v => {
            originalName: v.name,
            variable: v.tensor.variable(trainable)
          }));
    }

    getConfig(): ConfigDict {
      return {
        'learningRate': this.learningRate,
        'beta1': this.beta1,
        'beta2': this.beta2,
        'epsilon': this.epsilon,
      }
    }

    /** @nocollapse */
    static fromConfig<T extends Serializable>(
      cls: SerializableConstructor<T>, config: ConfigDict): T {
      return new cls(
        config['learningRate'], config['beta1'], config['beta2'],
        config['epsilon']);
    }

    registerClass(AdamOptimizer);
  }

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=============================================================================

import {ENGINE} from '../engine';
import {dispose, tidy} from '../globals';
import {abs} from '../ops/abs';
import {add} from '../ops/add';
import {div} from '../ops/div';
import {maximum} from '../ops/maximum';
import {mul} from '../ops/mul';
import {scalar} from '../ops/scalar';
import {sub} from '../ops/sub';
import {zerosLike} from '../ops/zeros_like';
import {ConfigDict, registerClass, Serializable, SerializableConstructor} from '../serialization';
import {Variable} from '../tensor';
import {NamedTensor, NamedVariableMap} from '../tensor_types';

import {Optimizer, OptimizerVariable} from './optimizer';

export class AdamaxOptimizer extends Optimizer {
  /** @nocollapse */
  static className = 'Adamax';  // Note: Name
  private accBeta1: Variable;
  private iteration: Variable;

  private
  accumulatedFirstMoment: OptimizerVariable[] = [];
  private accumulatedWeightedInfNorm: OptimizerVariable[] = [];

  constructor(
      protected learningRate: number, protected beta1: number,
      protected beta2: number,
      protected epsilon: number = null,
      protected decay = 0.0) {
    super();

    tidy(() => {
      this.iteration = scalar(0).variable();
      this.accBeta1 = scalar(beta1).variable();
    });

    if (epsilon == null) {
      this.epsilon = ENGINE.backend.epsilon();
    }
  }

  applyGradients(variableGradients:
  NamedVariableMap|NamedTensor[]) {
    const variableNames = Array.isArray(variableGradients) ?
        variableGradients.map(item => item.name) :
        Object.keys(variableGradients);

    tidy(() => {
      const
      oneMinusAccBeta1 = sub(1, this.accBeta1);
      const lr =
          div(-this.learningRate, add(mul(this.iteration,
          this.decay), 1));

      variableNames.forEach((name, i) => {
        const value =
            ENGINE.registeredVariables[name];
        const trainable = false;
        if (this.accumulatedFirstMoment[i] ==
            null) {
          this.accumulatedFirstMoment[i] = {
            originalName: `${name}/m`,
            variable:
                zerosLike(value).variable(trainable)
          };
        }
        if (this.accumulatedWeightedInfNorm[i] ==
            null) {
          this.accumulatedWeightedInfNorm[i] = {
            originalName: `${name}/v`,
            variable:
                zerosLike(value).variable(trainable)
          };
        }

        const gradient = Array.isArray(variableGradients) ?
            variableGradients[i].tensor :
            variableGradients[name];
        if (gradient == null) {
          return;
        }

        const firstMoment = this.accumulatedFirstMoment[i].variable;
        const weightedInfNorm =
            this.accumulatedWeightedInfNorm[i].variable;

        const newFirstMoment =
            add(mul(firstMoment,
            this.beta1), mul(gradient, 1 - this.beta1));

        const ut0 = mul(weightedInfNorm, this.beta2);
        const ut1 =
            abs(gradient);

        const newWeightedInfNorm = maximum(ut0, ut1);

        firstMoment.assign(newFirstMoment);
        weightedInfNorm.assign(newWeightedInfNorm);

        const
        newValue =
            add(mul(div(lr, oneMinusAccBeta1),
                    div(newFirstMoment,
                    add(newWeightedInfNorm, this.epsilon))),
                value);

        value.assign(newValue);
      });

      this.iteration.assign(add(this.iteration, 1));
      this.accBeta1.assign(mul(this.accBeta1, this.beta1));
    });

    this.incrementIterations();
  }

  dispose(): void {
    this.accBeta1.dispose();
    this.iteration.dispose();

    if
    (this.accumulatedFirstMoment != null) {
      dispose(this.accumulatedFirstMoment.map(v => v.variable));
    }

    if (this.accumulatedWeightedInfNorm != null) {
      dispose(this.accumulatedWeightedInfNorm.map(v =>
          v.variable));
    }

    throw new Error('getWeights() is not implemented for Adamax yet.');
  }

  async getWeights(): Promise<NamedTensor[]> {
    throw new Error('getWeights() is not implemented for Adamax yet.');
  }

  async setWeights(weightValues: NamedTensor[]): Promise<void> {
    throw new Error('setWeights(weightValues: NamedTensor[]) is not implemented for Adamax yet.');
  }

  getConfig(): ConfigDict {
    return
    {learningRate: this.learningRate, 
    beta1: this.beta1, 
    beta2: this.beta2, 
    epsilon: this.epsilon, 
    decay: this.decay, 
    // *** @nocollapse */
  static fromConfig<T extends Serializable>(
      cls: SerializableConstructor<T>, config: ConfigDict): T {
    return
      new cls(config);
  }

  registerClass(AdamaxOptimizer);
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=============================================================================

*/

import {ENGINE} from '../engine';
import {keep, tidy} from '../globals';
import {add} from '../ops/add';
import {mul} from '../ops/mul';
import {scalar} from '../ops/scalar';
import {ConfigDict, registerClass, Serializable, SerializableConstructor} from '../serialization';
import {Scalar} from '../tensor';
import {NamedTensor, NamedTensorMap} from '../tensor_types';

import {Optimizer} from './optimizer';

/**
 * @doclink Optimizer */
export class SGDOptimizer extends Optimizer {
  /** @nocollapse */
  static className = 'SGD';  // Note: Name matters for Python compatibility.
  protected c: Scalar;

  constructor(protected learningRate: number) {
    super();
    this.setLearningRate(learningRate);
  }

  applyGradients(variableGradients: NamedTensorMap|NamedTensor[]) {
    const varNames =
          Array.isArray(variableGradients) ?
              variableGradients.map(v => v.name) :
          Object.keys(variableGradients);
    varNames.forEach((name, i) => {
      const gradient =
            (name, i) => {
        const newValue = add(mul(this.c, gradient), value);
        value.assign(newValue);
      });
    });

    this.incrementIterations();
  }

  /**
   * Sets the learning rate of the optimizer.
   */
  setLearningRate(learningRate: number) {
    this.learningRate = learningRate;
    if (this.c != null) {
      this.c.dispose();
    }
    this.c = keep(scalar(-learningRate));
  }

  dispose() {
    this.c.dispose();
  }

  async getWeights(): Promise<NamedTensor[]> {
    return [await this.saveIterations()];
  }

  async setWeights(weightValues: NamedTensor[]) {
    weightValues = await this.extractIterations(weightValues);
    if (weightValues.length !== 0) {
      throw new Error('SGD optimizer does not have settable weights.');
    }
  }

  getConfig(): ConfigDict {
    return {'learningRate': this.learningRate};
  }

  /** @nocollapse */
  static fromConfig<T extends Serializable>(
      cls: SerializableConstructor<T>, config: ConfigDict): T {
    return new cls(config['learningRate']);
  }
}
registerClass(SGDOptimizer);

*/

import {ENGINE} from '../engine';
import {dispose, tidy} from '../globals';
import {add} from '../ops/add';
import {mul} from '../ops/mul';
import {scalar} from '../ops/scalar';
import {zerosLike} from '../ops/zeros_like';
import {ConfigDict, registerClass, Serializable, SerializableConstructor} from '../serialization';
import {Scalar, Tensor} from '../tensor';
import {NamedTensor, NamedVariableMap} from '../tensor_types';

import {OptimizerVariable} from './optimizer';
import {SGDOptimizer} from './sgd_optimizer';

/** @doclink Optimizer */
export class MomentumOptimizer extends SGDOptimizer {
  /**
   * @nocollapse */
  static className = 'Momentum';  // Name matters for Python compatibility.
  private m: Scalar;
  private accumulations: OptimizerVariable[] = [];

  constructor(
      protected learningRate: number,
      private momentum: number,
      private useNesterov = false) {
    super(learningRate);
    this.m = scalar(this.momentum);
  }

  applyGradients(variableGradients: NamedVariableMap|NamedTensor[]) {
    const variableNames = Array.isArray(variableGradients) ?
          variableGradients.map(item => item.name) :
          Object.keys(variableGradients);

    variableNames.forEach((name, i) => {
      const trainable = false;
      if (this.accumulations[i] == null) {
        this.accumulations[i] = {
          originalName: `$name/momentum`;
      }
    });

    this.incrementIterations();
  }

    this.c = keep(scalar(-learningRate));
  }

  dispose() {
    this.c.dispose();
  }

  async getWeights(): Promise<NamedTensor[]> {
    return [await this.saveIterations()];
  }

  async setWeights(weightValues: NamedTensor[]) {
    weightValues = await this.extractIterations(weightValues);
    if (weightValues.length !== 0) {
      throw new Error('SGD optimizer does not have settable weights.');
    }
  }

  getConfig(): ConfigDict {
    return {'learningRate': this.learningRate};
  }

  /** @nocollapse */
  static fromConfig<T extends Serializable>(
      cls: SerializableConstructor<T>, config: ConfigDict): T {
    return new cls(config['learningRate']);
  }
}
registerClass(SGDOptimizer);

*/

*
const accumulation = this.accumulations[i].variable;

      const gradient = Array.isArray(variableGradients) ?
          variableGradients[i].tensor :
          variableGradients[name];
      if (gradient == null) {
        return;
      }

      tidy(() => {
        let newValue:
        Tensor;
        const newAccumulation = add(mul(this.m, accumulation), gradient);
        if (this.useNesterov) {
          newValue = add(mul(this.c, add(gradient, mul(newAccumulation, this.m))), value);
        } else {
          newValue = add(mul(this.c, newAccumulation), value);
        }

        accumulation.assign(newAccumulation);
        value.assign(newValue);
      });
    });
    this.incrementIterations();
  }

  dispose(): void {
    this.m.dispose();
    if (this.accumulations != null) {
      dispose(this.accumulations.map(v => v.variable));
    }
  }

  /**
   * Sets the momentum of the optimizer.
   *
   * @param momentum
   */
  setMomentum(momentum: number) {
    this.momentum = momentum;
  }

  async getWeights(): Promise<NamedTensor[]> {
    return await this.saveIterations().concat(this.accumulations.map(v => ({name: v.name, tensor: v.tensor})));}

  async setWeights(weightValues: NamedTensor[]): Promise<void> {
    weightValues = await this.extractIterations(weightValues);
    this.accumulations = weightValues.map(v => ({originalName: v.name, variable: v.tensor.variable}));
  }

  getConfig(): ConfigDict {
    return {
      'learningRate': this.learningRate,
      'momentum': this.momentum,
      'useNesterov': this.useNesterov
    };}

  /** @nocollapse */
  static fromConfig<T extends Serializable>(cls: SerializableConstructor<T>,
      config: ConfigDict): T {
    return new cls(
        config['learningRate'], config['momentum'],
        config['useNesterov']);
  }
}

registerClass(MomentumOptimizer);
tidy(() => zerosLike(value).variable(trainable))
\nif (gradient == null) {
  return;
}

const accumulatedMeanSquare =
  this.accumulatedMoments[i].variable;

// Plain gradient
const newAccumulatedMeanGrad =
  add(mul(accumulatedMeanSquare, this.decay),
      mul(square(gradient), 1 - this.decay));

if (this.centered) {
  const accumulatedMeanGrad =
    this.accumulatedMeanGrads[i].variable;

  // Centered gradient
  const newAccumulatedMeanGrad =
    add(mul(accumulatedMeanGrad, this.decay),
        mul(gradient, 1 - this.decay));
}

const gradContribution =
  div(mul(gradient, this.learningRate),
       sqrt(add(square(newAccumulatedMeanSquare,
                  this.epsilon))));

accumulatedMeanSquare.assign(newAccumulatedMeanSquare);
accumulatedMeanGrad.assign(newAccumulatedMeanGrad);
accumulatedMoments.assign(newAccumulatedMoments);

const newValue = sub(value,
           newAccumulatedMoments);
value.assign(newValue);

const variableGradients =
  newAccumulatedMoments 
  .map((v) => v.variable(trainable));

if (Array.isArray(variableGradients)) {
  variableGradients[i].tensor
  .variable(trainable);
} else { // Plain gradient
    const newAccumulatedMoments =
      add(mul(square(gradient), this.accumulatedMoments, this.momentum),
          div(mul(gradient, this.learningRate),
               sqrt(add(square(newAccumulatedMeanSquare,
                           this.epsilon))));

    accumulatedMeanSquare.assign(newAccumulatedMeanSquare);
    accumulatedMeanGrad.assign(newAccumulatedMeanGrad);
    accumulatedMoments.assign(newAccumulatedMoments);

    const newValue = sub(value,
                          newAccumulatedMoments);
    value.assign(newValue);
}

if (this.centered) {
  const accumulatedMeanGrad =
    this.accumulatedMeanGrads[i].variable;

  // Centered gradient
  const newAccumulatedMeanGrad =
    add(mul(accumulatedMeanGrad, this.decay),
         mul(gradient, 1 - this.decay));
}

const gradContribution =
  div(mul(gradient, this.learningRate),
        sqrt(add(square(newAccumulatedMeanSquare,
                   this.epsilon))));

accumulatedMeanSquare.assign(newAccumulatedMeanSquare);
accumulatedMeanGrad.assign(newAccumulatedMeanGrad);
accumulatedMoments.assign(newAccumulatedMoments);

const newValue = sub(value,
                       newAccumulatedMoments);
value.assign(newValue);
}

this.incrementIterations();
}

this.dispose();
}

async getWeights(): Promise<NamedTensor[]> {
  // Order matters for Python compatibility.
  const variables: OptimizerVariable[] =
    [...this.accumulatedMeanSquares, ...
           ...this.accumulatedMoments];
  if (this.centered) {
    variables.push(...this.accumulatedMeanGrads);
  }

  return [await this.saveIterations().concat(variables.map(v =>
                                           ({
                                               name: v.name,
                                               variable: v.tensor.variable(
                                                                 trainable)
                                           })))].concat(
                  variables.map(v => ({
                                               name: v.name,
                                               variable: v.tensor.variable(
                                                                 trainable)
                                           })));}

this.getConfig(): ConfigDict {
  return {
    'learningRate': this.learningRate,
    'decay': this.decay,
    'momentum': this.momentum,
    'epsilon': this.epsilon,
    'centered': this.centered
  };
}

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 */

export default RMSPropOptimizer;

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update.
   * @param epsilon A constant epsilon used to better condition the grad
   * update.
   * @doc
   * static adadelta(learningRate = 0.01, rho = .95, epsilon: number = null):
   * AdadeltaOptimizer
   * return new AdadeltaOptimizer(learningRate, rho,
   * epsilon);
   */
  }

  /**
   * Constructs a `tf.AdamaxOptimizer` that uses the Adamax algorithm.
   * @param learningRate The learning rate decay for the 1st
   * moment estimates.
   * @param beta1 The exponential decay rate for the 2nd moment estimates.
   * @param epsilon A small constant for numerical stability.
   * @doc
   */
  static adamax(
    learningRate = 0.002, beta1 = 0.9, beta2 = 0.999, epsilon: number = null,
    decay = 0.0):
    return new AdamaxOptimizer(learningRate, beta1, beta2, epsilon, decay);
  }

  /**
   * Constructs a `tf.AdagradOptimizer` that uses the Adagrad algorithm.
   * @param learningRate The learning rate to use for the Adagrad gradient
   * descent algorithm.
   * @param initialAccumulatorValue Starting value for the accumulators, must be
   * positive.
   * @doc
   */
  static adagrad(learningRate: number,
    initialAccumulatorValue = 0.1):
    return new AdagradOptimizer(learningRate,
    initialAccumulatorValue);
}

// So typings can propagate.
import {AdadeltaOptimizer} from './optimizers/adadelta_optimizer';
import {AdagradOptimizer} from './optimizers/adagrad_optimizer';
import {AdamOptimizer} from './optimizers/adam_optimizer';
import {AdamaxOptimizer} from './optimizers/adamax_optimizer';
import {MomentumOptimizer} from './optimizers/momentum_optimizer';
import {OptimizerConstructors} from './optimizers/optimizer_constructors';
import {RMSPropOptimizer} from './optimizers/rmsprop_optimizer';
import {SGDOptimizer} from './optimizers/sgd_optimizer';

// tslint:disable-next-line:no-unused-expression
[MomentumOptimizer, SGDOptimizer, AdadeltaOptimizer, AdagradOptimizer,
RMSPropOptimizer, AdamaxOptimizer, AdamOptimizer];

export const train = {
  sgd:
  OptimizerConstructors.sgd,
  momentum: OptimizerConstructors.momentum,
  adadelta:
  OptimizerConstructors.adadelta,
  adagrad: OptimizerConstructors.adagrad,
  rmsprop: OptimizerConstructors.rmsprop,
};

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 * distributed under the License is distributed on an "AS IS" BASIS,
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 * limitations under the License.
 */

const delayCallback: Function = (() => {
  if (typeof requestAnimationFrame !== 'undefined') {
    return requestAnimationFrame;
  } else if (typeof setImmediate !== 'undefined') {
    return setImmediate;
  }
  return

  /*
   * So typings can propagate.
   */
  export {AdadeltaOptimizer} from './optimizers/adadelta_optimizer';
  export {AdagradOptimizer} from './optimizers/adagrad_optimizer';
  export {AdamOptimizer} from './optimizers/adam_optimizer';
  export {AdamaxOptimizer} from './optimizers/adamax_optimizer';
  export {MomentumOptimizer} from './optimizers/momentum_optimizer';
  export {OptimizerConstructors} from './optimizers/optimizer_constructors';
  export {RMSPropOptimizer} from './optimizers/rmsprop_optimizer';
  export {SGDOptimizer} from './optimizers/sgd_optimizer';

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   * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
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   * limitations under the License.
   */
  // tslint:disable-next-line:no-unused-expression
  [MomentumOptimizer, SGDOptimizer, AdadeltaOptimizer, AdagradOptimizer,
RMSPropOptimizer, AdamaxOptimizer, AdamOptimizer];

  export const train = {
    sgd: OptimizerConstructors.sgd,
    momentum: OptimizerConstructors.momentum,
    adadelta: OptimizerConstructors.adadelta,
    adagrad: OptimizerConstructors.adagrad,
    rmsprop: OptimizerConstructors.rmsprop,
  };

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   */

  const delayCallback: Function = (() => {
    if (typeof requestAnimationFrame !== 'undefined') {
      return requestAnimationFrame;
    } else if (typeof setImmediate !== 'undefined') {
      return setImmediate;
    }
    return
  });

**Context**

In the context of the code, the `nextFrame()` function is a promise that resolves when a requestAnimationFrame has completed. This function is used to ensure smooth animations in web applications.

**Usage**

The `nextFrame()` function is used in the following lines of code to create a requestAnimationFrame that resolves when the animation has completed:

```
import {nextFrame} from './next-frame';

export function setupAnimation() {
  nextFrame().then(() => {
    // Animation code
  });
}
```

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---

**Implementation**

The `nextFrame()` function is implemented by returning a promise that resolves when a requestAnimationFrame has completed. This function is used to ensure smooth animations in web applications.

```
function nextFrame(): Promise<void> {
  return new Promise<void>(resolve => delayCallback(() => resolve()));
}
```

**Example Usage**

This function can be used in the following way:

```
import {nextFrame} from './next-frame';

export function setupAnimation() {
  nextFrame().then(() => {
    // Animation code
  });
}
```
software

* * *

* Gets the new shape of the input Tensor after it's been reshaped to:
* blockShape[0], ..., blockShape[M-1], batch / prod(blockShape), 
* inputShape[1], ..., inputShape[N-1] ]

* See step 1:
https://www.tensorflow.org/api_docs/python/tf/batch_to_space_nd

* An export function getReshaped( 
* inputShape: number[], blockShape: number[], prod: number, 
* batchToSpace = true): number[]

* let reshaped:
* number[] = []
* if (batchToSpace) {
* 
* reshaped = reshaped.concat(blockShape.slice(0));
*
* reshaped.push(inputShape[0] / prod);
* 
* reshaped = reshaped.concat(inputShape.slice(1));
* 
* const spatialLength = blockShape.length;
* for (let i = 0; i < spatialLength; ++i) {
* 
* reshaped = reshaped.concat([inputShape[i + 1] / blockShape[i], blockShape[i]]);
* 
* }
* 
* return reshaped;
* }

* * *

* Gets the permutation that will transpose the dimensions of the:
* reshaped tensor to shape:
* batchShapeRank: number, blockShapeRank: number, 
* batchToSpace = true): number[]

* const permuted = []
* if (batchToSpace) {
* 
* permuted.push(blockShapeRank);
* 
* for (let i = blockShapeRank + 1; i < batchShapeRank; ++i) {
* 
* if (i <= 2 * blockShapeRank) {
* 
* permuted.push(i);
* 
* permuted.push(i + (blockShapeRank + 1));
* 
* } else {
* 
* permuted.push(i);
* 
* } } else {
* 
* const 
* permutedBeforeBatch = [];
* 
* for (let i = 1; i < reshapedRank; ++i) {
* 
* permutedBeforeBatch.push(i);
* 
* }
* 
* return permuted;
* }

* * *

* Gets the shape of the reshaped and 
* permuted input Tensor before any cropping is applied. The new shape will be:
* batchShapeRank: number, blockShapeRank: number, 
* prod: number, 
* batchToSpace = true): number[]

* const reshapedPermuted = []
* if (batchToSpace) {
* 
* reshapedPermuted.push(inputShape[0] / prod);
* 
* } else {
* 
* reshapedPermuted.push(inputShape[0] * prod);
* 
* }

* * *

* An export function getSliceBeginCoords( 
* crops: number[][], blockShape: number[]

* Gets the slice argument into the beginning coordinates of a slice operation.
* An export function getSliceBeginCoords( 
* crops: number[], blockShape: number[]

* const sliceBeginCoords = [];
* for (let i = 0; i < blockShape.length; ++i) {
* 
* sliceBeginCoords.push(crops[i][0]);
* 
* }

* * *

* Converts the crops argument into the size of a slice operation. When * combined with getSliceBeginCoords this function 

* allows the reshaped and 
* permuted Tensor to be cropped to its final output shape of:

* blockShape[0] - crops[0][0] - crops[0][1], ..., 
* inputShape[M] * blockShape[M-1] - crops[M-1][0] - 
* 
* * *

* Converts the crops argument into the size of a slice operation. When * combined with getSliceBeginCoords this function 

* allows the reshaped and 
* permuted Tensor to be cropped to its final output shape of:

* blockShape[0] - crops[0][0] - crops[0][1], ..., 
* inputShape[M] * blockShape[M-1] - crops[M-1][0] - 
* 
* * *

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=============================================================================

export const SELU_SCALEALPHA = 1.7580993408473768599402175208123;
export const SELU_SCALE = 1.0507009873554804934193349852946;

/*=============================================================================

export const ERF_P = 0.3275911;
export const ERF_A1 = 0.254829592;
export const ERF_A2 = -0.284496736;
export const ERF_A3 = 1.421413741;
export const ERF_A4 = -1.453152027;
export const ERF_A5 = 1.061405429;

/*=============================================================================

import {env} from './environment';

export function warn(...msg: Array<{}>): void {
  if (!env().getBool('IS_TEST')) {
    console.warn(...msg);
  }
}

export function log(...msg: Array<{}>): void {
  if (!env().getBool('IS_TEST')) {
    console.log(...msg);
  }
}

/*=============================================================================

import {TypedArray} from '../types';

/**
 * Merges real and imaginary Float32Arrays into a single complex Float32Array.
 *
 * The memory layout is interleaved as follows:
 * real: [r0, r1, r2]
 * imag: [i0, i1, i2]
 * complex: [r0, i0, r1, i1, r2, i2]
 * This is the inverse of splitRealAndImagArrays().
 *
 * @param real The real values of the complex tensor values.
 * @param imag The imaginary values of the complex tensor values.
 * @returns A complex tensor as a Float32Array with merged values.
 * @param real
 * @param imag
 * @returns
 */
export function mergeRealAndImagArrays(
    real: Float32Array, imag: Float32Array): Float32Array {
  if (real.length !== imag.length) {
    throw new Error(`Cannot merge real and imag arrays of different lengths. real: 
` + `imag: ${real.length}, ${imag.length}.`);
  }
  const result = new Float32Array(real.length * 2);
  for (let i = 0; i < result.length; i += 2) {
    result[i] = real[i / 2];
    result[i + 1] = imag[i / 2];
  }
  return result;
}

/*=============================================================================

import {TypedArray} from '../types';

/**
 * Splits a complex Float32Array into real and imaginary parts.
 *
 * The memory layout is interleaved as follows:
 * complex: [r0, i0, r1, i1, r2, i2]
 * real: [r0, r1, r2]
 * imag: [i0, i1, i2]
 * This is the inverse of mergeRealAndImagArrays().
 *
 * @param complex The complex tensor values.
 * @returns An object with real and imag Float32Array components of the complex tensor.
 * @param complex
 * @returns
 */
export function splitRealAndImagArrays(complex: Float32Array): {
  real: Float32Array, imag: Float32Array
} {
  const result = new Float32Array(complex.length * 2);
  for (let i = 0; i < result.length; i += 2) {
    result[i] = real[i / 2];
    result[i + 1] = imag[i / 2];
  }
  return result;
}

/*=============================================================================
imag[i / 2] = complex[i + 1];
  }
  return {real, imag};
}

/**
 * Extracts even indexed complex values in the given array.
 * @param complex The complex tensor values
 */
export function complexWithEvenIndex(complex: Float32Array): ({real: Float32Array, imag: Float32Array} {real: Float32Array, imag: Float32Array} {
  const len = Math.ceil(complex.length / 4);
  const real = new Float32Array(len);
  const imag = new Float32Array(len);
  for (let i = 0; i < complex.length; i += 4) {
    real[Math.floor(i / 4)] = complex[i];
    imag[Math.floor(i / 4)] = complex[i + 1];
  }
  return {real, imag};
}

/**
 * Extracts odd indexed complex values in the given array.
 * @param complex The complex tensor values
 */
export function complexWithOddIndex(complex: Float32Array):
    {real: Float32Array, imag: Float32Array} {
  const len = Math.floor(complex.length / 4);
  const real = new Float32Array(len);
  const imag = new Float32Array(len);
  for (let i = 2; i < complex.length; i += 4) {
    real[Math.floor(i / 4)] = complex[i];
    imag[Math.floor(i / 4)] = complex[i + 1];
  }
  return {real, imag};
}

/**
 * Get the map representing a complex value in the given array.
 * @param complex The complex tensor values
 */
export function getComplexWithIndex(
    complex: Float32Array, index: number): {real: number, imag: number} {
  const real = complex[index * 2];
  const imag = complex[index * 2 + 1];
  return {real, imag};
}

/**
 * Insert a given complex value into the TypedArray.
 * @param data The array in which the complex value is inserted.
 * @param c The complex value to be inserted.
 * @param index An index of the target complex value.
 */
export function assignToTypedArray(
    data: TypedArray, real: number, imag: number, index: number) {
  data[index * 2] = real;
  data[index * 2 + 1] = imag;
}

/**
 * Make the exponent term used by FFT.
 */
export function exponent(
    k: number, n: number, inverse: boolean): {real: number, imag: number} {
  const x = (inverse ? 2 : -2) * Math.PI * (k / n);
  const real = Math.cos(x);
  const imag = Math.sin(x);
  return {real, imag};
}

/**
 * Make the list of exponent terms used by FFT.
 */
export function exponents(
    n: number, inverse: boolean): {real: Float32Array, imag: Float32Array} {
  const real = new Float32Array(n / 2);
  const imag = new Float32Array(n / 2);
  for (let i = 0; i < Math.ceil(n / 2); i++) {
    const x = (inverse ? 2 : -2) * Math.PI * (i / n);
    real[i] = Math.cos(x);
    imag[i] = Math.sin(x);
  }
  return {real, imag};
}

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 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
 * See the License for the specific language governing permissions and
 * limitations under the License.
 */

---

import {TensorInfo} from '../kernel_registry';
import {Tensor} from '../tensor';
import {assert} from '../util';

/**
 * Prepare the split size array. When the input is a number, the axis is evenly
 * divided among the
 * split size. When the input contains the negative value, the
 * rest of the axis is allocated toward that.
 */
export function prepareSplitSize(
    x: Tensor|TensorInfo, numOrSizeSplits: number[]|number,
    axis = 0): number[] {  
  let splitSizes = [];
  if (typeof (numOrSizeSplits) === 'number') {
    assert(x.shape[axis] % numOrSizeSplits === 0,
        () => 'Number of splits must evenly divide the axis.');
    splitSizes =
        new Array(numOrSizeSplits).fill(x.shape[axis] / numOrSizeSplits);
  } else {
    const numOfNegs = numOrSizeSplits.reduce((count, value) => {
      if (value === -1) {
        count += 1;
      }
      return count;
    }, 0);
    assert(numOfNegs <= 1,
        () => 'There should be only one negative value in split array.');
    splitSizes = numOrSizeSplits.fill(x.shape[axis] / numOrSizeSplits);  
  } else {
    const negIndex = numOrSizeSplits.indexOf(-1);
    // Allow the number of split array to be -1, which indicates the
    // rest of dimension is allocated to that split.
    if (negIndex !== -1) {
      const total = numOrSizeSplits.reduce((a, b) => b > 0 ? a + b : a);
      const negSize = negIndex * x.shape[axis] / total;
      splitSizes = numOrSizeSplits.map((size) => size - negSize);
    }
  }

  return splitSizes;
}
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=============================================================================

*/

import {TensorInfo} from '../kernel_registry';
import {nearestDivisor} from '../util';

import {PARALLELIZE_THRESHOLD} from './reduce_util';

export interface SegOpInfo {
  windowSize: number;
  batchSize: number;
  inSize: number;
  numSegments: number;
}

export function segOpComputeOptimalWindowSize(inSize: number, numSegments: number): number {
  let res;

  if (inSize <= PARALLELIZE_THRESHOLD) {
    res = inSize;
  } else {
    res = nearestDivisor(inSize, Math.floor(Math.sqrt(inSize)));
  }

  while (res > numSegments) {
    res = nearestDivisor(res, Math.floor(res / 2));
  }

  return res;
}

export function computeOutShape(aShape: number[], axis: number): number[] {
  const outShape = aShape.slice(0, axis);
  for (let i = axis; i < aShape.length; ++i) {
    outShape.push(aShape[i]);
  }

  return outShape;
}

export interface GatherOpShapeInfo {
  batchSize: number;
  sliceSize: number;
  outerSize: number;
  dimSize: number;
  outputShape: number[];
}

export function collectGatherOpShapeInfo(x: TensorInfo, indices: TensorInfo, axis: number, batchDims: number): GatherOpShapeInfo {
  const indicesRank = indices.shape.length;
  const xRank = x.shape.length;

  if (batchDims !== 0) {
    if (batchDims < -indicesRank || batchDims > indicesRank) {
      throw new Error(`Expect batchDims in the range of [-${indicesRank}, ${indicesRank}], but got ${batchDims}`);
    }
  }

  if (batchDims < 0) {
    batchDims += indicesRank;
  }

  if (batchDims > xRank) {
    throw new Error(`batchDims (${batchDims}) must be less than rank(x) (${xRank}).`);
  }

  if (axis < batchDims) {
    throw new Error(`batchDims (${batchDims}) must be less than or equal to axis (${axis}).`);
  }

  for (let i = 0; i < batchDims; ++i) {
    if (x.shape[i] !== indices.shape[i]) {
      throw new Error(`x.shape[${i}]: ${x.shape[i]} should be equal to indices.shape[${i}]: ${indices.shape[i]}.`);
    }
  }

  const dimSize = x.shape[axis];

  const outputShape: number[] = [1];
  let batchSize = 1;
  let outerSize = 1;
  let sliceSize = 1;

  for (let i = 0; i < batchDims; ++i) {
    outputShape.push(x.shape[i]);
  }

  for (let i = batchDims; i < axis; ++i) {
    outputShape.push(x.shape[i]);
  }

  for (let i = axis; i < indicesRank; ++i) {
    outputShape.push(indices.shape[i]);
  }

  for (let i = axis + 1; i < xRank; ++i) {
    outputShape.push(x.shape[i]);
  }

  return {batchSize, sliceSize, outerSize, dimSize, outputShape};
}
BackendTimingInfo, DataMover, DataStorage} from './backends/backend';

// Export all kernel names /
info.
export * from './kernel_names';

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 */

// Required side effectful code.
import './base_side_effects';

export * from './base';

/**
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 */

const contexts: {[key: string]: WebGLRenderingContext} = {};

const WEBGL_ATTRIBUTES: WebGLContextAttributes = {
  alpha: false,
  depth: false,
  stencil: false,
  failIfMajorPerformanceCaveat: true
};

export function getWebGLRenderingContext(webGLVersion: number): WebGLRenderingContext {
  if (webGLVersion !== 1 && webGLVersion !== 2) {
    throw new Error('Cannot get WebGL rendering context, WebGL is disabled.');
  }
  const canvas = createCanvas(webGLVersion);

  canvas.addEventListener('webglcontextlost', (ev: Event) => {
    ev.preventDefault();
    delete contexts[webGLVersion];
  }, false);
  if (webGLVersion === 1) {
    return (canvas.getContext('webgl', WEBGL_ATTRIBUTES) ||
            canvas.getContext('experimental-webgl', WEBGL_ATTRIBUTES)) as
    WebGLRenderingContext;
  }
  return canvas.getContext('webgl2', WEBGL_ATTRIBUTES) as
    WebGLRenderingContext;
}


*/

import {backend_util, DataId, DataType, env, TensorInfo, util} from '@tensorflow/tfjs-core';

export enum PackingScheme {
  /**
   * All values in a single texel are densely packed without any constraints.
   * This is how the shader encodes a tensor with shape = [2, 3, 4].
   * (indices are [batch, row, col]).
   * This is how the shader encodes a tensor with shape = [2, 3, 5].
   */
  DENSE,

  /**
   * Single texels contain only values from the same batch, and from adjacent rows and columns.
   * This is how the shader encodes a tensor with shape = [2, 3, 5].
   */

  SHARED_BATCH
}

export enum TextureUsage {
  RENDER,
  UPLOAD,
  PIXELS,

  DOWNLOAD
}

export enum PhysicalTextureType {
  UNPACKED_FLOAT16,

  UNPACKED_FLOAT32,
  PACKED_4X1_UNSIGNED_BYTE,
  PACKED_2X2_FLOAT32,

  PACKED_2X2_FLOAT16
}

export interface TextureData {
  // Required.
  shape: number[];
  dtype: DataType;

  // Optional.
  values?: backend_util.BackendValues;
  texture?: WebGLTexture;
  // For complex numbers, the real and imaginary parts are stored as their own
  // individual TensorInfos, with a parent joining the two with the
  // complexTensors field. When this is defined, texture will be null.
  complexTensorInfos?: {real: TensorInfo, imag: TensorInfo};
  /** 
   * [rows, columns] shape of the texture. *\n   * texShape?: [number, number];
   */

  texShape?: [number, number];
  usage?: TextureUsage;
  isPacked?: boolean;

  refCount: number;

  // Available when the tensor has been
  // sliced.
  slice?: {
    // Offset in the 'flat index' space.
    flatOffset: number;
    // Used for counting how many
    // sliced tensors point to the same texture.
    origDataId: DataId;
  };
}

export function
getUnpackedMatrixTextureShapeWidthHeight(
  rows: number, columns: number): [number, number] {
  return [columns, rows];
}

export function getUnpackedArraySizeFromMatrixSize(
  matrixSize: number,
  channelsPerTexture: number): number {
  return matrixSize * channelsPerTexture;
}

export function getColorMatrixTextureShapeWidthHeight(
  rows: number, columns: number): [number, number] {
  return [columns * 4, rows];
}

/**
 * Get shape for densely packed RGBA texture.
 */
export function getDenseTexShape(shape: number[]): [number, number] {
  const size = util.sizeFromShape(shape);
  const texelsNeeded = Math.ceil(size / 4);
  return util.sizeToSquarishShape(texelsNeeded);
}

export function decodeMatrixFromUnpackedColorRGBAArray(
  unpackedArray: Float32Array, matrix: Float32Array,
  channels: number) {
  const requiredSize = unpackedArray.length * channels / 4;
  if (matrix.length < requiredSize) {
    throw new Error('matrix.length < $\{requiredSize\}')
  }

  let dst = 0;
  for (let src = 0; src < unpackedArray.length; src += 4) {
    matrix[dst++] = unpackedArray[src + c];
  }
}

export function
getPackedMatrixTextureShapeWidthHeight(
  rows: number, columns: number): [number, number] {
  return [Math.ceil(columns / 2), Math.ceil(rows / 2)];
}

export function
getPackedRGBAArraySizeFromMatrixShape(
  rows: number, columns: number): number {
  const [w, h] = getPackedMatrixTextureShapeWidthHeight(rows, columns);
  return w * h * 4;
}

export function
getTextureConfig(
  // tslint:disable-next-line:no-any
  gl: WebGLRenderingContext,
  textureHalfFloatExtension?: any): TextureConfig {
  // tslint:disable-next-line:no-any
  const glany = gl as
```javascript

let internalFormatFloat: number;
let internalFormatHalfFloat: number;
let internalFormatPackedHalfFloat: number;
let internalFormatPackedFloat: number;
let textureFormatFloat: number;

let downloadTextureFormat: number;
let downloadUnpackNumChannels: number;

let defaultNumChannels: number;
let textureTypeHalfFloat: number;
let textureTypeFloat: number;

if (env().getNumber('WEBGL_VERSION') === 2) {
  internalFormatFloat = glany.R32F;
  internalFormatHalfFloat = glany.R16F;
  internalFormatPackedHalfFloat = glany.RGBA16F;
  internalFormatPackedFloat = glany.RGBA32F;
  textureFormatFloat = glany.RED;
  downloadUnpackNumChannels = 4;
  defaultNumChannels = 1;
  textureTypeHalfFloat = glany.HALF_FLOAT;
  textureTypeFloat = glany.FLOAT;
} else {
  internalFormatFloat = gl.RGBA;
  internalFormatHalfFloat = gl.RGBA;
  internalFormatPackedHalfFloat = gl.RGBA;
  internalFormatPackedFloat = gl.RGBA;
  textureFormatFloat = gl.RGBA;
  downloadUnpackNumChannels = 4;
  defaultNumChannels = 1;
  textureTypeHalfFloat = textureHalfFloatExtension != null ?
    textureHalfFloatExtension.HALF_FLOAT_OES :
    null;
  textureTypeFloat = gl.FLOAT;
}

downloadTextureFormat = gl.RGBA;

return {
  internalFormatFloat,
  internalFormatHalfFloat,
  internalFormatPackedHalfFloat,
  internalFormatPackedFloat,
  textureFormatFloat,
  downloadTextureFormat,
  downloadUnpackNumChannels,
  defaultNumChannels,
  textureTypeHalfFloat,
  textureTypeFloat
};
```

```
Error('Failed to compile vertex shader.');?>
  return vertexShader;
}

export function
createFragmentShader(gl: WebGLRenderingContext, fragmentShaderSource: string): WebGLShader {
  const shader = gl.createShader(gl.FRAGMENT_SHADER);
  callAndCheck(gl, () =>
      gl.shaderSource(shader, fragmentShaderSource));
  callAndCheck(gl, () =>
      gl.compileShader(shader));
  if (gl.getShaderParameter(shader, gl.COMPILE_STATUS) !== true) {
    logShaderSourceAndInfoLog(gl, shaderSource, shaderInfoLog);
    throw new Error('Failed to compile fragment shader.');
  }
  return shader;
}

const lineNumberRegex = /
ERROR: [0-9]+:([0-9]+):/g;
function logShaderSourceAndInfoLog(shaderSource: string, shaderInfoLog: string) {
  const lineNumberRegexResult = lineNumberRegex.exec(shaderInfoLog);
  if (lineNumberRegexResult === null) {
    console.log(`Couldn't parse line number in error: ${shaderInfoLog}`);
    console.log(shaderSource);
    return;
  }
  const lineNumber = +lineNumberRegexResult[1];
  const shaderLines = shaderSource.split('
');
  const pad = shaderLines.length.toString().length + 2;
  const linesWithLineNumbers = shaderLines.map(line =>
      util.rightPad((lineNumber + 1).toString(), pad + line));
  let maxLineLength = 0;
  for (let i = 0; i < linesWithLineNumbers.length; i++) {
    maxLineLength = Math.max(maxLineLength,
        linesWithLineNumbers[i].length,
        maxLineLength);}
  const beforeErrorLines = linesWithLineNumbers.slice(0, lineNumber - 1);
  const errorLine = linesWithLineNumbers.slice(lineNumber - 1);
  const afterErrorLines = linesWithLineNumbers.slice(lineNumber);
  beforeErrorLines.forEach(line =>
      console.log(line));
  console.log(shaderInfoLog.split('
')[0]);
  console.log(`%c ${util.rightPad(errorLine[0], maxLineLength)}`,
      'border:1px solid red; background-color:#e3d2d2;
      color:#a61717');
  afterErrorLines.forEach(line =>
      console.log(line));
}

export function createProgram(gl: WebGLRenderingContext): WebGLProgram {
  const program = gl.createProgram();
  callAndCheck(gl, () =>
      gl.useProgram(program));
  callAndCheck(gl, () =>
      gl.linkProgram(program));
  if (gl.getProgramParameter(program, gl.LINK_STATUS) !== true) {
    throw new Error('Failed to link vertex and fragment shaders.');
  }
}

export function validateProgram(gl: WebGLRenderingContext, program: WebGLProgram) {
  callAndCheck(gl, () =>
      gl.validateProgram(program));
  if (gl.getProgramParameter(program, gl.VALIDATE_STATUS) !== true) {
    throw new Error('Shader program validation failed.');
  }
}

export function createStaticVertexBuffer(gl: WebGLRenderingContext, data: Float32Array): WebGLBuffer {
  const buffer = gl.createBuffer();
  callAndCheck(gl, () =>
      gl.bindBuffer(gl.ARRAY_BUFFER, buffer));
  callAndCheck(gl, () =>
      gl.bufferData(gl.ARRAY_BUFFER, data, gl.STATIC_DRAW));
  return buffer;
}

export function createStaticIndexBuffer(gl: WebGLRenderingContext, data: Uint16Array): WebGLBuffer {
  const buffer = gl.createBuffer();
  callAndCheck(gl, () =>
      gl.bindBuffer(gl.ELEMENT_ARRAY_BUFFER, buffer));
  callAndCheck(gl, () =>
      gl.bufferData(gl.ELEMENT_ARRAY_BUFFER, data, gl.STATIC_DRAW));
  return buffer;
}

export function getNumChannels(): number {
  if (env().getNumber('WEBGL_VERSION') === 2) {
    return 1;
  }
  return 4;
}

export function createTexture(gl: WebGLRenderingContext): WebGLTexture {
  return gl.createTexture();
}

export function validateTextureSize(width: number, height: number) {
  const maxTextureSize = env().getNumber('WEBGL_MAX_TEXTURE_SIZE');
  if (width <= 0 || height <= 0) {
    const requested = `[${width}x${height}]`;
    throw new Error(`Requested texture size '${requested}' is invalid.`);
  }
  if (width > maxTextureSize || height > maxTextureSize) {
    const max = `[${maxTextureSize}x${maxTextureSize}]`;
    throw new Error(`Requested texture size '${requested}' is greater than WebGL maximum on this browser / GPU + max + +`);
  }
}

export function
createFramebuffer(gl: WebGLRenderingContext): WebGLFramebuffer {
  return gl.createFramebuffer();
}
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, 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,

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textureUnit: number) { // const maxTextureUnit = gl.MAX_COMBINED_TEXTURE_IMAGE_UNITS - 1; const glTextureUnit = textureUnit + gl.TEXTURE0; if (glTextureUnit > maxTextureUnit) { const textureUnitRange = `[gl.TEXTURE0, gl.TEXTURE${maxTextureUnit}]`; throw new Error(`textureUnit must be in ${textureUnitRange}.`); }

export function getBatchDim(shape: number[], dimsToSkip = 2): number { return util.sizeFromShape(shape.slice(0, shape.length - dimsToSkip)); }

export function getRowsCols(shape: number[]): [number, number] { if (shape.length === 0) { throw Error('Cannot get rows and columns of an empty shape array.'); } let shapeAs3D = [1, 1, 1]; const isScalar = shape.length === 0 || (shape.length === 1 && shape[0] === 1); if (!isScalar) { shapeAs3D = [getBatchDim(shape), ...getRowsCols(shape)] as [number, number, number]; } return shapeAs3D; }

export function getTextureShapeFromLogicalShape(logShape: number[], isPacked = false): [number, number] { let maxTexSize = env().getNumber('WEBGL_MAX_TEXTURE_SIZE'); if (isPacked) { maxTexSize = maxTexSize * 2; } // This logic ensures we accurately count the number of packed texels needed // to accommodate the tensor. We can only pack values in the same texel if // they are from adjacent pairs of rows/cols within the same batch. So if \n // tensor has 3 rows, we pretend it has 4 rows in order to account for the // fact that the texels containing the third row are half empty. \n
  logShape = logShape.map((d, i) => i >= logShape.length - 2 ? util.nearestLargerEven(logShape[i]) : logShape[i]);

  // Packed texture height is at least 2 (the channel height of a single \n // texel). \n
  if (logShape.length === 1) {
    return [2, logShape[0]]; // If logical shape is 2, we don't squeeze, since we want to match physical. \n
    logShape = [logShape.length !== 2 ? 1 : logShape[0]]; // 2 \n
    } else if (logShape.length === 2) {
      logShape[1] <= maxTexSize ? logShape : [logShape[0], logShape[1]].map(d => d * 2) as [number, number];
    }

    // 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
    const batchDim = getBatchDim(logShape); \n
    let rows = 2, cols = 2; \n
    return util.sizeToSquarishShape(size).map(d => d * 2) as [number, number];
  }

  if (isEven(logShape[0]) && isEven(logShape[1])) {
    return [logShape[0], logShape[1] * logShape[2]]; // One of the shapes is a vector.

    if (isEven(logShape[0]) && isEven(logShape[1] * logShape[2])) {
      return [logShape[0], logShape[1]]; // One of the shapes is a scalar.

      logShape = [logShape.length !== 2 ? 1 : logShape[0]].map(d => d * 2) as [number, number];
    }

    if (logShape.length === 4) {
      logShape[2] <= maxTexSize ? logShape : [logShape[0], logShape[1], logShape[2]].map(d => d * 2) as [number, number, number];
    }

    if (logShape.length === 3) {
      logShape[2] <= maxTexSize ? logShape : [logShape[0], logShape[1], logShape[2]].map(d => d * 2) as [number, number, number];
    }

    if (logShape.length === 2) {
      logShape[1] <= maxTexSize ? logShape : [logShape[0], logShape[1]].map(d => d * 2) as [number, number];
    }

    if (logShape.length === 1) {
      logShape[0] <= maxTexSize ? logShape : [logShape[0]].map(d => d * 2) as [number, number];
    }

    return util.sizeFromShape(logShape); // 2

  } else if (logShape.length === 3) {
    logShape[2] <= maxTexSize ? logShape : [logShape[0], logShape[1], logShape[2]].map(d => d * 2) as [number, number, number];
  } else if (logShape.length === 2) {
    logShape[1] <= maxTexSize ? logShape : [logShape[0], logShape[1]].map(d => d * 2) as [number, number];
  } else if (logShape.length === 1) {
    logShape[0] <= maxTexSize ? logShape : [logShape[0]].map(d => d * 2) as [number, number];
  } else {
    return util.sizeToSquarishShape(size).map(d => d * 2) as [number, number];
  }


  function isEven(n: number): boolean { return n % 2 === 0; }

  function isReshapeFree(shape1: number[], shape2: number[]): boolean {
    if (util.arraysEqual(shape1, shape2)) { return true; }

    const shape1Cols = shape1.slice(-1)[0];
    const shape2Cols = shape2.slice(-1)[0];

    if (shape1Cols === shape2Cols && isEven(shape1Cols) && isEven(shape2Cols)) { return true; }

    return false;
  }

  function isReshapeFreeFree(shape1: number[], shape2: number[]): boolean {
    if (shape1.length >= 2) { // One of the shapes is a vector.
      const shape1Cols = shape1.slice(-1)[0];
      const shape2Cols = shape2.slice(-1)[0];

      if (shape1Cols === shape2Cols && isEven(shape1Cols) && isEven(shape2Cols)) { return true; }

      return false;
    }

    return true;
  }
WebGLContext for
// MAX_TEXTURE_SIZE
let MAX_TEXTURE_SIZE: number;

MAX_TEXTURE_SIZE_IN_SHADER: number;
export function getWebGLMaxTextureSize(webGLVersion: number): number {
  if (MAX_TEXTURE_SIZE === null) {
    const gl = getWebGLContext(webGLVersion);
    MAX_TEXTURE_SIZE = gl.getParameter(gl.MAX_TEXTURE_SIZE);
  }
  return MAX_TEXTURE_SIZE;
}

export function resetMaxTextureSize() {
  MAX_TEXTURE_SIZE = null;
}

export function resetMaxTexturesInShader() {
  MAX_TEXTURE_SIZE_IN_SHADER = null;
}

export function getWebGLMaxTexturesInShader(webGLVersion: number): number {
  if (MAX_TEXTURE_SIZE_IN_SHADER === null) {
    const gl = getWebGLContext(webGLVersion);
    MAX_TEXTURE_SIZE_IN_SHADER = gl.getProgramParameter(gl.MAX_TEXTURE_IMAGE_UNITS);
  }
  return MAX_TEXTURE_SIZE_IN_SHADER;
}

export function getMaxTexturesInShader(webGLVersion: number): number {
  if (MAX_TEXTURES_IN_SHADER === null) {
    const gl = getWebGLContext(webGLVersion);
    MAX_TEXTURES_IN_SHADER = gl.getParameter(gl.MAX_TEXTURE_IMAGE_UNITS);
  }
  return Math.min(16, MAX_TEXTURES_IN_SHADER);
}

export function getWebGLDisjointQueryTimerVersion(webGLVersion: number): number {
  if (webGLVersion === 0) {
    return 0;
  }
  let queryTimerVersion: number;
  const gl = getWebGLContext(webGLVersion);
  if (hasExtension(gl, 'EXT_disjoint_timer_query_webgl2') &&
      webGLVersion === 2)
    queryTimerVersion = 2;
  else if (hasExtension(gl, 'EXT_disjoint_timer_query'))
    queryTimerVersion = 1;
  else
    queryTimerVersion = 0;
  return queryTimerVersion;
}

export function hasExtension(gl: WebGLRenderingContext, extensionName: string): boolean {
  const ext = gl.getExtension(extensionName);
  return ext !== null;
}

export function isWebGLVersionEnabled(webGLVersion: 1|2) {
  try {
    const gl = getWebGLContext(webGLVersion);
    if (gl !== null) {
      return true;
    }
  } catch (e) {
    console.log('Error when getting WebGL context: ', e);
    return false;
  }
  return false;
}

export function isCapableOfRenderingToFloatTexture(webGLVersion: number): boolean {
  if (webGLVersion === 0) {
    return false;
  }
  const gl = getWebGLContext(webGLVersion);
  if (webGLVersion === 1) {
    if (!hasExtension(gl, 'OES_texture_float')) {
      return false;
    }
    if (!hasExtension(gl, 'WEBGL_color_buffer_float')) {
      return false;
    }
    const isFrameBufferComplete =
        createFloatTextureAndBindToFramebuffer(gl);
    return isFrameBufferComplete;
  }
  const isFrameBufferComplete =
      createHalfFloatTextureAndBindToFramebuffer(gl, null);
  return isFrameBufferComplete;
}

export function createFloatTextureAndBindToFramebuffer(gl: WebGLRenderingContext): boolean {
  const texConfig = getTextureConfig(gl);
  const texture =
      gl.createTexture();
  const width = 1;
  const height = 1;
  gl.bindTexture(gl.TEXTURE_2D, texture);
  gl.texImage2D(gl.TEXTURE_2D, 0, texConfig.internalFormatFloat, width, height, 0,
      texConfig.format, texConfig.type, Float32Array); // Create the texture
  gl.framebufferTexture2D(gl.FRAMEBUFFER, texConfig.typeFloat, null);
  const frameBuffer =
      gl.createFramebuffer();
  gl.bindFramebuffer(gl.FRAMEBUFFER, frameBuffer);
  gl.framebufferTexture2D(gl.FRAMEBUFFER, gl.COLOR_ATTACHMENT0, gl.TEXTURE_2D, texture, 0);
  const isFrameBufferComplete =
      gl.checkFramebufferStatus(gl.FRAMEBUFFER) ===
      gl.FRAMEBUFFER_COMPLETE;
  if (isFrameBufferComplete) {
    gl.deleteTexture(texture);
  }
  return isFrameBufferComplete;
}

export function createHalfFloatTextureAndBindToFramebuffer(gl: WebGLRenderingContext): boolean {
  const texConfig = getTextureConfig(gl);
  const texture =
      gl.createTexture();
  const width = 1;
  const height = 1;
  gl.bindTexture(gl.TEXTURE_2D, texture);
  gl.texImage2D(gl.TEXTURE_2D, 0, texConfig.internalFormatFloat, width, height, 0,
      texConfig.format, texConfig.type, Float32Array); // Create the texture
  gl.framebufferTexture2D(gl.FRAMEBUFFER, texConfig.typeFloat, null);
  const frameBuffer =
      gl.createFramebuffer();
  gl.bindFramebuffer(gl.FRAMEBUFFER, frameBuffer);
  gl.framebufferTexture2D(gl.FRAMEBUFFER, gl.COLOR_ATTACHMENT0, gl.TEXTURE_2D, texture, 0);
  const isFrameBufferComplete =
      gl.checkFramebufferStatus(gl.FRAMEBUFFER) ===
      gl.FRAMEBUFFER_COMPLETE;
  if (isFrameBufferComplete) {
    gl.deleteTexture(texture);
  }
  return isFrameBufferComplete;
}
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```javascript
function deleteFramebuffer(frameBuffer) {
  return isFrameBufferComplete;
}

function createHalfFloatTextureAndBindToFramebuffer(gl, textureHalfFloatExtension) {
  const texConfig = getTextureConfig(gl, textureHalfFloatExtension);
  const width = 1;
  const height = 1;
  const frameBuffer = gl.createFramebuffer();
  gl.bindFramebuffer(gl.FRAMEBUFFER, frameBuffer);
  gl.framebufferTexture2D(gl.FRAMEBUFFER, gl.COLOR_ATTACHMENT0, gl.TEXTURE_2D, texture, 0);
  const isFrameBufferComplete =
    gl.checkFramebufferStatus(gl.FRAMEBUFFER) === gl.FRAMEBUFFER_COMPLETE;
  gl.bindTexture(gl.TEXTURE_2D, null);
  gl.bindFramebuffer(gl.FRAMEBUFFER, null);
  gl.deleteTexture(texture);
  gl.deleteFramebuffer(frameBuffer);
  return isFrameBufferComplete;
}

export function isWebGLFenceEnabled(webGLVersion) {
  if (webGLVersion !== 2) {
    return false;
  }
  const gl = getWebGLContext(webGLVersion);
  const isEnabled = (gl as any).fenceSync != null;
  return isEnabled;
}

export function assertNotComplex(tensor: TensorInfo|TensorInfo[], opName: string) {
  if (!Array.isArray(tensor)) {
    tensor = [tensor];
  }
  tensor.forEach(t => {
    if (t != null) {
      util.assert(t.dtype !== 'complex64', () => `${opName} does not support complex64 tensors`);
    }
  });
}
```

---

/* @tensorflow/tfjs-core */

```javascript
import {device_util, env} from '@tensorflow/tfjs-core';

import {getMaxTexturesInShader, getWebGLDisjointQueryTimerVersion, getWebGLMaxTextureSize, isCapableOfRenderingToFloatTexture, isDownloadFloatTextureEnabled, isWebGLFenceEnabled, isWebGLVersionEnabled} from './webgl_util';

const ENV = env();

/**
 * This file contains WebGL-specific flag registrations.
 */

/**
 * True if WebGL is supported.
 */
ENV.registerFlag('HAS_WEBGL', () => ENV.getNumber('WEBGL_VERSION') > 0);

/** 0: No WebGL, 1: WebGL 1.0, 2: WebGL 2.0. */
ENV.registerFlag('WEBGL_VERSION', () => {
  if (isWebGLVersionEnabled(2)) {
    return 2;
  } else if (isWebGLVersionEnabled(1)) {
    return 1;
  } return 0;
});

/** Whether to check for numerical representation problems. */
ENV.registerFlag('WEBGL_CHECK_NUMERICAL_PROBLEMS', () => false);

/** Whether the WebGL backend will sometimes forward ops to the CPU. */
ENV.registerFlag('WEBGL_CPU_FORWARD', () => true);

/** Whether we will pack the batchnormalization op. */
// TODO: https://github.com/tensorflow/tfjs/issues/1679
ENV.registerFlag('WEBGL_PACK_DEPTHWISECONV', () => false);

/** Whether we will pack binary ops. */
ENV.registerFlag('WEBGL_PACK_BINARY_OPERATIONS', () => true);

/** Whether we will pack unary ops. */
ENV.registerFlag('WEBGL_PACK_UNARY_OPERATIONS', () => true);
```
'WEBGL_PACK_ARRAY_OPERATIONS', () => ENV.getBool('WEBGL_PACK'))

/** Whether we will pack image ops. */
ENV.registerFlag('WEBGL_PACK_IMAGE_OPERATIONS', () =>
  ENV.getBool('WEBGL_PACK'))

/** Whether we will pack reduce ops. */
ENV.registerFlag('WEBGL_PACK_REDUCE', () => ENV.getBool('WEBGL_PACK'))

/** Whether we will pack WebGL kernels lazily unpack their outputs. */
ENV.registerFlag('WEBGL_LAZILY_UNPACK', () =>
  ENV.getBool('WEBGL_PACK'))

/** Whether we will use the im2col algorithm to speed up convolutions. */
ENV.registerFlag('WEBGL_CONV_IM2COL', () => ENV.getBool('WEBGL_PACK'))

/** The maximum texture dimension. */
ENV.registerFlag('
  WEBGL_MAX_TEXTURE_SIZE', () =>
  getWebGLMaxTextureSize(ENV.getNumber('WEBGL_VERSION')))

/** The maximum texture dimension. */
ENV.registerFlag('WEBGL_MAX_TEXTURES_IN_SHADER', () =>
  getMaxTexturesInShader(ENV.getNumber('WEBGL_VERSION')))

/** The disjoint_query_timer extension version. */
ENV.registerFlag('WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_VERSION', () => {
  const webGLVersion = ENV.getNumber('WEBGL_VERSION');
  if (webGLVersion === 0) {
    return 0;
  }
  return getWebGLDisjointQueryTimerVersion(webGLVersion);
});

/** Whether the timer object from the disjoint_query_timer extension gives timing information that is reliable. */
ENV.registerFlag('WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_RELIABLE', () =>
  ENV.getNumber('WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_VERSION') > 0 &&
  device_util.isMobile());

/** Whether rendering to float32 textures is enabled. If disabled, renders to float16 textures. */
ENV.registerFlag('WEBGL_RENDER_FLOAT32_ENABLED', () =>
  ENV.getBool('WEBGL_FORCE_F16_TEXTURES') ?
    false :
  ENV.getBool('WEBGL_RENDER_FLOAT32_ENABLED'));

/** Whether downloading float textures is enabled (16 or 32 bit). If disabled, uses IEEE 754 encoding of the float32 values to 4 uint8 when downloading. */
ENV.registerFlag('WEBGL_DOWNLOAD_FLOAT_ENABLED', () =>
  isDownloadFloatTextureEnabled(ENV.getNumber('WEBGL_VERSION')));

/** Whether the fence API is available. */
ENV.registerFlag('WEBGL_FENCE_API_ENABLED', () =>
  isWebGLFenceEnabled(ENV.getNumber('WEBGL_VERSION')));

/** Tensors with size <= than this will be uploaded as uniforms, not textures. */
ENV.registerFlag('WEBGL_SIZE_UPLOAD_UNIFORM', () =>
  useUniforms ? 4 : 0);

/** The total number of bytes allocated on the GPU is greater than this number, we will aggressively delete textures upon disposal with glDeleteMatrixTexture, rather than making them available for reuse. */
ENV.registerFlag('WEBGL_DELETE_TEXTURE_THRESHOLD', () =>
  threshold <= 1 ?
    threshold := -1
  : throw new Error('WEBGL_DELETE_TEXTURE_THRESHOLD must be -1 (indicating never `+in _` delete) or at least 0, but got $\langle threshold\rangle$'));

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/* Unless required by applicable law or agreed to in writing, software distributed under the License is distributed on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied. See the License for the specific language governing permissions and limitations under the License. */
```javascript
import {env} from '@tensorflow/tfjs-core';

export type GLSL = {
  version: string,
  attribute: string,
  varyingVs: string,
  varyingFs: string,
  texture2D: string,
  output: string,
  defineOutput: string,
  defineSpecialNaN: string,
  defineSpecialInf: string,
  defineRound: string
};

export function getGlslDifferences(): GLSL {
  let version: string;
  let attribute: string;
  let varyingVs: string;
  let varyingFs: string;
  let texture2D: string;
  let output: string;
  let defineOutput: string;
  let defineSpecialNaN: string;
  let defineSpecialInf: string;
  let defineRound: string;

  if (env().getNumber('WEBGL_VERSION') === 2) {
    version = '#version 300 es';
    attribute = 'in';
    varyingVs = 'out';
    varyingFs = 'in';
    texture2D = 'texture';
    output = 'outputColor';
    defineOutput = 'out vec4 outputColor;';

    // Use custom isnan definition to work across differences between
    // implementations on various platforms. While this should happen in ANGLE
    // we still see differences between android and windows (on chrome) when
    // using isnan directly.
    defineSpecialNaN = `bool isnan_custom(float val) {
      return (val > 0.0 || val < 0.0) ? false : val != 0.0;
    }
    bvec4 isnan_custom(vec4 val) {
      return bvec4(isnan_custom(val.x),
        isnan_custom(val.y),
        isnan_custom(val.z),
        isnan_custom(val.w));
    }
    // In webgl 2 we do not need to specify a custom isnan so there is none
    // need for a special INFINITY constant.
    defineSpecialInf = `uniform float INFINITY;
    bool isinf(float val) {
      return abs(val) == INFINITY;
    }
    bvec4 isinf(vec4 val) {
      return equal(abs(val), vec4(INFINITY));
    }
    `;
    defineSpecialInf = `uniform float INFINITY;
    bool isinf(float val) {
      return abs(val) == INFINITY;
    }
    bvec4 isinf(vec4 val) {
      return equal(abs(val), vec4(INFINITY));
    }
    defineRound = `int round(float value) {
      return int(floor(value + 0.5));
    }
    ivec4 round(vec4 value) {
      return ivec4(floor(value + vec4(0.5)));
    }
    `;
  } else {
    version = '';
    attribute = 'attribute';
    varyingVs = 'varying';
    varyingFs = 'varying';
    texture2D = 'texture2D';
    output = 'gl_FragColor';
    defineOutput = '';

    // WebGL1 has no built in isnan so we define one here.
    defineSpecialNaN = `bool isnan(value) isnan_custom(value) {
      return (value > 0. || value < 1. || value == 0.) ? false : true;
    }
    bvec4 isnan_custom(vec4 val) {
      return bvec4(isnan(val.x), isnan(val.y),
        isnan(val.z),
        isnan(val.w));
    }
    // In webgl 2 we do not need to specify a custom isnan so there is none
    // need for a special INFINITY constant.
    defineSpecialInf = `uniform float INFINITY;
    bool isinf(float val) {
      return abs(val) == INFINITY;
    }
    bvec4 isinf(vec4 val) {
      return equal(abs(val), vec4(INFINITY));
    }
    defineRound = `int round(float value) {
      return int(floor(value + 0.5));
    }
    ivec4 round(vec4 value) {
      return ivec4(floor(value + vec4(0.5)));
    }
    `;
  }

  return {
    version,
    attribute,
    varyingVs,
    varyingFs,
    texture2D,
    output,
    defineOutput,
    defineSpecialNaN,
    defineSpecialInf,
    defineRound
  };
}

import {util} from '@tensorflow/tfjs-core';

/**
 * Produces GLSL code that derives logical coordinates
 * from a flat index. The code performs integer division
 * with each stride and decrements the index until the
 * index equals the final dimension coordinate.
 * @param coords - An array of strings representing the
 * shape of the array.
 * @param shape - An array of numbers representing the
 * shape of the array.
 * @returns A string representing the logical coordinates.
 */
export function getLogicalCoordinatesFromFlatIndex(coords: string[], shape: number[]): string {
  const strides = util.computeStrides(shape);
  return strides
      .map((stride, i) => {
        const line1 = `int ${coords[i]} = index / ${stride} `;
        const line2 = i === strides.length - 1 ?
            `int ${coords[i + 1]} = index % ${coords[i]} * ${strides[i]}` :
            `index -= ${coords[i]} * ${strides[i]};`;
        return `${line1}; ${line2};`;
      })
      .join('');
}

const vec4 = buildVec(['x', 'y', 'z', 'w']);

/**
 * Produces GLSL code that computes the dot product of the input x and y vectors. Handles splitting inputs into increments of vec4s when necessary.
 * @param x - An array of strings representing the x vector.
 * @param y - An array of strings representing the y vector.
 * @returns A string representing the dot product.
 */
export function dotify(x: string[], y: string[]): string {
  const nearestVec4 = Math.floor(x.length / 4);
  const nearestVec4Remainder = x.length % 4;
  return "// Computational code

  // Define logical coordinates
  const logicalCoords = getLogicalCoordinatesFromFlatIndex(x);
  const logicalYCoords = getLogicalCoordinatesFromFlatIndex(y);

  // Compute dot product
  let dotProduct = 0;
  for (let i = 0; i < nearestVec4; i++) {
    const vecX = x.slice(i * 4, Math.min(x.length, (i + 1) * 4));
    const vecY = y.slice(i * 4, Math.min(y.length, (i + 1) * 4));
    dotProduct += dotify(vecX, vecY);
  }

  // Handle remainder
  if (nearestVec4Remainder > 0) {
    const vecX = x.slice(nearestVec4 * 4);
    const vecY = y.slice(nearestVec4 * 4);
    dotProduct += dotify(vecX, vecY);
  }

  return dotProduct;
}
```

nearestVec4; i++) {
    const xSlice = x.slice(i * 4, i * 4 + 4);
    const ySlice = y.slice(i * 4, i * 4 + 4);
    slices.push($({buildVec(xSlice)}, $({buildVec(ySlice)})});
  } if (nearestVec4Remainder !== 0) { let xSlice = xSlice.map(d => `float(d)`);
    ySlice = ySlice.map(d => `float(d)`);
  } return slices.push($({buildVec(xSlice)}, $({buildVec(ySlice)})});

  if (nearestVec4Remainder !== 0) {
    let xSlice = x.slice(nearestVec4 * 4);
    let ySlice = y.slice(nearestVec4 * 4);
    if (xSlice.length === 1) { xSlice = xSlice.map(d => `float(d)`);
      ySlice = ySlice.map(d => `float(d)`);
    }
    slices.push(`${buildVec(xSlice)}, ${buildVec(ySlice)}`);
  }

  return slices.map((d, i) => `dot(${d})`).join('+');
}

/**
 * Produces GLSL that computes the flat index from 3D coordinates.
 */
export function getFlatIndexFrom3D(shape: number[], number, number, number): string {
  const strides = shape.map(d => d.toString());
  return `int getFlatIndex(vec3 coords) {
    return coords.x * ${strides[0]} + coords.y * ${strides[1]} + coords.z;
  }
`;

  ENCODE_FLOAT_SNIPPET = `
    const float FLOAT_MAX = 1.70141184e38;
    const float FLOAT_MIN = 1.17549435e-38;
    lowp vec4 encode_float(highp float v) {
      if (isnan(v)) {
        return vec4(255, 255, 255, 255);
      }

      highp float av = abs(v);
      if (av < FLOAT_MIN) {
        return vec4(0.0, 0.0, 0.0, 0.0);
      } else if (v > FLOAT_MAX) {
        return vec4(0.0, 0.0, 128.0, 255.0) / 255.0;
      } else if (v < -FLOAT_MAX) {
        return vec4(0.0, 0.0, 255.0, 128.0) / 255.0;
      }

      highp vec4 c = vec4(0, 0, 0, 0);
      highp float e = floor(log2(av));
      highp float m = exp2(fract(log2(av))) - 1.0;
      c[2] = floor(128.0 * m);
      m -= c[2] / 128.0;
      c[1] = floor(32768.0 * m);
      m -= c[1] / 32768.0;
      c[0] = floor(8388608.0 * m);
      m -= c[0] / 8388608.0;
      return c[0];
    }
  `;
  return `vec4 decode_float(vec4 v) {
    int i = int(v[3]) + 128.0 * step(0.0, -v[0]);
    ivec3 coords = ivec3(v[0], v[1], v[2]);
    return getFlatIndexFrom3D(coords);`;
}

export class DecodeMatrixProgram implements GPGPUProgram {
  variableNames = ['A'];
  userCode: string;
  outputShape: number[];
  packedInputs = false;
  packedOutput = true;
  outPackingScheme = PackingScheme.DENSE;

  constructor(outputShape: number[]) {
    const texShape = getDenseTexShape(outputShape);
    const glsl = getGlslDifferences();
    this.outputShape = outputShape;
    this.userCode = `ivec3 outCoordsFromFlatIndex(int index) {
      return ivec3(r, c, d);
    }

    void main() {
      ivec2 resTexRC = ivec2(resultUV.yx * vec2($({texShape[0]}), vec2($({texShape[0]})));
      int index = 4 * (resTexRC.x * $({texShape[1]})) + resTexRC.y;
      vec4 result = vec4(0.0);
      for (int i=0; i<4; i++) {
        int flatIndex = index + i;
        ivec3 rc = outCoordsFromFlatIndex(flatIndex);
        result[i] = getA(rc.x, rc.y, rc.z);
      }
      float resUV = result.y;
      return vec4(0.0, 0.0, 0.0, 0.0);
    }`;
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```javascript
userCode: string;
packedInputs = true;
packedOutput = true;
outputShape: [number, number, number];
outPackingScheme = PackingScheme.DENSE;

const texShape = getDenseTexShape(outputShape);
const glsl = getGlsDifferences();
this.outputShape = outputShape;
this.userCode = `ivec3 outCoordsFromFlatIndex(int index) {
  return ivec3(r, c, d);
}

void main() {
  ivec3 texRC = ivec2(resultUV.yx) * vec2(texShape[0]);
  int index = 4 * (texRC.x * texShape[1]) + texRC.y;
  vec4 result = vec4(0.);
  for (int i=0; i<4; i++) {
    float x = getChannel(getA(i, resultUV.yxy), vec2(i, resultUV.zz));
    result[i] = getChannel(getAAtOutCoords(), vec2(i, resultUV.zz));
  }
  return result;
}

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 */

import {getGlsDifferences} from './gls_version';
import {GPGPUProgram} from './gpgpu_math';
import {ENCODE_FLOAT_SNIPPET} from './shader_compiler_util';
import {TextureUsage} from './tex_util';

export class EncodeFloatProgram implements GPGPUProgram {
  variableNames = ['A'];
  userCode: string;
  outputShape: number[];
  outTexUsage = TextureUsage.DOWNLOAD;

  constructor(outputShape: number[]) {
    const glsl = getGlsDifferences();
    this.outputShape = outputShape;
    this.userCode = `float x = getAAtOutCoords();
    return encode_float(x);
  }
}

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 * under the License.
 */

import {getGlsDifferences} from './gls_version';
import {GPGPUProgram} from './gpgpu_math';
import * as shader_util from './shader_compiler_util';

export class EncodeMatrixProgram implements GPGPUProgram {
  variableNames = ['A'];
  userCode: string;
  outputShape: number[];
  outTexUsage = TextureUsage.DOWNLOAD;

  constructor(outputShape: number[]) {
    const glsl =
```
variableNames = ['A'];

userCode: string;

outputShape: number[];

constructor(
  outputShape: number[];
  texShape: number[],
  inputsIsUnsignedByte = false);

const glsl = getGlslDifferences();

const [height, width] = texShape;

let outputShape = 'result';

if (inputsIsUnsignedByte) {
  outputShape = 'floor(result * 255. + 0.5)';
}

this.userCode = '$\{shader_util.getFlatIndexFrom3D(outputShape)\}';

void main() {

  ivec3 coords = getOutputCoords();

  int flatIndex = getFlatIndex(coords);

  int offset = imod(flatIndex, 4);

  int r = flatIndex / $\{width\};

  int c = imod(flatIndex, $\{width\});

  float result;

  if (offset == 0) {
    result = values[0];
  } else if (offset == 1) {
    result = values[1];
  } else if (offset == 2) {
    result = values[2];
  } else {
    result = values[3];
  }

  $\{glsl.output\} = vec4($\{output\}, 0., 0., 0.);
}

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 *
 *=============================================================================

import {getGlslDifferences} from './glsl_version';
import {GPGPUProgram} from './gpgpu_math';
import *

as shader_util from './shader_compiler_util';

/*
This is how the shader encodes a tensor with shape = [2, 3, 5]
(indices are [batch, row, col]).

000|001| 002| 003| 004| xxx| 020| 021| 022| 023| 024| xxx
-------|-------|-----|-----|-----|----|-------|-------|-------|-------|-------|-------
010| 011| 012| 013| 014| xxx| xxx| xxx| xxx| xxx| xxx| xxx| xxx| xxx| xxx| xxx| xxx| xxx| xxx| xxx| xxx

100| 101| 102| 103| 104| xxx| xxx| xxx| xxx| xxx| xxx| xxx| xxx| xxx| xxx| xxx| xxx| xxx| xxx| xxx| xxx

120| 121| 122| 123| 124|x.xxx| x.xxx| x.xxx| x.xxx| x.xxx| x.xxx| x.xxx| x.xxx| x.xxx| x.xxx| x.xxx| x.xxx| x.xxx| x.xxx| x.xxx| x.xxx| x.xxx| x.xxx

Single texels contain only values from the same batch, and from adjacent rows and
columns.
 */

export class EncodeMatrixPackedProgram implements GPGPUProgram {

  variableNames = ['A'];

  userCode: string;

  outputShape: number[];

  packedInputs = false;

  packedOutput = true;

  constructor(
    outputShape: number[];
    texShape: number[];
    inputIsUnsignedByte = false);

  const glsl = getGlslDifferences();

  const [height, width] = texShape;

  let mainLoop = '';

  let output = 'result';

  if (inputIsUnsignedByte) {
    output = 'floor(result * 255. + 0.5)';
  }

  for (let row = 0; row <= 1; row++) {
    for (let col = 0; col <= 1; col++) {

      const channel = row * 2 + col;

      mainLoop += `
        localCoords = coords;
        if(localCoords[2] + ${col} < ${outputShape[2]}) {
          if(localCoords[1] + ${row} < ${outputShape[1]}) {
            localCoords[1] += ${row};

            flatIndex = getFlatIndex(localCoords);

            offset = imod(flatIndex, 4);

            int r = flatIndex / ${width};

            c = imod(flatIndex, $\{width\});

            uv = (vec2(c, r) + halfCR) / vec2($\{width\}, 0, $\{height\}, 0);

            values = $\{glsl.texture2D\}(A, uv);

            if (offset == 0) {
              result[\$\{channel\}] = values[0];
            } else if (offset == 1) {
              result[\$\{channel\}] = values[1];
            } else if (offset == 2) {
              result[\$\{channel\}] = values[2];
            } else {
              result[\$\{channel\}] = values[3];
            }

            $\{glsl.output\} = vec4($\{output\}, 0., 0., 0.);
        }
      `;
    }
  }

  this.userCode = `\n    ${shader_util.getFlatIndexFrom3D(outputShape)}

    void main() {
      ivec3 coords = getOutputCoords();

      vec4 result = vec4(0.);

      int flatIndex, r, c,

      int offset = imod(flatIndex, 4);

      int r = flatIndex / $\{width\};

      int c = imod(flatIndex, $\{width\});

      vec2 uv = (vec2(c, r) + halfCR) / vec2($\{width\}, 0, $\{height\}, 0);

      vec4 values = $\{glsl.texture2D\}(A, uv);

      if (offset == 0) {
        result[\$\{channel\}] = values[0];
      } else if (offset == 1) {
        result[\$\{channel\}] = values[1];
      } else if (offset == 2) {
        result[\$\{channel\}] = values[2];
      } else {
        result[\$\{channel\}] = values[3];
      }

      $\{glsl.output\} = vec4($\{output\}, 0., 0., 0.);
    }
``
import {PixelData, TypedArray} from '@tensorflow/tfjs-core';

import {getGlslDifferences} from './glsl_version';
import * as tex_util from './tex_util';
import {TextureConfig} from './tex_util';

export function createTexture(gl: WebGLRenderingContext, textureConfig: TextureConfig): WebGLTexture {
  const width = textureConfig.width;
  const height = textureConfig.height;
  const internalFormat = textureConfig.internalFormat;
  const textureFormat = textureConfig.textureFormat;
  const textureType = textureConfig.textureType;

  const texture = webgl_util.createTexture(gl);

  const tex2d = gl.TEXTURE_2D;
  webgl_util.callAndCheck(gl, () =>
    gl.bindTexture(tex2d, texture));
  webgl_util.callAndCheck(gl, () =>
    gl.texParameteri(tex2d, gl.TEXTURE_WRAP_S, gl.CLAMP_TO_EDGE));
  webgl_util.callAndCheck(gl, () =>
    gl.texParameteri(tex2d, gl.TEXTURE_WRAP_T, gl.CLAMP_TO_EDGE));
  webgl_util.callAndCheck(gl, () =>
    gl.texImage2D(tex2d, 0, internalFormat, width, height, 0, textureFormat, textureType, null));
  webgl_util.callAndCheck(gl, () =>
    gl.bindTexture(gl.TEXTURE_2D, null));

  return texture;
}

export function getInternalFormatForFloat32MatrixTexture(textureConfig: TextureConfig): number {
  return textureConfig.internalFormatFloat;
}

export function createFloat32MatrixTexture(gl: WebGLRenderingContext, rows: number, columns: number, textureConfig: TextureConfig): WebGLTexture {
  const [width, height] = tex_util.getPackedMatrixTextureShapeWidthHeight(rows, columns);
  return createTexture(gl, width, height, getInternalFormatForFloat32MatrixTexture(textureConfig), textureConfig.width, textureConfig.height, textureConfig.textType, textureConfig.textureFormat, textureConfig.textureType, textureConfig.textureTypeHalf);
function getInternalFormatForFloat16PackedMatrixTexture(
    textureConfig: TextureConfig) {
  return textureConfig.internalFormatPackedHalfFloat;
}

export function createFloat16PackedMatrixTexture(
    gl: WebGLRenderingContext, rows: number, columns: number,
    textureConfig: TextureConfig): WebGLTexture {
  const [width, height] = tex_util.getPackedMatrixTextureShapeWidthHeight(rows, columns);
  return createAndConfigureTexture(gl, width, height, getInternalFormatForFloat16PackedMatrixTexture(textureConfig), gl.RGBA);
}

function bindVertexProgramAttributeStreams(
    gl: WebGLRenderingContext, program: WebGLProgram, vertexBuffer: WebGLBuffer): boolean {
  const posOffset = 0; // x is the first buffer element
  const uvOffset = 3 * 4; // uv comes after [x y z]
  const stride = (3 * 4) + (2 * 4); // xyz + uv, each entry is 4-byte float
  webgl_util.callAndCheck(gl, () => gl.bindBuffer(gl.ARRAY_BUFFER, vertexBuffer));
  const success = webgl_util.bindVertexBufferToProgramAttribute(gl, program, 'clipSpacePos', vertexBuffer, 3, stride, posOffset);
  return success &&
      webgl_util.bindVertexBufferToProgramAttribute(gl, program, 'uv', vertexBuffer, 2, stride, uvOffset);
}

export function uploadDenseMatrixToTexture(
    gl: WebGLRenderingContext, texture: WebGLTexture, width: number, height: number, data: TypedArray,
    textureConfig: TextureConfig) {
  webgl_util.callAndCheck(gl, () => gl.bindTexture(gl.TEXTURE_2D, texture));
  let dataForUpload: TypedArray, texelDataType: number, internalFormat: number;
  if (data instanceof Uint8Array) {
    dataForUpload = new Uint8Array(width * height * 4);
    texelDataType = gl.UNSIGNED_BYTE;
    internalFormat = gl.RGBA;
  } else {
    dataForUpload = new Float32Array(width * height * 4);
    texelDataType = gl.FLOAT;
    internalFormat = textureConfig.internalFormatPackedFloat;
  }
  dataForUpload.set(data);
  webgl_util.callAndCheck(
      gl,
      () => gl.texImage2D(
          gl.TEXTURE_2D, 0, internalFormat, width, height, 0, gl.RGBA,
          texelDataType, dataForUpload));
  webgl_util.callAndCheck(gl, () => gl.bindTexture(gl.TEXTURE_2D, null));
}

export function uploadPixelDataToTexture(
    gl: WebGLRenderingContext, texture: WebGLTexture,
    pixels: PixelData|ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement) {
  webgl_util.callAndCheck(gl, () => gl.bindTexture(gl.TEXTURE_2D, texture));
  if ((pixels as PixelData).data instanceof Uint8Array) {
    webgl_util.callAndCheck(
        gl,
        () => gl.texImage2D(
            gl.TEXTURE_2D, 0, gl.RGBA, (pixels as ImageData).width, (pixels as ImageData).height,
            gl.RGBA, gl.UNSIGNED_BYTE, (pixels as ImageData).data));
  } else {
    webgl_util.callAndCheck(
        gl,
        () => gl.texImage2D(
            gl.TEXTURE_2D, 0, gl.RGBA, gl.RGBA, gl.UNSIGNED_BYTE,
            pixels as ImageData | HTMLImageElement | HTMLCanvasElement | HTMLVideoElement));
  }
  webgl_util.callAndCheck(gl, () => gl.bindTexture(gl.TEXTURE_2D, null));
}

export function createBufferFromOutputTexture(
    gl2: WebGL2RenderingContext, rows: number, columns: number,
    textureConfig: TextureConfig): WebGLBuffer {
  // Create and bind the buffer
  const buffer = gl2.createBuffer();
  webgl_util.callAndCheck(gl2, () => gl2.bindBuffer(gl2.PIXEL_PACK_BUFFER, buffer));
  // Initialize the buffer to the size of the texture in bytes
  const bytesPerFloat = 4;
  const valuesPerTexel = 4;
  const bufferSizeBytes = bytesPerFloat * valuesPerTexel * rows * columns;
  webgl_util.callAndCheck(gl2, () => gl2.bufferData(gl2.PIXEL_PACK_BUFFER,
      bufferSizeBytes, gl2.FLOAT, 0));
  // Enqueue a command on the GPU command queue to copy of texture into the buffer
  webgl_util.callAndCheck(gl2, () => gl2.readPixels(0, 0, columns, rows, gl2.RGBA, gl2.FLOAT, 0));
  webgl_util.callAndCheck(gl2, () => gl2.bindBuffer(gl2.PIXEL_PACK_BUFFER, null));
  return buffer;
}

export function downloadFloat32MatrixFromBuffer(
    gl: WebGLRenderingContext, buffer: WebGLBuffer, size: number): Float32Array {
  const gl2 = gl as WebGL2RenderingContext;
  const downloadTarget = new Float32Array(size);
  gl2.bindBuffer(gl2.PIXEL_PACK_BUFFER, buffer);
  gl2.getBufferSubData(gl2.PIXEL_PACK_BUFFER, 0, downloadTarget);
  return buffer;
}

export function downloadByteEncodedFloatMatrixFromOutputTexture(
    gl: WebGLRenderingContext, rows: number, columns: number,
    textureConfig: TextureConfig): Float32Array {
  const gl2 = gl as WebGL2RenderingContext;
  const buffer = gl2.createBuffer();
  webgl_util.callAndCheck(gl2, () => gl2.bindBuffer(gl2.PIXEL_PACK_BUFFER, buffer));
  // Initialize the buffer to the size of the texture in bytes
  const bytesPerFloat = 4;
  const valuesPerTexel = 4;
  const bufferSizeBytes = bytesPerFloat * valuesPerTexel * rows * columns;
  webgl_util.callAndCheck(gl2, () => gl2.bufferData(gl2.PIXEL_PACK_BUFFER,
      bufferSizeBytes, gl2.FLOAT, 0));
  // Enqueue a command on the GPU command queue to copy of texture into the buffer
  webgl_util.callAndCheck(gl2, () => gl2.readPixels(0, 0, columns, rows, gl2.RGBA, gl2.FLOAT, 0));
  webgl_util.callAndCheck(gl2, () => gl2.bindBuffer(gl2.PIXEL_PACK_BUFFER, null));
  return buffer;
}
number,
    textureConfig: TextureConfig) {
  const [w, h] =
  tex_util.getUnpackedMatrixTextureShapeWidthHeight(rows, columns);
  const numChannels = 4;
  const downloadTarget = new Uint8Array(
      tex_util.getUnpackedArraySizeFromMatrixSize(rows * columns,
      numChannels));
  webgl_util.callAndCheck(gl, gl.readPixels(0, 0, w, h,
      textureConfig.downloadTextureFormat, gl.UNSIGNED_BYTE,
      downloadTarget));
  // By wrapping the buffer in a Float32Array, we use native browser IEEE 754
  // decoding of the 4 bytes that back each 32 bit float.
  return new Float32Array(downloadTarget.buffer);
}

export function downloadMatrixFromPackedOutputTexture(
    gl: WebGLRenderingContext, physicalRows: number,
    physicalCols: number): Float32Array {
  const packedRGBA = new Float32Array(physicalRows * physicalCols * 4);
  webgl_util.callAndCheck(gl, gl.readPixels(0, 0, physicalCols, physicalRows,
      gl.RGBA, gl.FLOAT, packedRGBA));
  return packedRGBA;
}

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 *-----------------------------------------------------------------------------
Get the extension or throw an error if the extension is not available.

If the environment flag WEBGL_FORCE_F16_TEXTURES is set to true, this method will throw a new Error if the GL context does not support color renderable half floats. Otherwise, it will return the WebGLUtil's getExtensionOrThrow method with the COLOR_BUFFER_HALF_FLOAT extension.

If the WebGLUtil is not defined in the global object, a new error will be thrown. Otherwise, the ColorBufferFloatExtension will be created using WebGLUtil.createColorBufferFloatExtension.

The ColorBufferHalfFloatExtension will be created using WebGLUtil.createColorBufferHalfFloatExtension.
return gpgpu_util.downloadPackedMatrixFromBuffer(
    this.gl, buffer, batch, rows, columns, physicalRows, physicalCols, this.textureConfig);
}

public downloadFloat32MatrixFromBuffer(buffer: WebGLBuffer, size: number): Float32Array {
    return gpgpu_util.downloadFloat32MatrixFromBuffer(this.gl, buffer, size);
}

public createBufferFromTexture(texture: WebGLTexture, rows: number, columns: number): WebGLBuffer {
    this.bindTextureToFrameBuffer(texture);
    const result = gpgpu_util.createBufferFromOutputTexture(this.gl as WebGL2RenderingContext, rows, columns, this.textureConfig);
    this.unbindTextureToFrameBuffer();
    return result;
}

public downloadMatrixFromPackedTexture(texture: WebGLTexture, physicalRows: number, physicalCols: number): Float32Array {
    return this.downloadMatrixDriver(texture, () => gpgpu_util.downloadMatrixFromPackedOutputTexture(this.gl, physicalRows, physicalCols));
}

private vertexAttrsAreBound = false;

public createProgram(fragmentShaderSource: string): WebGLProgram {
    this.throwIfDisposed();
    const gl = this.gl;
    const fragmentShader: WebGLShader = gpgpu_util.createFragmentShader(gl, fragmentShaderSource);
    const vertexShader: WebGLShader = gpgpu_util.createVertexShader(gl);
    const program: WebGLProgram = webgl_util.createProgram(gl);
    webgl_util.callAndCheck(gl, () => gl.attachShader(program, vertexShader));
    webgl_util.callAndCheck(gl, () => gl.attachShader(program, fragmentShader));
    gl.linkProgram(program);
    if (this.debug) {
        webgl_util.validateProgram(gl, program);
    }
    if (!this.vertexAttrsAreBound) {
        this.setProgram(program);
        this.vertexAttrsAreBound = gpgpu_util.bindVertexProgramAttributeStreams(gl, this.gl, this.program, this.vertexBuffer);
    }
    return program;
}

public deleteProgram(program: WebGLProgram) {
    this.throwIfDisposed();
    if (program === this.program) {
        this.program = null;
    }
    if (program != null) {
        webgl_util.callAndCheck(gl, () => gl.deleteProgram(program));
    }
}

public setProgram(program: WebGLProgram|null) {
    this.throwIfDisposed();
    this.throwIfNoProgram();
    webgl_util.bindTextureToProgramUniformSampler(gl, this.program, this.programId, program);
}

public setInputMatrixTexture(inputMatrixTexture: WebGLTexture, uniformLocation: WebGLUniformLocation, textureUnit: number) {
    this.throwIfDisposed();
    this.throwIfNoProgram();
    webgl_util.bindTextureToProgramUniformSampler(gl, this.program, this.programId, program, uniformLocation, inputMatrixTexture, textureUnit);
}

public setOutputMatrixTexture(outputMatrixTexture: WebGLTexture, uniformLocation: WebGLUniformLocation, textureUnit: number) {
    this.throwIfDisposed();
    this.throwIfNoProgram();
    webgl_util.bindTextureToProgramUniformSampler(gl, this.program, this.programId, program, uniformLocation, outputMatrixTexture, textureUnit);
}
outputMatrixTexture: WebGLTexture, rows: number, columns: number) {
  this.setOutputMatrixTextureDriver(outputMatrixTexture, columns, rows);
}

public setOutputPackedMatrixTexture(outputPackedMatrixTexture: WebGLTexture, rows: number, columns: number) {
  this.throwIfDisposed();
  const [width, height] = tex_util.getMatrixTextureShapeWidthHeight(rows, columns);
  this.setOutputMatrixTextureDriver(outputMatrixTexture, columns, rows);
}

public setOutputPackedMatrixWriteRegion(startRow: number, numRows: number, startColumn: number, numColumns: number) {
  this.throwIfDisposed();
  if (this.program != null) {
    webgl_util.validateProgram(this.gl, this.program);
    this.throwIfNoProgram();
    this.setOutputMatrixWriteRegionDriver(startRow, numRows, startColumn, numColumns);
  }
}

public executeProgram() {
  this.throwIfDisposed();
  this.throwIfNoProgram();
  this.debugValidate();
  this.gl.drawElements(this.gl.TRIANGLES, 6, this.gl.UNSIGNED_SHORT, 0);
}

public blockUntilAllProgramsCompleted() {
  this.throwIfDisposed();
  this.gl.finish();
}

this.getQueryTimerExtension(): WebGL1DisjointQueryTimerExtension | WebGL2DisjointQueryTimerExtension {
  if (this.disjointQueryTimerExtension == null) {
    this.disjointQueryTimerExtension =
      webgl_util.getExtensionOrThrow(
        this.gl,
        env().getNumber(
            'WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_VERSION') === 2 ?
          'EXT_disjoint_timer_query_webgl2' :
          'EXT_disjoint_timer_query')
          as WebGL1DisjointQueryTimerExtension | WebGL2DisjointQueryTimerExtension;
    return this.disjointQueryTimerExtension;
  }
  return this.disjointQueryTimerExtension;
}

public waitForQueryAndGetTime(query: WebGLQuery): Promise<number> {
  await util.repeatedTry(
    () =>
      this.isQueryAvailable(query,
        env().getNumber(
            'WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_VERSION')));
  return this.getQueryTime(query,
    env().getNumber(
        'WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_VERSION'));
}

private getQueryTime(query: WebGLQuery, queryTimerVersion: number): number {
  if (queryTimerVersion === 0) {
    return null;
  }
  if (queryTimerVersion === 2) {
    const gl2 = this.gl as WebGL2RenderingContext;
    const timeElapsedNanos = gl2.getQueryParameter(query, gl2.QUERY_RESULT);
    // Return milliseconds.
    return timeElapsedNanos / 1000000;
  } else {
    const ext = this.getQueryTimerExtensionWebGL1();
    const timeElapsedNanos =
          ext.getQueryObjectEXT(query, ext.QUERY_RESULT_EXT);
    // Return milliseconds.
    return timeElapsedNanos / 1000000;
  }
}
if (queryTimerVersion === 2) {
  const gl2 = this.gl as WebGL2RenderingContext;
  const ext = this.getQueryTimerExtensionWebGL2();
  const available = gl2.getQueryParameter(query, gl2.QUERY_RESULT_AVAILABLE);
  if (this.disjoint === null) {
    this.disjoint = this.gl.getParameter(ext.GPU_DISJOINT_EXT);
  }
  return available && !this.disjoint;
} else {
  const ext = this.getQueryTimerExtensionWebGL1();
  const available = ext.getQueryObjectEXT(query, ext.QUERY_RESULT_AVAILABLE);
  if (this.disjoint === null) {
    this.disjoint = this.gl.getParameter(ext.GPU_DISJOINT_EXT);
  }
  return available && !this.disjoint;
}

pollFence(fenceContext: FenceContext) {
  return new Promise<void>(resolve => {
    this.addItemToPoll(() => fenceContext.isFencePassed(), () => resolve());
  });
}

private itemsToPoll: PollItem[] = [];

private addItemToPoll(isDoneFn: () => boolean, resolveFn: () => void) {
  this.itemsToPoll.push({isDoneFn, resolveFn});
  if (this.itemsToPoll.length > 1) {
    // We already have a running loop that polls.
    return;
  }
  // Start a new loop that polls.
  util.repeatedTry(() => {
    this.pollItems();
    // End the loop if no more items to poll.
    return this.itemsToPoll.length === 0;
  });
}

bindTextureToFrameBuffer(texture: WebGLTexture) {
  this.throwIfDisposed();
  webgl_util.bindColorTextureToFramebuffer(this.gl, texture, this.framebuffer);
  if (this.debug) {
    webgl_util.validateFramebuffer(this.gl);
  }
}

unbindTextureToFrameBuffer() {
  if (this.outputTexture != null) {
    webgl_util.bindColorTextureToFramebuffer(this.gl, this.outputTexture, this.framebuffer);
    if (this.debug) {
      webgl_util.validateFramebuffer(this.gl);
    }
    this.outputTexture = null;
    webgl_util.unbindColorTextureFromFramebuffer(this.gl, this.framebuffer);
  } else {
    webgl_util.unbindColorTextureFromFramebuffer(this.gl, this.framebuffer);
  }
}

downloadMatrixDriver(texture: WebGLTexture, downloadAndDecode: () => Float32Array): Float32Array {
  this.bindTextureToFrameBuffer(texture);
  const result = downloadAndDecode();
  this.unbindTextureToFrameBuffer();
  return result;
}

setOutputMatrixTextureDriver(outputMatrixTextureMaybePacked: WebGLTexture, width: number, height: number) {
  this.throwIfDisposed();
  this.throwIfNoProgram();
  const gl = this.gl;
  webgl_util.bindColorTextureToFramebuffer(gl, outputMatrixTextureMaybePacked, this.framebuffer);
  if (this.debug) {
    webgl_util.validateFramebuffer(gl);
  }
  this.outputTexture = outputMatrixTextureMaybePacked;
  webgl_util.callAndCheck(gl, () => this.gl.viewport(0, 0, width, height));
  webgl_util.callAndCheck(gl, () => this.gl.scissor(x: number, y: number, width: number, height: number));
  if (this.debug) {
    webgl_util.validateFramebuffer(gl);
  }
  this.throwIfDisposed();
  this.throwIfNoProgram();
  this.throwIfTensorFlowSessionNotReady();
  this.throwIfInvalidOutputBuffer();
  this.throwIfInvalidOutputTexture();
  webgl_util.callAndCheck(gl, () => this.gl.scissor(x: number, y: number, width: number, height: number));
  (isDoneFn) => resolveFn(); => voidFn);[*
  * Finds the index of the last true element using linear search.
  * Note: We can't do binary search because Chrome expects us to explicitly test all fences before
download: * https://github.com/tensorflow/tfjs/issues/1145
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distributed on an "AS IS" BASIS, WITHOUT WARRANTIES OF ANY KIND, either express or implied.
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  *=============================================================================
  */

import {backend_util, util} from '@tensorflow/tfjs-core';
const {getBroadcastDims} = backend_util;
import
export type ShapeInfo = {
  logicalShape: number[],
  texShape: [number, number],
  isUniform: boolean,
  isPacked: boolean,
  flatOffset: number[],
} export type InputInfo = {
  name: string,
  inputsInfo: InputInfo[],
  outputShape: ShapeInfo,
  userCode: string,
  usesPackedTextures: boolean:
};

function makeShader(
    inputsInfo: InputInfo[],
    outputShape: ShapeInfo,
    userCode: string,
    usesPackedTextures: boolean): string {
  const prefixSnippets: string[] = [];
  inputsInfo.forEach(x => {
    const size = util.sizeFromShape(x.shapeInfo.logicalShape);
    // Snippet when we decided to upload the
    // values as uniform.

    if (x.shapeInfo.isUniform) {
      prefixSnippets.push(`uniform float $x.name$;`);
    } else {
      prefixSnippets.push(`uniform sampler2D $x.name$;`);
      prefixSnippets.push(`uniform int offset${x.name};`);
    }
  });
  const inputPrefixSnippet = prefixSnippets.join('
');

  const inputSamplingSnippet =
      inputsInfo
          .map(x =>
              getInputSamplingSnippet(x, outputShape, usesPackedTextures))
          .join('
');

  const outputSamplingSnippet =
      getOutputSamplingSnippet(outputShape.logicalShape, outTexShape);

  const glsl = getGlslDifferences();
  const floatTextureSampleSnippet =
      getFloatTextureSampleSnippet(glsl);

  let outputSamplingSnippet: string;
  let floatTextureSetOutputSnippet: string;
  let shaderPrefix = getShaderPrefix(glsl);
  let shaderPrefix +=

  return getFloatTextureSetRGBASnippet(glsl);
}

function getSamplerFromInInfo(inInfo: InputInfo): string {
  const shape = inInfo.shapeInfo.logicalShape;
  switch (shape.length) {
    case 0:
      return getSamplerScalar(inInfo);
    case 1:
      return getSampler1D(inInfo);
    case 2:
      return getSampler2D(inInfo);
    case 3:
      return getSampler3D(inInfo);
    case 4:
      return getSampler4D(inInfo);
    case 5:
      return getSampler5D(inInfo);
    case 6:
      return getSampler6D(inInfo);
    default:
      throw new Error('6-D input sampling is not yet supported');
  }
}

function getPackedSamplerFromInInfo(inInfo: InputInfo): string {
  const shape = inInfo.shapeInfo.logicalShape;
  switch (shape.length) {
    case 0:
      return getPackedSamplerScalar(inInfo);
    case 1:
      return getPackedSampler1D(inInfo);
    case 2:
      return getPackedSampler2D(inInfo);
    case 3:
      return getPackedSampler3D(inInfo);
    case 4:
      return getPackedSampler4D(inInfo);
    case 5:
      return getPackedSampler5D(inInfo);
    case 6:
      return getPackedSampler6D(inInfo);
    default:
      throw new Error('6-D input sampling is not yet supported');
  }
}

function getInputSamplingSnippet(
    inInfo: InputInfo,
    outShapeInfo: ShapeInfo,
    usesPackedTextures = false): string {
  let res = '';

  if (usesPackedTextures) {
    res +=

  } else {
    res +=

  }

  return res;
}

function getPackedOutputSamplingSnippet(
    outShape: number[],
    outTexShape: [number, number]): string {
  switch (outShape.length) {
    case 0:
      return getOutputScalarCoords();
    case 1:
      return getOutput1DCoords(outShape as [number], outTexShape);
    case 2:
      return getOutput2DCoords(outShape as [number, number], outTexShape);
    case 3:
      return getOutput3DCoords(outShape as [number, number, number], outTexShape);
    case 4:
      return getOutput4DCoords(outShape as [number, number, number, number], outTexShape);
    case 5:
      return getOutput5DCoords(outShape as [number, number, number, number, number], outTexShape);
    case 6:
      return getOutput6DCoords(outShape as [number, number, number, number, number, number], outTexShape);
    default:
      return getOutputScalarCoords(outShape, outTexShape);
  }

  return res;
}

function getOutputSamplingSnippet(
    outShape: number[],
    outTexShape: [number, number]): string {
  switch (outShape.length) {
    case 0:
      return getOutputScalarCoords();
    case 1:
      return getOutput1DCoords(outShape as [number], outTexShape);
    case 2:
      return getOutput2DCoords(outShape as [number, number], outTexShape);
    case 3:
      return getOutput3DCoords(outShape as [number, number, number], outTexShape);
    case 4:
      return getOutput4DCoords(outShape as [number, number, number, number], outTexShape);
    case 5:
      return getOutput5DCoords(outShape as [number, number, number, number, number], outTexShape);
    case 6:
      return getOutput6DCoords(outShape as [number, number, number, number, number, number], outTexShape);
    default:
      return getOutputScalarCoords(outShape, outTexShape);
  }

  return res;
}

---

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const texelsInBatch = texelsInLogicalRow * Math.ceil(shape[1] / 2);

return `vec3 getOutputCoords() {
  ivec2 resTexRC = ivec2(resultUV.xy *
  vec2($\{\text{packedTexShape[0]}\}$),
  $\{\text{packedTexShape[1]}\}$)));

int index = resTexRC.x * $\{\text{packedTexShape[1]}\} + resTexRC.y;

int b = index / $\{\text{texelsInBatch}\};

int r = 2 * (index / $\{\text{texelsInLogicalRow}\}) * 2;

return ivec3(b, r, c);
}`;

let texelsInBatch = texelsInLogicalRow * Math.ceil(shape[1] / 2);

let texelsInBatchN = texelsInBatch;

let batches = `\n`;

let coords = `b, r, c`;
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 return `\n float ${funcName}(int row, int col) {\n  vec2 uv = (vec2(col, row) + halfCR) /\n  vec2(${shape[1]}, 1);\n  return sampleTexture(${texName}, uv);\n}`;

 Deze functie kan worden gebruikt om een gloed op een 3D-rendering toe te passen. De inputInformation WorstArrayInInfo moet een object zijn met de volgende eigenschappen:

 - `shape`: Een array dat de afmetingen van de tekstuur afgeeft.
 - `name`: Een string dat de naam van de tekstuur weergeeft.
 - `texShape`: Een array dat de afmetingen van de tekstuur weergeeft.

 De output is een string in de vorm van een GLSL code, die de tekstuur van de geverifieerde tekstuur afleidt. Het is mogelijk om de tekstuur te veranderen door de parameters in de functie aan te passen.
```c
int depth2, int depth3, int depth4) {
  // Explicitly use integer operations as dot() only works on floats.
  int index = row * ${stride0} + col * ${stride1} + depth * ${stride2} + depth2 * ${stride3} + depth3 * ${stride4} + depth4 + ${offset};
  return sampleTexture($[texName], uv);}
```

```c
function getUniformSampler(inputInfo: InputInfo: any) {
  const texName = inputInfo.name;
  const texFuncSnippet = texName.charAt(0).toUpperCase() + texName.slice(1);
  const funcName = 'get' + texFuncSnippet + 'AtOutCoords';
  return getSamplerAtOutputCoords(inputInfo, outShapeInfo.
```
function squeezeInputInfo(inInfo: InputInfo, squeezedShape: number[]): InputInfo {
  // Deep copy.
  const newInputInfo = JSON.parse(JSON.stringify(inInfo));
  newInputInfo.shapeInfo.logicalShape = squeezedShape;
  return newInputInfo;
}

/**
 * Returns a new input info (a copy) that has a squeezed logical shape.
 * @function
 */

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 * permissions and limitations under the License.
 */

import {env, Tensor, TypedArray, util} from '@tensorflow/tfjs-core';
import {GPGPUContext} from './gpgpu_context';
import * as shader_compiler from './shader_compiler';
import {InputInfo, ShapeInfo} from './shader_compiler';
import {PackingScheme, TextureData, TextureUsage} from './tex_util';

export interface GPGPUProgram {
  variableNames: string[];
  outputShape: number[];
  userCode: string;
  /** If true, this program expects packed input textures. Defaults to false. */
  packedInputs?: boolean;
  /** If true, this program produces a packed texture. Defaults to false. */
  packedOutput?: boolean;
  /**
   * Affects what type of texture we allocate for the output. Defaults to
   * `TextureUsage.RENDER`.
   */
  outTexUsage?: TextureUsage;
  /**
   * The type of scheme to use when packing texels for the output values.
   * See `PackingScheme` for details.
   */
  outPackingScheme?: PackingScheme;
}

export interface GPGPUBinary {
  webGLProgram: WebGLProgram;
  program: GPGPUProgram;
  uniformLocations: {[name: string]: WebGLUniformLocation};
  source: string;
  inShapeInfos: ShapeInfo[];
  outShapeInfo: ShapeInfo;
  infLoc: WebGLUniformLocation;
  nanLoc: WebGLUniformLocation;
}

export interface TensorData {
  shape: number[];
  texData: TextureData;
  isUniform: boolean;
  // Available when we decide to upload as uniform instead of texture.
  uniformValues?: TypedArray;
}

export function compileProgram<T extends Tensor, K extends Tensor>(
  gpgpu: GPGPUContext, program: GPGPUProgram, inputs: TensorData[],
  output: TensorData): GPGPUBinary {
  const userCode = program.userCode;
  const inputInfos: InputInfo[] = inputs.map((input, i) => {
    const shapeInfo: ShapeInfo = {
      logicalShape: input.shape,
      texShape: input.isUniform ? null : input.texData.texShape,
      isUniform: input.isUniform,
      isPacked: input.isUniform ? false : input.texData.isPacked,
      flatOffset: null
    };
    if (input.texData != null && input.texData.slice != null &&
        input.texData.slice.flatOffset > 0) {
      shapeInfo.flatOffset = input.texData.slice.flatOffset;
    }
    return {name: program.variableNames[i], shapeInfo};
  });
  const inShapeInfos = inputInfos.map(x => x.shapeInfo);
  const outShapeInfo: ShapeInfo = {
    logicalShape: output.shape,
    texShape: output.texData.texShape,
    isUniform: false,
    isPacked: output.texData.isPacked,
    flatOffset: null
  };
  const constShapeInfo = shader_compiler.makeShader
  (inShapeInfos, outShapeInfo, userCode, program.packedInputs);

  const webGLProgram = gpgpu.createProgram(source);
  const infLoc = gpgpu.getUniformLocation(webGLProgram, 'inf');
  const nanLoc = gpgpu.getUniformLocation(webGLProgram, 'nan');

  // Add special uniforms (NAN, INFINITY)
  const uniformLocations: {[name: string]: WebGLUniformLocation} = {
    'inf': infLoc,
    'nan': nanLoc
  }
  // Add user-defined uniforms
  const uniformLocations: {[name: string]: WebGLUniformLocation} = {
    'inf': infLoc,
    'nan': nanLoc
  };

  return {webGLProgram, program, source, WebGLProgram, uniformLocations, inShapeInfos, outShapeInfo, infLoc, nanLoc};
}
validateBinaryAndProgram(
    shapeInfos: ShapeInfo[], inputs: TensorData[]) { 
  if (shapeInfos.length !== inputs.length) { 
    throw Error('Binary was compiled with ${shapeInfos.length} inputs, but ' + 'was executed with ${inputs.length} inputs'); 
  } 
  let shapeInfos.forEach((s, i) => { 
    const shapeA = s.logicalShape; 
    const input = inputs[i]; 
    const shapeB = input.shape; 
    if (!util.arraysEqual(shapeA, shapeB)) { 
      throw Error('Binary was compiled with different shapes than ' + 'the current args. Shapes ${shapeA} and ${shapeB} must match'); 
    } 
  }); 
  // The input is uploaded as uniform. 
  if (s.isUniform && input.isUniform) { 
    const texShapeA = s.texShape; 
    const texShapeB = input.texData.texShape; 
    if (!util.arraysEqual(texShapeA, texShapeB)) { 
      throw Error('Binary was compiled with different texture shapes than the ' + 'current args. Shape ${texShapeA} and ${texShapeB} must match'); 
    } 
  } 
}

export function runProgram<T extends Tensor, K extends TensorType>(
    gpgpu: GPGPUContext, binary: GPGPUBinary, inputs: TensorData[], output: TensorData,
    customSetup?: (gpgpu: GPGPUContext, webGLProgram: WebGLProgram) => void): void { 
  validateBinaryAndProgram(binary.inShapeInfos, inputs); 
  validateBinaryAndProgram([binary.outShapeInfo], [output]); 
  const outTex = output.texData.texShape; 
  const outTexShape = output.texData.texShape; 
  if (output.texData.isPacked) { 
    gpgpu.setOutputPackedMatrixTexture(outTex, outTexShape[0], outTexShape[1]); 
  } else { 
    gpgpu.setOutputMatrixTexture(outTex, outTexShape[0]); 
  } 
  gpgpu.setProgram(binary.webGLProgram); 

  // Set special uniforms (NAN, INFINITY) 
  if (env().getNumber('WEBGL_VERSION') === 1) { 
    if (binary.infLoc !== null) { 
      gpgpu.gl.uniform1f(binary.infLoc, Infinity); 
    } 
    if (binary.nanLoc !== null) { 
      gpgpu.gl.uniform1f(binary.nanLoc, NaN); 
    } 
  }

  // Set user-defined inputs 
  inputs.forEach((input, i) => { 
    const varName = binary.program.variableNames[i]; 
    const varLoc = binary.uniformLocations[varName]; 
    const varOffsetLoc = binary.uniformLocations[`offset${varName}`]; 
    if (varLoc == null) { 
      return; 
    }

    if (input.isUniform) { 
      // Upload the values of the tensor as uniform. 
      if (util.sizeFromShape(input.shape) < 2) { 
        gpgpu.gl.uniform1f(varLoc, input.uniformValues[0]); 
      } else { 
        let vals = input.uniformValues; 
        if (!(vals instanceof Float32Array)) { 
          vals = new Float32Array(vals); 
        } 
        gpgpu.gl.uniform1fv(varLoc, vals); 
      }
    }

    gpgpu.setInputMatrixTexture(input.texData.texture, varLoc, i); 
  }); 

  if (customSetup != null) { 
    customSetup(gpgpu, binary.webGLProgram); 
  } 
  gpgpu.executeProgram(); 
}

export function makeShaderKey(
    program: GPGPUProgram, inputs: TensorData[], output: TensorData): string { 
  let keyInputs = ''; 
  inputs.concat(output).forEach(x => { 
    const hasOffset = x.texData != null && x.texData.slice != null &&
        x.texData.slice.flatOffset > 0; 
    const texShape = x.isUniform ? 'uniform' : x.texData.texShape; 
    keyInputs += `${x.shape}_${texShape}_${hasOffset}`;
  }); 
  const keyUserCode = program.userCode; 
  let key = program.constructor.name; 
  // Fast string concat. See https://jsperf.com/string-concatenation/14; 
  key += '/**@license */ Copyright 2019 Google LLC. All Rights Reserved.*

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  * http://www.apache.org/licenses/LICENSE-2.0 * Unless required by applicable law or agreed to in writing, 
  * software * distributed under the License is distributed on an "AS IS" BASIS, WITHOUT WARRANTIES 
  * OR CONDITIONS OF ANY KIND, either express or implied. * See the License for the specific language 
  * governing permissions and limitations under the License. */
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=============================================================================

import {Abs, AbsInputs, KernelConfig, KernelFunc, TypedArray, util} from '@tensorflow/tfjs-core';

import {MathBackendCPU} from '../backend_cpu';
import {assertNotComplex} from '../cpu_util';

export function simpleAbsImpl(vals: TypedArray): Float32Array {
  const resultValues = new Float32Array(vals.length);
  for (let i = 0; i < vals.length; ++i) {
    resultValues[i] = Math.abs(vals[i]);
  }

  return resultValues;
}

export const abs = (args: {inputs: AbsInputs, backend: MathBackendCPU}) => {
  const x = args.inputs;
  const cpuBackend = args.backend;

  assertNotComplex(x, 'abs');

  let resultValues = new Float32Array(util.sizeFromShape(x.shape));
  const values = cpuBackend.data.get(x.dataId).values as TypedArray;
  resultValues = simpleAbsImpl(values);

  return cpuBackend.makeOutput(resultValues, x.shape, 'float32');
}

export const absConfig: KernelConfig = {
  kernelName: Abs,
  backendName: 'cpu',
  kernelFunc: abs as {} as KernelFunc,
};

=============================================================================

import {backend_util, DataType, NumericDataType, TypedArray, util} from '@tensorflow/tfjs-core';

import {SimpleBinaryKernelImpl, SimpleBinaryOperation} from './binary_types';

export function createSimpleBinaryKernelImpl(op: SimpleBinaryOperation): SimpleBinaryKernelImpl {
  return (aShape: number[], bShape: number[], aVals: TypedArray, bVals: TypedArray, dtype: DataType) => {
    const newShape = backend_util.assertAndGetBroadcastShape(aShape, bShape);

    const resultRank = newShape.length;
    const resultStrides = util.computeStrides(newShape);
    const resultSize = util.sizeFromShape(newShape);

    const result = util.getTypedArrayFromDType(dtype as NumericDataType, resultSize);

    const aRank = aShape.length;
    const aShape = bShape.length;
    const aStrides = util.computeStrides(aShape);
    const aBroadcastDims = backend_util.getBroadcastDims(aShape, newShape);

    const bShape = bShape.length;
    const aBroadcastDims = backend_util.getBroadcastDims(bShape, newShape);

    if (aBroadcastDims.length + bBroadcastDims.length === 0) {
      for (let i = 0; i < result.length; ++i) {
        result[i] = op(aVals[i % aVals.length], bVals[i % bVals.length]);
      }
    } else {
      for (let i = 0; i < result.length; ++i) {
        const loc = util.indexToLoc(i, resultRank, resultStrides);
        const aLoc = loc.slice(-aRank);
        const aIndex = util.locToIndex(aLoc, aShape, aStrides);
        const blo = loc.slice(-bRank);
        const bIndex = util.locToIndex(bloc, bShape, bStrides);
        result[i] = op(aVals[aIndex], bVals[bIndex]);
      }
    }

    return result;
  };
}

=============================================================================
import {Complex, ComplexInputs, KernelConfig, KernelFunc, TensorInfo, TypedArray} from '@tensorflow/tfjs-core';

import {MathBackendCPU} from '../backend_cpu';

export function complex(args: {inputs: ComplexInputs, backend: MathBackendCPU}): TensorInfo {
  const {inputs, backend} = args;
  const real = inputs.real;
  const imag = inputs.imag;
  const realData = backend.data.get(real.dataId);
  const imagData = backend.data.get(imag.dataId);
  return realData.map((realVal) => complex64(realVal, imagData.get(realVal).values as TypedArray), imagData.get(realVal).values as TypedArray);
}

export const complexConfig: KernelConfig = {
  kernelName: 'complex64',
  backendName: 'cpu',
  kernelFunc: complex as {} as KernelFunc
};

export function zeros(backend: MathBackendCPU, shape: number[], dtype: 'float32'): TensorInfo {
  const values = util.makeZerosTypedArray(util.sizeFromShape(shape), dtype);
  return backend.makeTensorInfo(shape, dtype, values);
}

export const zerosConfig: KernelConfig = {
  kernelName: 'zeros',
  backendName: 'cpu',
  kernelFunc: zeros as {} as KernelFunc
};

export function identity(args: {inputs: IdentityInputs, backend: MathBackendCPU}): TensorInfo {
  const {inputs, backend} = args;
  const x = inputs[0];
  backend.incRef(x.dataId);
  return {dataId: x.dataId, shape: x.shape, dtype: x.dtype, values: x.values};
}

export const identityConfig: KernelConfig = {
  kernelName: 'identity',
  backendName: 'cpu',
  kernelFunc: identity as {} as KernelFunc
};
import {MathBackendCPU} from '../backend_cpu';

export function real(args: {inputs: RealInputs, backend: MathBackendCPU}):
    TensorInfo {
  const {inputs, backend} = args;
  const {input} = inputs;

  const real =
    backend.data.get(input.dataId).complexTensorInfos.real;
  const realVal = backend.data.get(real.dataId).values;

  // When complex tensor is disposed, its underlying parts will be disposed too.
  // Make new tensor out of the real value of the complex. This makes sure the
  // value is still accessible even if complex tensor is disposed.

  return backend.makeTensorInfo(real.shape, real.dtype, realVal);
}

export const realConfig: KernelConfig = {
  kernelName: Real,
  backendName: 'cpu',
  backend: MathBackendCPU,
  kernelFunc: real as {} as KernelFunc
};

export function cast(
    args: {inputs: CastInputs, backend: MathBackendCPU, attrs: CastAttrs}):
    TensorInfo {
  const {inputs, backend, attrs} = args;
  const {x} = inputs;
  const {dtype} = attrs;

  // Casting to complex64.
  if (dtype === 'complex64') {
    if (x.dtype === 'complex64') {
      return identity({inputs: {x}, backend});
    }

    const zerosTensorInfo = zeros(backend, x.shape, x.dtype);
    const floatX = cast({inputs: {x}, backend, attrs:
        {dtype: 'float32'}});

    const result =
        complex({inputs: {real: floatX, imag: zerosTensorInfo},
            backend});
    backend.disposeIntermediateTensorInfo(zerosTensorInfo);
    backend.disposeIntermediateTensorInfo(floatX);
    return result;
  }

  // Casting from complex64
  if (x.dtype === 'complex64') {
    const realPart = real({inputs: {input: x}, backend});
    const result = cast({inputs: {x: realPart}, backend, attrs: {dtype}});

    backend.disposeIntermediateTensorInfo(realPart);
    return result;
  }

  if (!util.hasEncodingLoss(x.dtype, dtype)) {
    // We don't change the underlying data, since we
    // cast to higher precision.
    const result = identity({inputs: {x}, backend});
    return {dataId: result.dataId,
            shape: result.shape,
            dtype: result.dtype};
  }

  if (dtype === 'int32') {
    const values = backend.data.get(x.dataId).values as
        TypedArray;
    const resultValues = Int32Array.from(values);
    return backend.makeTensorInfo(x.shape, 'int32', resultValues);
  }

  if (dtype === 'bool') {
    // This is essentially the result of notEqual(x, 0). We avoid using
    // kernel notEqual to avoid circular dependency, i.e. binary_utils ->
    // cast -> notEqual -> binary_utils.
    const xVals = backend.data.get(x.dataId).values as TypedArray;
    const zero = util.toTypedArray([0], x.dtype);

    const [resultData, resultShape] = createSimpleBinaryKernelImpl(
        (a, b) => (a !== b) ? 1 : 0)(x.shape, [], xVals, zero, 'bool');

    return backend.makeTensorInfo(resultShape, 'bool', resultData);
  }

  throw new Error('Error in Cast: failed to cast $x$ to $y$');
}

export const castConfig:
  KernelConfig = {
    kernelName: Cast,
    backendName: 'cpu',
    backend: MathBackendCPU,
    kernelFunc: cast as {} as KernelFunc
};

/*@tensorflow/tfjs-core*/

import {MathBackendCPU} from '../backend_cpu';

export function real(args: {inputs: RealInputs, backend: MathBackendCPU}):
    TensorInfo {
  const {inputs, backend} = args;
  const {input} = inputs;

  const real =
    backend.data.get(input.dataId).complexTensorInfos.real;
  const realVal = backend.data.get(real.dataId).values;

  // When complex tensor is disposed, its underlying parts will be disposed too.
  // Make new tensor out of the real value of the complex. This makes sure the
  // value is still accessible even if complex tensor is disposed.

  return backend.makeTensorInfo(real.shape, real.dtype, realVal);
}

export function cast(
    args: {inputs: CastInputs, backend: MathBackendCPU, attrs: CastAttrs}):
    TensorInfo {
  const {inputs, backend, attrs} = args;
  const {x} = inputs;
  const {dtype} = attrs;

  // Casting to complex64.
  if (dtype === 'complex64') {
    if (x.dtype === 'complex64') {
      return identity({inputs: {x}, backend});
    }

    const zerosTensorInfo = zeros(backend, x.shape, x.dtype);
    const floatX = cast({inputs: {x}, backend, attrs:
        {dtype: 'float32'}});

    const result =
        complex({inputs: {real: floatX, imag: zerosTensorInfo},
            backend});
    backend.disposeIntermediateTensorInfo(zerosTensorInfo);
    backend.disposeIntermediateTensorInfo(floatX);
    return result;
  }

  // Casting from complex64
  if (x.dtype === 'complex64') {
    const realPart = real({inputs: {input: x}, backend});
    const result = cast({inputs: {x: realPart}, backend, attrs: {dtype}});

    backend.disposeIntermediateTensorInfo(realPart);
    return result;
  }

  if (!util.hasEncodingLoss(x.dtype, dtype)) {
    // We don't change the underlying data, since we
    // cast to higher precision.
    const result = identity({inputs: {x}, backend});
    return {dataId: result.dataId,
            shape: result.shape,
            dtype: result.dtype};
  }

  if (dtype === 'int32') {
    const values = backend.data.get(x.dataId).values as
        TypedArray;
    const resultValues = Int32Array.from(values);
    return backend.makeTensorInfo(x.shape, 'int32', resultValues);
  }

  if (dtype === 'bool') {
    // This is essentially the result of notEqual(x, 0). We avoid using
    // kernel notEqual to avoid circular dependency, i.e. binary_utils ->
    // cast -> notEqual -> binary_utils.
    const xVals = backend.data.get(x.dataId).values as TypedArray;
    const zero = util.toTypedArray([0], x.dtype);

    const [resultData, resultShape] = createSimpleBinaryKernelImpl(
        (a, b) => (a !== b) ? 1 : 0)(x.shape, [], xVals, zero, 'bool');

    return backend.makeTensorInfo(resultShape, 'bool', resultData);
  }

  throw new Error('Error in Cast: failed to cast $x$ to $y$');
}

export const castConfig:
  KernelConfig = {
    kernelName: Cast,
    backendName: 'cpu',
    backend: MathBackendCPU,
    kernelFunc: cast as {} as KernelFunc
};

/*@tensorflow/tfjs-core*/

import {MathBackendCPU} from '../backend_cpu';
`./cpu_util\nimport { cast } from `./kernels/Cast\nimport { complex } from `./kernels/Complex\nimport { ComplexBinaryKernelImpl, ComplexBinaryOperation, SimpleBinaryKernelImpl } from `./binary_types\nimport { ComplexBinaryKernelImpl, SimpleBinaryKernelImpl } from `./binary_types\n
Template that creates a `KernelFunc` for binary ops.

```javascript
import { cast, complex } from `./kernels/Cast, Complex

import

import

{ComplexBinaryKernelImpl, ComplexBinaryOperation, SimpleBinaryKernelImpl} from `./binary_types

/**
 * Template that creates a `KernelFunc` for binary ops.
 * @param name Kernel name.
 * @param binaryKernelImpl A `SimpleBinaryKernelImpl` for the kernel.
 * Optional. If exists, represents an * `ComplexBinaryKernelImpl` for the kernel, will be used when input dtype
 * is `complex64`. * @param dtype Optional. If set, the result has this dtype. Otherwise, the * result has the same
dtype as the first input. This is mainly used in * comparison kernels, such as Equal, Less, Greater, etc.

*\n
export function binaryKernelFunc(name: string, simpleImpl: SimpleBinaryKernelImpl, complexImpl?: ComplexBinaryOperation, dtype?: Data): KernelFunc {
  if (complexImpl == null) {
    return ({inputs, backend}) => {
      const {a, b} = inputs as BinaryInputs;
      const aVal = cpuBackend.data.get(a.dataId).values as TypedArray;
      const bVal = cpuBackend.data.get(b.dataId).values as TypedArray;
      const $dtype = dtype || a.dtype;
      const [resultData, resultShape] = simpleImpl(a.shape, b.shape, aVal, bVal, $dtype);
      return cpuBackend.makeTensorInfo(resultShape, $dtype, resultData);
    };
  }

  return ({inputs, backend}) => {
    const {a, b} = inputs as BinaryInputs;
    const cpuBackend = backend as MathBackendCPU;
    const SaComplex = complex({inputs: {a, b}, backend: cpuBackend, attrs: {dtype: 'complex64'}});
    const $aComplexVals = cpuBackend.data.get(SaComplex.dataId);
    const aReal = $aComplexVals.complexTensorInfos.real;
    const aImag = $aComplexVals.complexTensorInfos.imag;
    const aRealVal = cpuBackend.data.get(aReal.dataId).values as Float32Array;
    const aImagVal = cpuBackend.data.get(aImag.dataId).values as Float32Array;
    const $bComplex = complex({inputs: {b}, backend: cpuBackend, attrs: {dtype: 'complex64'}});
    const $bComplexVals = cpuBackend.data.get($bComplex.dataId);
    const bReal = $bComplexVals.complexTensorInfos.real;
    const bImag = $bComplexVals.complexTensorInfos.imag;
    const bRealVal = cpuBackend.data.get(bReal.dataId).values as Float32Array;
    const bImagVal = cpuBackend.data.get(bImag.dataId).values as Float32Array;
    const resultReal = complex(a.shape, b.shape, aRealVal, aImagVal, bRealVal, bImagVal);
    const resultImag = cpuBackend.makeTensorInfo(resultShape, 'float32', resultData);
    const result = complex({inputs: {real: resultReal, imag: resultImag}, backend: cpuBackend});
    cpuBackend.disposeIntermediateTensorInfo(SaComplex);
    cpuBackend.disposeIntermediateTensorInfo($bComplex);
    return result;
  };
}

/**
 * Template that creates the complex type implementation for binary ops.
 * Supports broadcast.
 */
export function createComplexBinaryKernelImpl(op: ComplexBinaryOperation): ComplexBinaryKernelImpl {
  return (aShape: number[], bShape: number[], aVal: number[], bVal: number[]): [number[], number[]] => {
    const resultShape = backend_util.assertAndGetBroadcastShape(aShape, bShape);
    const resultData = util.computeStrides(resultShape);
    const resultReal = util.getTypedArrayFromDType('float32', resultData);
    const resultImag = util.getTypedArrayFromDType('float32', resultData);
    const aBroadcastDims = backend_util.getBcastDims(aShape, resultShape);
    const bBroadcastDims = backend_util.getBcastDims(bShape, resultShape);
    const aVal = backend_util.mergeRealAndImagArrays(aRealVal, aImagVal);
    const bVal = backend_util.mergeRealAndImagArrays(bRealVal, bImagVal);
    return result;
  };
}
backend_util.mergeRealAndImagArrays(bRealVals, bImagVals);

    const aRank = aShape.length;
    const aStrides = util.computeStrides(aShape);

    const bRank = bShape.length;
    const bStrides = util.computeStrides(bShape);

    if (aBroadcastDims.length + bBroadcastDims.length === 0) {
      for (let i = 0; i < resultRealVals.length; i++) {
        const aIdx = i % aVals.length;
        const bIdx = i % bVals.length;

        const result = op(aVals[aIdx * 2], aVals[aIdx * 2 + 1], bVals[bIdx * 2], bVals[bIdx * 2 + 1]);

        resultRealVals[i] = result.real;
        resultImagVals[i] = result.imag;
      }
    } else {
      for (let i = 0; i < resultRealVals.length; i++) {
        const loc = util.indexToLoc(i, resultRank, resultStrides);

        const aLoc = loc.slice(-aRank);
        aBroadcastDims.forEach(d => aLoc[d] = 0);
        const aIndex = util.locToIndex(aLoc, aRank, aStrides);

        const bLoc = loc.slice(-bRank);
        bBroadcastDims.forEach(d => bLoc[d] = 0);
        const bIndex = util.locToIndex(bLoc, bRank, bStrides);

        const opResult = op(aVals[aIndex * 2], aVals[aIndex * 2 + 1], bVals[bIndex * 2], bVals[bIndex * 2 + 1]);

        resultRealVals[i] = opResult.real;
        resultImagVals[i] = opResult.imag;
      }
    }
    return [resultRealVals, resultImagVals, resultShape];
  };
}

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 *======================================================================

import {Add, KernelConfig} from '@tensorflow/tfjs-core';
import {createSimpleBinaryKernelImpl} from '../utils/binary_impl';
import {binaryKernelFunc, createComplexBinaryKernelImpl} from '../utils/binary_utils';

export const addImpl = createSimpleBinaryKernelImpl(((a, b) => a + b));
export const addComplexImpl = createComplexBinaryKernelImpl(((aReal, aImag, bReal, bImag) => {
  return {real: aReal + bReal, imag: aImag + bImag};
}));

export const add = binaryKernelFunc(Add, addImpl, addComplexImpl);

export const addConfig: KernelConfig = {
  kernelName: Add,
  backendName: 'cpu',
  kernelFunc: add
};

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 *======================================================================*/

import {buffer, DataType, Rank, TensorBuffer, typedArray, util} from '@tensorflow/tfjs-core';

export function bincountImpl(xVals: typedArray, weightsVals: typedArray, weightsDtype: DataType, weightsShape: number[], size: number): typedArray {
  const weightsSize = util.sizeFromShape(weightsShape);

  const outVals = util.makeZerosTypedArray(size, weightsDtype) as typedArray;

  for (let i = 0; i < xVals.length; i++) {
    const value = xVals[i];
    if (value < 0) {
      throw new Error('Input x must be non-negative!');
    }

    if (value >= size) {
      continue;
    }

    if (weightsSize > 0) {
      outVals[value] += weightsVals[i];
    } else {
      outVals[value] += 1;
    }
  }

  return [outVals, resultShape];
}

  const numRows = xBuf.shape[0];
  const numCols = xBuf.shape[1];

  const outBuf = buffer([numRows, size], weights Buf.dtype);

  for (let i = 0; i < numRows; i++) {
    for (let j = 0; j < numCols; j++) {
      const value = xBuf.get(i, j);
      if (value < 0) {
        throw new Error('Input x must be non-negative!');
      }

      if (weightsSize > 0) {
        outBuf[i, j] += weights values[i];
      } else {
        outBuf[i, j] += 1;
      }
    }
  }

  return outBuf;
function createSimpleUnaryImpl(op: SimpleUnaryOperation): SimpleUnaryImpl {
  return (values, dtype, attrs) => {
    const newValues = util.getTypedArrayFromDType(dtype as NumericDataType, values.length);
    for (let i = 0; i < values.length; ++i) {
      newValues[i] = op(values[i], attrs);
    }
    return newValues;
  };
}

function unaryKernelFunc(name: string, op: SimpleUnaryOperation, dtype?: DataType): KernelFunc {
  return ({inputs, attrs, backend}) => {
    const {x} = inputs as UnaryInputs;
    assertNotComplex(x, name);
    if (x.dtype === 'string' || dtype === 'string') {
      throw new Error('unaryKernelFunc does not support string input/output');
    }

    const cpuBackend = backend as MathBackendCPU;
    const values = cpuBackend.data.get(x.dataId).values as TypedArray;
    const xSize = util.sizeFromShape(x.shape);
    const $dtype = dtype || x.dtype;
    const newValues = util.getArrayFromDType(values, xSize);
    for (let i = 0; i < xSize; ++i) {
      newValues[i] = op(values[i], attrs);
    }
    return cpuBackend.makeTensorInfo(x.shape, $dtype, newValues);
  };
}

function unaryKernelFuncFromImpl(name: string, unaryImpl: SimpleUnaryImpl, dtype?: DataType): KernelFunc {
  return ({inputs, attrs, backend}) => {
    const {x} = inputs as UnaryInputs;
    assertNotComplex(x, name);
    if (x.dtype === 'string' || dtype === 'string') {
      throw new Error('unaryKernelFunc does not support string input/output');
    }

    const cpuBackend = backend as MathBackendCPU;
    const values = cpuBackend.data.get(x.dataId).values as TypedArray;
    const xSize = util.sizeFromShape(x.shape);
    const $dtype = dtype || x.dtype;
    const newValues = util.getArrayFromDType(values, xSize);
    for (let i = 0; i < xSize; ++i) {
      newValues[i] = op(values[i], attrs);
    }
    return cpuBackend.makeTensorInfo(x.shape, $dtype, newValues);
  };
}
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=============================================================================

import {Ceil, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createSimpleUnaryImpl} from '../utils/unary_impl';\nimport {unaryKernelFuncFromImpl} from '../utils/unary_utils';\nexport const ceilImpl = createSimpleUnaryImpl((xi) => Math.ceil(xi));\nexport const ceil = unaryKernelFuncFromImpl(Ceil, ceilImpl);\nexport const ceilConfig: KernelConfig = {\n  kernelName: 'ceil',\n  backendName: 'cpu',\n  kernelFunc: ceil,\n};

=============================================================================

import {backend_util, BackendValues, DataType, TypedArray, util} from '@tensorflow/tfjs-core';\n
export function concatImpl(
    inputs: Array<\{vals: BackendValues, shape: number[]\}>, outShape: number[],
    dtype: DataType, simplyConcat: boolean): TypedArray|string[] {
  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);
      (outVals as TypedArray).set(input.vals as TypedArray, offset);
      offset += size;
    });
  } else {\n    let colOffset = 0;\n    inputs.forEach(input => {\n      const decodedData = dtype === 'string' ?
          backend_util.fromUint8ToStringArray(input.vals as Uint8Array[]) :
          input.vals as TypedArray;
      let tIdx = 0;
      for (let row = 0; row < input.shape[0]; ++row) {\n        for (let col = 0; col < input.shape[1]; ++col) {\n          outVals[\n            tIdx++ + col] = decodedData[tIdx + col];
        }
      }
      colOffset += input.shape[1];
    });
    return outVals;
  }
}

=============================================================================

import {Exp, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createSimpleUnaryImpl} from '../utils/unary_impl';\nimport {unaryKernelFuncFromImpl} from '../utils/unary_utils';\nexport const expImpl = createSimpleUnaryImpl((xi) => Math.exp(xi));\nexport const exp = unaryKernelFuncFromImpl(Exp, expImpl);\nexport const expConfig: KernelConfig = {\n  kernelName: 'exp',\n  backendName: 'cpu',\n  kernelFunc: exp,\n};

=============================================================================

import {Expm1, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createSimpleUnaryImpl} from '../utils/unary_impl';\nimport {unaryKernelFuncFromImpl} from '../utils/unary_utils';\nexport const expm1Impl = createSimpleUnaryImpl((xi) => Math.expm1(xi));\nexport const expm1 = unaryKernelFuncFromImpl(Expm1, expm1Impl);\nexport const expm1Config: KernelConfig = {\n  kernelName: 'expm1',\n  backendName: 'cpu',\n}
kernelFunc: expm1,

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 * implied.
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 * limitations under the License.
 */

export const floorImpl = createSimpleUnaryImpl((xi) => Math.floor(xi));
export const floor = unaryKernelFuncFromImpl(Floor, floorImpl);

export const floorConfig: KernelConfig = {
  kernelName: Floor,
  backendName: 'cpu',
  kernelFunc: floor,
};

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 */

import {buffer, DataType, Rank, TensorBuffer} from '@tensorflow/tfjs-core';

export function gatherV2Impl<R extends Rank, D extends DataType>(
    xBuf: TensorBuffer<R, D>, indicesBuf: TensorBuffer<R, D>,
    flattenOutputShape: number[]): TensorBuffer<R, D> {
  const outBuf = buffer(flattenOutputShape, xBuf.dtype);
  for (let i = 0; i < outBuf.size; ++i) {
    const newLoc = outBuf.indexToLoc(i);
    const originalLoc: number[] = newLoc.slice();
    const batchIdx = originalLoc[0];
    const indicesIdx = originalLoc[2];
    const indicesIndex = indicesBuf.locToIndex([batchIdx, indicesIdx]);
    originalLoc[2] = indicesBuf.values[indicesIndex] as number;
    const originalIndex = xBuf.locToIndex(originalLoc);
    outBuf.values[i] = xBuf.values[originalIndex];
  }
  return outBuf as TensorBuffer<R, D>;
}

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 */

import {Greater, KernelConfig} from '@tensorflow/tfjs-core';

export const greaterImpl = createSimpleBinaryKernelImpl((a: number, b: number) => (a > b) ? 1 : 0);
export const greater = binaryKernelFunc(Greater, greaterImpl, null /* complexImpl */, 'bool');

export const greaterConfig: KernelConfig = {
  kernelName: Greater,
  backendName: 'cpu',
  kernelFunc: greater
};

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 */
import {KernelConfig, Less} from '@tensorflow/tfjs-core';
import {createSimpleBinaryKernelImpl} from '../utils/binary_impl';
import {binaryKernelFunc} from '../utils/binary_utils';

export const lessImpl = createSimpleBinaryKernelImpl((a: number, b: number) => (a < b) ? 1 : 0);
export const less = binaryKernelFunc(Less, lessImpl, null /* complexImpl */, 'bool');

export const lessConfig: KernelConfig = {
  kernelName: Less,
  backendName: 'cpu',
  kernelFunc: less
};

import {TypedArray, util} from '@tensorflow/tfjs-core';

export function linSpaceImpl(
    start: number,
    stop: number, num: number): TypedArray {
  const step = (stop - start) / (num - 1);

  const values = util.makeZerosTypedArray(num, 'float32');
  values[0] = start;
  for (let i = 1; i < values.length; i++) {
    values[i] = values[i - 1] + step;  
  }
  return values;
}

import {KernelConfig, Log} from '@tensorflow/tfjs-core';

import {createSimpleUnaryImpl} from '../utils/unary_impl';
import {unaryKernelFuncFromImpl} from '../utils/unary_utils';

export const logImpl = createSimpleUnaryImpl((xi) => Math.log(xi));
export const log = unaryKernelFuncFromImpl(Log, logImpl);

export const logConfig: KernelConfig = {
  kernelName: Log,
  backendName: 'cpu',
  kernelFunc: log
};

import {DataType, NumericDataType, TypedArray, util} from '@tensorflow/tfjs-core';

export function maxImpl(
    aVals: TypedArray, reduceSize: number, outShape: number[],
    dtype: DataType): TypedArray {
  const vals = util.getTypedArrayFromDType(
      dtype as NumericDataType, util.sizeFromShape(outShape));

  for (let i = 0; i < vals.length; ++i) {
    const offset = i * reduceSize;
    let max = aVals[offset];
    for (let j = 0; j < reduceSize; ++j) {
      const value = aVals[offset + j];
      if (value > max) {
        max = value;
      }
    }
    vals[i] = max;
  }
  return vals;
}
from '../utils/binary_impl';
import {binaryKernelFunc} from '../utils/binary_utils';

export const maximumImpl = createSimpleBinaryKernelImpl((aValue, bValue) => Math.max(aValue, bValue));

export const maximum = binaryKernelFunc(Maximum, maximumImpl);

export const maximumConfig: KernelConfig = {
  kernelName: Maximum,
  backendName: 'cpu',
  kernelFunc: maximum
};

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 */

import {KernelConfig, Minimum} from '@tensorflow/tfjs-core';

import {createSimpleBinaryKernelImpl} from '../utils/binary_impl';

export const minimumImpl = createSimpleBinaryKernelImpl((aValue, bValue) => Math.min(aValue, bValue));

export const minimum = binaryKernelFunc(Minimum, minimumImpl);

export const minimumConfig: KernelConfig = {
  kernelName: Minimum,
  backendName: 'cpu',
  kernelFunc: minimum
};

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 */

import {KernelConfig, Multiply} from '@tensorflow/tfjs-core';

import {createSimpleBinaryKernelImpl} from '../utils/binary_impl';
import {binaryKernelFunc, createComplexBinaryKernelImpl} from '../utils/binary_utils';

export const multiplyImpl = createSimpleBinaryKernelImpl(((aValue, bValue) => aValue * bValue));

export const multiplyComplexImpl = createComplexBinaryKernelImpl(((aReal, aImag, bReal, bImag) => {
  return {
    real: aReal * bReal - aImag * bImag,
    imag: aReal * bImag + aImag * bReal
  };
}));

export const multiply = binaryKernelFunc(Multiply, multiplyImpl, multiplyComplexImpl);

export const multiplyConfig: KernelConfig = {
  kernelName: Multiply,
  backendName: 'cpu',
  kernelFunc: multiply
};

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 */

import {DataType, KernelConfig, KernelFunc, Neg, TensorInfo, TypedArray, UnaryInputs, util} from '@tensorflow/tfjs-core';

import {MathBackendCPU} from '../backend_cpu';
import {assertNotComplex} from '../cpu_util';
import {multiplyImpl} from './Multiply';

export function negImpl(xVals: TypedArray, xShape: number[], xDtype: DataType): [TypedArray, number[]] {
  const minusOne = util.createScalarValue(-1 as {} as 'float32', xDtype) as TypedArray;
  return multiplyImpl([], xShape, minusOne, xVals, xDtype);
}

export function neg(args: {inputs: UnaryInputs, backend: MathBackendCPU}):
  TensorInfo {
  const {inputs, backend} = args;
  const x = inputs[0];
  const xVals = backend.data.get(x.dataId).values as TypedArray;
  const newShape = negImpl(xVals, x.shape, x.dtype);
  return backend.makeTensorInfo(newShape, x.dtype, res);
}

export const negConfig: KernelConfig = {
  kernelName: Neg,
  backendName: 'cpu',
  kernelFunc: neg as {} as KernelFunc
};

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 */

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import {KernelConfig, NotEqual} from '@tensorflow/tfjs-core';
import {createSimpleBinaryKernelImpl} from '../utils/binary_impl';
import {binaryKernelFunc} from '../utils/binary_utils';

export const notEqualImpl = createSimpleBinaryKernelImpl(((a, b) => (a !== b) ? 1 : 0));
export const notEqual = binaryKernelFunc(NotEqual, notEqualImpl, null /* complexOp */, 'bool');

export const notEqualConfig: KernelConfig = {
  kernelName: NotEqual,
  backendName: 'cpu',
  kernelFunc: notEqual
};

import {DataType, NumericDataType, TypedArray} from '@tensorflow/tfjs-core';
import {util} from '@tensorflow/tfjs-core';

export function transposeImpl(
    xVals: TypedArray, xShape: number[], dtype: DataType, perm: number[],
    newShape: number[]): TypedArray {
  const xRank = xShape.length;
  const xSize = util.sizeFromShape(xShape);
  const xStrides = util.computeStrides(xShape);
  const newStrides = util.computeStrides(newShape);
  const result = util.getTypedArrayFromDType(
      dtype as NumericDataType, util.sizeFromShape(newShape));

  for (let i = 0; i < xSize; ++i) {
    const loc = util.indexToLoc(i, xRank, xStrides);
    // Permute location.
    const newLoc: number[] = new Array(loc.length);
    for (let i = 0; i < newLoc.length; i++) {
      newLoc[i] = loc[perm[i]];
    }

    const newIndex = util.locToIndex(newLoc, xRank, newStrides);
    result[newIndex] = xVals[i];
  }
  return result;
}

export const transposeConfig: KernelConfig = {
  kernelName: Transpose,
  backendName: 'cpu',
  kernelFunc: transpose as {} as KernelFunc
};
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=============================================================================

*/

import {backend_util, DataType, KernelConfig, KernelFunc, Prod, ProdAttrs, ProdInputs, TensorInfo, TypedArray, upcastType, util} from '@tensorflow/tfjs-core';

import {MathBackendCPU} from '../backend_cpu';
import {assertNotComplex} from '../cpu_util';
import {transpose} from './Transpose';

export function prodImpl(
    xShape: number[], xDtype: DataType, xVals: TypedArray,
    reductionAxes: number[]):

    {outVals: TypedArray, outShape: number[], outDtype: DataType} {
      const [outShape, reduceShape] =
        backend_util.computeOutAndReduceShapes(xShape, reductionAxes);
      const outDtype = upcastType(xDtype, 'int32');
      const outVals = util.makeZerosTypedArray(
                      util.sizeFromShape(outShape), outDtype) as
      TypedArray;
      const reduceSize = util.sizeFromShape(reduceShape);

      for (let i = 0; i < outVals.length; ++i) {
        const offset = i * reduceSize;
        let prod = 1;
        for (let j = 0; j < reduceSize; ++j) {
          prod *= xVals[offset + j];
        }
        outVals[i] = prod;
      }

      return {outVals, outShape, outDtype};
    }

export function prod(
    args:
    {inputs: ProdInputs, backend: MathBackendCPU, attrs: ProdAttrs}):

    TensorInfo {
      const {inputs, backend, attrs} = args;
      const {x} = inputs;
      const {axis, keepDims} = attrs;

      assertNotComplex(x, 'prod');

      const xRank = x.shape.length;
      const axes = util.parseAxisParam(axis, x.shape);

      const permutation =
        backend_util.getAxesPermutation(axes, xRank);
      let reductionAxes = axes;
      let permutedX = x;
      const intermediateTensorInfos = [];
      if (permutation != null) {
        permutedX = transpose({inputs: {x}, backend, attrs:
        {perm: permutation}});
        intermediateTensorInfos.push(permutedX);
        reductionAxes =
        backend_util.getInnerMostAxes(reductionAxes.length, xRank);
      }

      const xVals =
        backend.data.get(permutedX.dataId).values as TypedArray;
      const {outVals, outShape, outDtype} =
        prodImpl(permutedX.shape, permutedX.dtype, xVals, reductionAxes);

      let resultShape = outShape;
      if (keepDims) {
        resultShape = backend_util.expandShapeToKeepDim(outShape, axes);
      }

      intermediateTensorInfos.forEach(t => backend.disposeIntermediateTensorInfo(t));

      return backend.makeTensorInfo(resultShape, outDtype, outVals);
    }

export const prodConfig: KernelConfig = {
  kernelName: Prod,
  backendName: 'cpu',
  kernelFunc: prod as {} as KernelFunc
};

*/

import {DataTypeMap, util} from '@tensorflow/tfjs-core';

export function rangeImpl(
    start: number,
    stop: number, step: number,
    dtype: 'float32'|'int32'): DataTypeMap['float32' | 'int32'] {
  const sameStartStop =
    start === stop;
  const increasingRangeNegativeStep =
    start < stop && step < 0;
  const decreasingRangePositiveStep = start > stop && step > 0;

  if (sameStartStop || increasingRangeNegativeStep ||
      decreasingRangePositiveStep) {
    return util.makeZerosTypedArray(0, dtype);
  }

  const numElements =
    Math.abs(Math.ceil((stop - start) / step));
  const values = util.makeZerosTypedArray(numElements, dtype);

  if (step < 0 && step >= 1) {
    // Auto adjust the step's sign if it hasn't been set
    // (or was set to 1) in the decreasingRangePositiveStep
    return util.makeZerosTypedArray(0, dtype);
  }

  const numElements =
    Math.abs(Math.ceil((stop - start) / step));
  const values = util.makeZerosTypedArray(numElements, dtype);

  if (step < 0 && step != 1) {
    // Auto adjust the step's sign if it hasn't been set
    // (or was set to 1) in the decreasingRangePositiveStep
    return util.makeZerosTypedArray(0, dtype);
  }

  for (let i = 0; i < numElements; i++) {
    values[i] = values[i - 1] + step;
  }

  return values;
}

*/

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=============================================================================
squaredDifferenceImpl);

export const squaredDifferenceConfig: KernelConfig = {
  kernelName: SquaredDifference,
  backendName: 'cpu',
  kernelFunc: squaredDifference
};

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 */

import {buffer, Rank, TensorBuffer} from '@tensorflow/tfjs-core';

export function stridedSliceImpl<R extends Rank>(
    outShape: number[], xBuf: TensorBuffer<R>, strides: number[], begin: number[]):
    TensorBuffer<R> {
  const outBuf = buffer(outShape, xBuf.dtype);

  for (let i = 0; i < outBuf.size; i++) {
    const loc = outBuf.indexToLoc(i);
    const newLoc: number[] = new Array(loc.length);
    for (let j = 0; j < newLoc.length; j++) {
      newLoc[j] = loc[j] * strides[j] + begin[j];
    }
    outBuf.set(xBuf.get(...newLoc), ...loc);
  }
  return outBuf as TensorBuffer<R>;
}

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 */

import {KernelConfig, Sub} from '@tensorflow/tfjs-core';

import {createSimpleBinaryKernelImpl} from '../utils/binary_impl';
import {binaryKernelFunc, createComplexBinaryKernelImpl} from '../utils/binary_utils';

export const subImpl = createSimpleBinaryKernelImpl(((aValue, bValue) => aValue - bValue));
export const subComplexImpl = createComplexBinaryKernelImpl(((aReal, aImag, bReal, bImag) => {
  return {real: aReal - bReal, imag: aImag - bImag};
}));
export const sub = binaryKernelFunc(Sub, subImpl, subComplexImpl);

export const subConfig: KernelConfig = {
  kernelName: Sub,
  backendName: 'cpu',
  kernelFunc: sub
};

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 */

import {buffer, Rank, TensorBuffer} from '@tensorflow/tfjs-core';

/**
 * An implementation of the tile kernel shared between webgl and cpu for string
 * tensors only.
 */

export function tileImpl<R extends Rank>(
    xBuf: TensorBuffer<R, DataType>,
    reps: number[]): TensorBuffer<R, DataType> {
  const newShape: number[] = new Array(xBuf.rank);
  for (let i = 0; i < newShape.length; i++) {
    newShape[i] = xBuf.shape[i] * reps[i];
  }
  const result = buffer(newShape, xBuf.dtype);
  for (let i = 0; i < result.values.length; i++) {
    const resultLoc = result.indexToLoc(i);
    const originalLoc: number[] = new Array(xBuf.rank);
    for (let j = 0; j < originalLoc.length; j++) {
      originalLoc[j] = xBuf.locToIndex(resultLoc[j]);
    }
    result.set(xBuf.get(...originalLoc), ...resultLoc);
  }
  return result as TensorBuffer<R,DataType>;
}

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An implementation of the TopK kernel shared between webgl and cpu.

```javascript
import {buffer, NumericDataType, Rank, ShapeMap, Tensor, TensorBuffer, TypedArray, util} from '@tensorflow/tfjs-core';

export function topKImpl<T extends Tensor, R extends Rank>(
    x: TypedArray, xShape: number[], xDtype: NumericDataType, k: number, sorted: boolean):
    [TensorBuffer<R, NumericDataType>, TensorBuffer<R, 'int32'>] {
  // Reshape into a 2d tensor [batch, lastDim] and compute topk along lastDim.
  const lastDim = xShape[xShape.length - 1];
  const [batch, size] = [x.length / lastDim, lastDim];
  const allTopKVals = util.getTypedArrayFromDType(xDtype, batch * k);
  const allTopKIndices = util.getTypedArrayFromDType('int32', batch * k);

  for (let b = 0; b < batch; b++) {
    const offset = b * size;
    const vals = x.subarray(offset, offset + size);
    const valAndInd: Array<{value: number, index: number}> = [];
    for (let i = 0; i < vals.length; i++) {
      valAndInd.push({value: vals[i], index: i});
    }
    valAndInd.sort((a, b) => b.value - a.value);
    const outOffset = b * k;
    const topKVals = allTopKVals.subarray(outOffset, outOffset + k);
    const topKIndices = allTopKIndices.subarray(outOffset, outOffset + k);
    for (let i = 0; i < k; i++) {
      topKVals[i] = valAndInd[i].value;
      topKIndices[i] = valAndInd[i].index;
    }
  }

  // Reshape back to the original input shape, except that the last dimension is k.
  const outputShape = xShape.slice();
  outputShape[outputShape.length - 1] = k;
  return [buffer(outputShape as ShapeMap[R], xDtype, allTopKVals),
         buffer(outputShape as ShapeMap[R], 'int32', allTopKIndices)];
}
```

---

An implementation of the TopK kernel shared between webgl and cpu.

```javascript
import {BackendValues, DataType, TensorBuffer, TypedArray, util} from '@tensorflow/tfjs-core';

export function uniqueImpl(values: BackendValues, axis: number, shape: number[], dtype: DataType): {
  outputValues: BackendValues,
  outputShape: number[],
  indices: BackendValues
} {
  const $axis = util.parseAxisParam(axis, shape)[0];

  const newShape = [1, shape[0], 1];
  for (let i = 0; i < $axis; i++) {
    newShape[0] *= shape[i];
  }
  newShape[1] = shape[$axis];
  for (let i = $axis + 1; i < shape.length; i++) {
    newShape[2] *= shape[i];
  }

  const outputShape = [1, shape[0], 1];
  for (let i = 0; i < $axis; i++) {
    outputShape[0] *= shape[i];
  }
  outputShape[$axis] = shape[$axis];
  for (let i = $axis + 1; i < shape.length; i++) {
    outputShape[2] *= shape[i];
  }

  return {
    outputValues: util.getTensorBufferFromShape(outputShape, values, dtype),
    outputShape: outputShape,
    indices: util.getTensorBufferFromShape(outputShape, values, 'int32')
  };
}
```

---

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A map from unique elements (their string representations) to their values // in "indices" (below).
const uniqueElements: {[key: string]: number} = {};
// The indices of each unique element in the original tensor along the given axis // axis. It is 1D and has the same size as the given axis.
const indices = new Int32Array(shape[$axis]);
// Create a buffer so we can easily extract value at a given location.
const inputBuffer = new TensorBuffer(newShape, dtype, values as TypedArray);
// The indices along the given axis that have unique elements. This is a de-duped version of "indices" above.
const uniqueIndices: number[] = [];

for (let i = 0; i < shape[$axis]; i++) {
  // Extract values along the axis.
  let element: string;
  if (is1DTensor) {
    // Fast path for 1D tensor input.
    element = values[i].toString();
  } else {
    const axisValues = [];
    for (let m = 0; m < newShape[0]; m++) {
      for (let n = 0; n < newShape[2]; n++) {
        axisValues.push(inputBuffer.get(m, i, n));
      }
    }
    element = axisValues.join(',');
  }

  // Dedup and update various indices.
  if (uniqueElements[element] !== undefined) {
    indices[i] = uniqueElements[element];
  } else {
    const uniqueIndex = Object.keys(uniqueElements).length;
    uniqueElements[element] = uniqueIndex;
    indices[i] = uniqueIndex;
    uniqueIndices.push(i);
  }
}

// The output shape can be calculated from the input shape with the size of $axis // the given axis replaced by the number of unique elements along that axis.
const outputShape = shape.slice();
outputShape[$axis] = Object.keys(uniqueElements).length;

// Now we know where each of the unique elements are located along the axis // (uniqueIndices). Extract them from input buffer and store them in the output buffer.
const outputTmpShape = newShape.slice();
outputTmpShape[1] = Object.keys(uniqueElements).length;
const outputBuffer = new TensorBuffer(outputTmpShape, dtype);

for (let i = 0; i < uniqueIndices.length; i++) {
  for (let m = 0; m < newShape[0]; m++) {
    for (let n = 0; n < newShape[2]; n++) {
      outputBuffer.set(inputBuffer.get(m, uniqueIndices[i], n), m, i, n);
    }
  }
}

// Export functions for each backend.
export {simpleAbsImpl} from './kernels/Abs';
export {addImpl} from './kernels/Add';
export {bincountImpl, bincountReduceImpl} from './kernels/Bincount_impl';
export {ceilImpl} from './kernels/Ceil';
export {concatImpl} from './kernels/Concat_impl';
export {expImpl} from './kernels/Exp';
export {expm1Impl} from './kernels/Expm1';
export {floorImpl} from './kernels/Floor';
export {gatherV2Impl} from './kernels/GatherV2_impl';
export {greaterImpl} from './kernels/Greater';
export {lessImpl} from './kernels/Less';
export {linSpaceImpl} from './kernels/LinSpace_impl';
export {logImpl} from './kernels/Log';
export {maxImpl} from './kernels/Max_impl';
export {maximumImpl} from './kernels/Maximum';
export {minimumImpl} from './kernels/Minimum';
export {multiplyImpl} from './kernels/Multiply';
export {negImpl} from './kernels/Neg';
export {notEqualImpl} from './kernels/NotEqual';
export {prodImpl} from './kernels/Prod';
export {rangeImpl} from './kernels/Range_impl';
export {rsqrtImpl} from './kernels/Rsqrt';
export {sliceImpl} from './kernels/Slice';
export {squaredDifferenceImpl} from './kernels/SquaredDifference';
export {stridedSliceImpl} from './kernels/StridedSlice_impl';
export {subImpl} from './kernels/Sub';
export {tileImpl} from './kernels/Tile_impl';
export {topKImpl} from './kernels/TopK_impl';
export {transposeImpl} from './kernels/Transpose_impl';
export {uniqueImpl} from './kernels/Unique_impl';
export {ComplexBinaryKernelImpl, SimpleBinaryKernelImpl} from './utils/binary_types';
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=============================================================================

```typescript
// Import shared functionality from tfjs-backend-cpu without triggering side effects.
import * as shared from '@tensorflow/tfjs-backend-cpu/dist/shared';

export type SimpleBinaryKernelImplCPU = SimpleBinaryKernelImpl;
export type SimpleUnaryKernelImplCPU = SimpleUnaryImpl;

const {
  addImplCPU,
  bincountImplCPU,
  bincountReduceImplCPU,
  ceilImplCPU,
  concatImplCPU,
  expImplCPU,
  expm1ImplCPU,
  floorImpl:
  floorImplCPU,
  gatherV2Impl:
  gatherV2ImplCPU,
  greaterImpl:
  greaterImplCPU,
  lessImpl:
  lessImplCPU,
  logImpl:
  logImplCPU,
  maximumImpl:
  maximumImplCPU,
  minimumImpl:
  minimumImplCPU,
  multiplyImpl:
  multiplyImplCPU,
  negImpl:
  negImplCPU,
  prodImpl:
  prodImplCPU,
  rangeImpl:
  rangeImplCPU,
  rsqrtImpl:
  rsqrtImplCPU,
  simpleAbsImplCPU,
  sliceImpl:
  sliceImplCPU,
  stridedSliceImpl:
  stridedSliceImplCPU,
  subImpl:
  subImplCPU,
  tileImpl:
  tileImplCPU,
  topKImpl:
  topKImplCPU,
  transposeImplCPU,
  uniqueImpl:
  uniqueImplCPU,
  equals:
  equalsCPU,
  less:
  lessCPU,
  greater:
  greaterCPU,
  logicalAnd:
  logicalAndCPU,
  logicalOr:
  logicalOrCPU,
  logicalXor:
  logicalXorCPU,
  maximum:
  maximumCPU,
  minimum:
  minimumCPU,
  multiply:
  multiplyCPU,
  neg:
  negCPU,
  prod:
  prodCPU,
  range:
  rangeCPU,
  rsqrt:
  rsqrtCPU,
  simpleAbs:
  simpleAbsCPU,
  slice:
  sliceCPU,
  stridedSlice:
  stridedSliceCPU,
  sub:
  subCPU,
  tile:
  tileCPU,
  topK:
  topKCPU,
  transpose:
  transposeCPU,
  unique:
  uniqueCPU,
  equals:
  equalsCPU,
  less:
  lessCPU,
  greater:
  greaterCPU,
  logicalAnd:
  logicalAndCPU,
  logicalOr:
  logicalOrCPU,
  logicalXor:
  logicalXorCPU,
  maximum:
  maximumCPU,
  minimum:
  minimumCPU,
  multiply:
  multiplyCPU,
  neg:
  negCPU,
  prod:
  prodCPU,
  range:
  rangeCPU,
  rsqrt:
  rsqrtCPU,
  simpleAbs:
  simpleAbsCPU,
  slice:
  sliceCPU,
  stridedSlice:
  stridedSliceCPU,
  sub:
  subCPU,
  tile:
  tileCPU,
  topK:
  topKCPU,
  transpose:
  transposeCPU,
  unique:
  uniqueCPU,
} = shared;

export {
  addImplCPU,
  bincountImplCPU,
  bincountReduceImplCPU,
  ceilImplCPU,
  concatImplCPU,
  expImplCPU,
  expm1ImplCPU,
  floorImpl:
  floorImplCPU,
  gatherV2Impl:
  gatherV2ImplCPU,
  greaterImpl:
  greaterImplCPU,
  lessImpl:
  lessImplCPU,
  logImpl:
  logImplCPU,
  maximumImpl:
  maximumImplCPU,
  minimumImpl:
  minimumImplCPU,
  multiplyImpl:
  multiplyImplCPU,
  negImpl:
  negImplCPU,
  prodImpl:
  prodImplCPU,
  rangeImpl:
  rangeImplCPU,
  rsqrtImpl:
  rsqrtImplCPU,
  simpleAbsImplCPU,
  sliceImpl:
  sliceImplCPU,
  stridedSliceImpl:
  stridedSliceImplCPU,
  subImpl:
  subImplCPU,
  tileImpl:
  tileImplCPU,
  topKImpl:
  topKImplCPU,
  transposeImpl:
  transposeImplCPU,
  uniqueImpl:
  uniqueImplCPU,

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 */

import {GPGPUProgram} from './gpgpu_math';
import {getChannels} from './packing_util';
import {getCoordsDataType} from './shader_compiler';

export class PackProgram implements GPGPUProgram {

/* !n *export function getVecChannels(name: string, rank: number): string[] {
  return ['x', 'y', 'z', 'w', 'u', 'v'].slice(0, rank).map(d => `_${name}.${d}`).join('');
}

/* !n *export function getChannels(name: string, rank: number): string[] {
  return getVecChannels(name, rank);}

/* !n *export function getSourceCoords(rank: number, dims: string[]): string[] {
  if (rank === 1) {
    return [name];
  }
  for (let i = 0; i < rank; i++) {
    coords += dims[i];
  }
  return coords;
}

/* !n *export function getCoordsDataType(name: string, rank: number): string[] {
  return ['x', 'y', 'z', 'w', 'u', 'v'].slice(0, rank).map(d => `_${name}.${d}`).join('');
}

/* !n *export class PackProgram implements GPGPUProgram {

/* !n *export function getVecChannels(name: string, rank: number): string[] {
  return ['x', 'y', 'z', 'w', 'u', 'v'].slice(0, rank).map(d => `_${name}.${d}`).join('');
}

/* !n *export function getChannels(name: string, rank: number): string[] {
  return getVecChannels(name, rank);}

/* !n *export function getSourceCoords(rank: number, dims: string[]): string[] {
  if (rank === 1) {
    return [name];
  }
  for (let i = 0; i < rank; i++) {
    coords += dims[i];
  }
  return coords;
}

/* !n *export function getCoordsDataType(name: string, rank: number): string[] {
  return ['x', 'y', 'z', 'w', 'u', 'v'].slice(0, rank).map(d => `_${name}.${d}`).join('');
}
```

Open Source Used in Cisco Meeting Server (formerly Acano Server) 3.4 3783
```javascript
variableNames = ['A'];
outputShape: number[]; userCode: string;
packedInputs = false;
packedOutput = true;
constructor(outputShape: number[]) { //
  // Only input / output 3D tensors.
  this.outputShape = outputShape;
  const rank = outputShape.length;
  if (rank === 0) { this.userCode = 
      
    void main() {
        setOutput(vec4(0, 0, 0, 0));
    } } else {
    const channels = getChannels('rc', rank);
    const dtype = getCoordsDataType(type);
    const outOfBoundsCondition = getOutOfBoundsCondition(rank, shape, channels);
    const setup = getSetup(rank, channels);
    const output = getOutput(outputShape, channels);

    this.userCode = 
        `void main() {
        ${output}.z += 1;
        if(${outOfBoundsCondition}) {
            setOutput(vec4(0));
        } else {
            ${setup}
            setOutput(vec4(${output}));
        }
    }`;
  }
}

function
getSourceCoordsArr(rank: number, dims: string[]): string[] {
    const coords = [];
    for (let row = 0; row <= 1; row++) {
        for (let col = 0; col <= 1; col++) {
            const coord = `${row === 0 ? 'r' : 'rp1'}, ${col === 0 ? 'c' : 'cp1'},`;
            for (let d = 2; d < rank; d++) {
                coord = `${dims[dims.length - 1 - d]},` + coord;
            }
            coords.push(coord);
        }
    }
    return coords;
}

function getOutOfBoundsCondition(rank: number, shape: number[], dims: string[]): string {
    if (rank === 1) {
        return `rc > ${shape[0]}`;
    }
    let cond = '';
    for (let i = rank - 2; i < rank; i++) {
        cond += `${dims[i]} >= ${shape[i]}`;
        if (i < rank - 1) {
            cond += '||';
        }
    }
    return cond;
}

function getSetup(rank: number, cols: number, rows: number, dims: string[]): string {
    if (rank === 1) {
        return '';
    }
    const innerDims = dims.slice(-2);
    return `
    int r = ${innerDims[0]};
    int c = ${innerDims[1]};
    int rEdge = cEdge >= ${cols};
    int cEdge = cp1 >= $[rows];
    $[shape[i]]:`;
    if (i < rank - 1) {
        cond += '||';
    }
    } return cond;
}

function getOutput(shape: number[], channels: string[]): string {
    const rank = shape.length;
    const sourceCoords = getSourceCoordsArr(rank, channels);
    if (rank === 1) {
        return `getA(rc),
            rc + 1 >= ${shape[0]} ? 0. : getA(rc + 1),
            0, 0`;
    }
    return `getA(${sourceCoords[0]}),
          cEdge ? 0. : getA(${sourceCoords[1]}),
          rEdge ? 0. :
        getA(${sourceCoords[2]}),
        rEdge || cEdge ? 0. : getA(${sourceCoords[3]}),
    """`;
}
}
```

---

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* *
*=============================================================================
```
ivec3 inputCoordsFromReshapedOutCoords(int index) {
    ${coordsFromIndexSnippet}
    return ivec3(r, c, d);
}

ivec3 outputCoordsFromReshapedOutCoords(int index) {
    return ivec3(0, 0, 0);
}

ivec3 inputCoordsFromReshapedOutCoords(int index) {
    ${coordsFromIndexSnippet}
    return ivec3(r, c, d);
}

ivec3 outputCoordsFromReshapedOutCoords(int index) {
    return ivec3(0, 0, 0);
}

ivec3 inputCoordsFromReshapedOutCoords(int index) {
    ${coordsFromIndexSnippet}
    return ivec3(r, c, d);
}

ivec3 outputCoordsFromReshapedOutCoords(int index) {
    return ivec3(0, 0, 0);
}

ivec3 inputCoordsFromReshapedOutCoords(int index) {
    ${coordsFromIndexSnippet}
    return ivec3(r, c, d);
}

ivec3 outputCoordsFromReshapedOutCoords(int index) {
    return ivec3(0, 0, 0);
}

ivec3 inputCoordsFromReshapedOutCoords(int index) {
    ${coordsFromIndexSnippet}
    return ivec3(r, c, d);
}

ivec3 outputCoordsFromReshapedOutCoords(int index) {
    return ivec3(0, 0, 0);
}

ivec3 inputCoordsFromReshapedOutCoords(int index) {
    ${coordsFromIndexSnippet}
    return ivec3(r, c, d);
}

ivec3 outputCoordsFromReshapedOutCoords(int index) {
    return ivec3(0, 0, 0);
}

ivec3 inputCoordsFromReshapedOutCoords(int index) {
    ${coordsFromIndexSnippet}
    return ivec3(r, c, d);
}

ivec3 outputCoordsFromReshapedOutCoords(int index) {
    return ivec3(0, 0, 0);
}
this._numBytesAllocated -= texBytes; 
  } else {
    this.freeTextures[shapeKey].push(texture);
    this.freeTextures[shapeKey].forEach(tex => {
      this.gpgpu.deleteMatrixTexture(tex);
    });
    this.numFreeTextures++;
    this._numBytesFree += texBytes;
  }

  this.numUsedTextures--;

  const texList = this.usedTextures[shapeKey];
  const texIndex = texList.indexOf(texture);
  if (texIndex < 0) {
    throw new Error(
      'Cannot release a texture that was never provided by this ' +
      'texture manager');
  }
  texList.splice(texIndex, 1);
  this.log();
}

private log() {
  if (!this.logEnabled) {
    return;
  }
  const total = this.numFreeTextures + this.numUsedTextures;
  console.log('
    Free/Used',
    `${this.numFreeTextures} / ${this.numUsedTextures}`,
    `(${total})`);
  const freeRatio =
      this._numBytesFree / this._numBytesAllocated;
  console.log(`Bytes unused: ${this._numBytesFree} (${Math.round(100 * freeRatio)}%)`);
  get numBytesAllocated(): number {
    return this._numBytesAllocated;
  }

  get numBytesFree(): number {
    return this._numBytesFree;
  }

  getNumUsedTextures(): number {
    return this.numUsedTextures;
  }

  getNumFreeTextures(): number {
    return this.numFreeTextures;
  }

  dispose() {
    if (this.freeTextures == null) {
      // Already disposed.
      return;
    }
    for (const texShape in this.freeTextures) {
      this.freeTextures[texShape].forEach(tex => {
        this.gpgpu.deleteMatrixTexture(tex);
      });
    }
    for (const texShape in this.usedTextures) {
      this.usedTextures[texShape].forEach(tex => {
        this.gpgpu.deleteMatrixTexture(tex);
      });
    }
    this.freeTextures = null;
    this.usedTextures = null;
    this.numUsedTextures = 0;
    this.numFreeTextures = 0;
    this._numBytesAllocated = 0;
    this._numBytesFree = 0;
  }
}

function numBytesForInternalFormat(
    gl: WebGLRenderingContext,
    internalFormat: number): number {
  // tslint:disable-next-line:no-any
  const glany = gl as any;
  if (internalFormat === glany.R32F) {
    return 4;
  } else if (internalFormat === glany.R16F) {
    return 2;
  } else if (internalFormat === glany.RGBA32F) {
    return 16;
  } else if (internalFormat === gl.RGBA) {
    return 16;
  } else if (internalFormat === glany.RGBA16F) {
    return 8;
  }
  throw new Error(`Unknown internal format ${internalFormat}`);
}

export function computeBytes(
    shape: [number, number],
    physicalTexType: PhysicalTextureType,
    gl: WebGLRenderingContext,
    textureConfig: TextureConfig,
    isPacked: boolean): number {
  // It is not possible to infer packed status from the texture type because
  // depending on the textureConfig, different texture types may resolve to the
  // same internal format (e.g. in
  // WebGL1, the internal format for UNPACKED_FLOAT16 textures is gl.RGBA). Therefore we pass in
  // explicitly.
  const internalFormat =
    internalFormatForPhysicalTexType(physicalTexType, textureConfig);

  let numElements: number;
  if (isPacked) {
    const [packedWidth, packedHeight] =
      getPackedMatrixTextureShapeWithHeight(shape[0], shape[1]);
    numElements = packedWidth * packedHeight;
  } else {
    const [width, height] =
      getUnpackedMatrixTextureShapeWithHeight(shape[0], shape[1]);
    numElements = width * height;
  }

  const bytesPerElement =
      numBytesForInternalFormat(gl, internalFormat);
  return numElements * bytesPerElement;
}

function internalFormatForPhysicalTexType(
    physicalTexType: PhysicalTextureType,
    textureConfig: TextureConfig): number {
  switch (physicalTexType) {
    case PhysicalTextureType.PACKED_2X2_FLOAT32:
      return getInternalFormatForPackedMatrixTexture(physicalTexType, textureConfig);
    case PhysicalTextureType.PACKED_2X2_FLOAT16:
      return getInternalFormatForPackedMatrixTexture(physicalTexType, textureConfig);
    case PhysicalTextureType.UNPACKED_FLOAT32:
      return getInternalFormatForUnpackedMatrixTexture(physicalTexType, textureConfig);
    case PhysicalTextureType.UNPACKED_FLOAT16:
      return getInternalFormatForUnpackedMatrixTexture(physicalTexType, textureConfig);
    case PhysicalTextureType.PACKED_4X1_UNSIGNED_BYTE:
      return getInternalFormatForUnsignedBytesMatrixTexture(physicalTexType, textureConfig);
    default:
      throw new Error(`Unknown physical texture type ${physicalTexType}`);
  }
}

// # inject function getPhysicalTextureForRendering is test only
function getPhysicalTextureForRendering(isPacked: boolean)
    PhysicalTextureType {
  if (env().getBool('WEBGL_RENDER_FLOAT32_ENABLED')) {
    return PhysicalTextureType.PACKED_2X2_FLOAT32;
  } else {
    return PhysicalTextureType.PACKED_2X2_FLOAT16;
  }
}
PhysicalTextureType.UNPACKED_FLOAT32

PhysicalTextureType.PACKED_2X2_FLOAT16

function getPhysicalFromLogicalTextureType

 */

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=============================================================================

import {GPGPUProgram} from './gpgpu_math';

export class UnaryOpProgram implements GPGPUProgram {

  variableNames = ['A'];
  userCode: string;
  outputShape: number[];

  constructor(aShape: number[], opSnippet: string) {
    this.outputShape = aShape;
    this.userCode = `void main() {
      float x = getAAtOutCoords();
      float y = unaryOperation(x);
      setOutput(y);
    }
`;
  }
}

export const CHECK_NAN_SNIPPET = `if (isnan(x)) return x;`;

export const LINEAR = `return x;`;

export const ELU = `vec4 result;

  result.r = (x.r >= 0.0) ? x.r : (exp(x.r) - 1.0);
  result.g = (x.g >= 0.0) ? x.g : (exp(x.g) - 1.0);
  result.b = (x.b >= 0.0) ? x.b : (exp(x.b) - 1.0);
  result.a = (x.a >= 0.0) ? x.a : (exp(x.a) - 1.0);

  return result;
`;

export const RELU = `vec4 result = x * vec4(greaterThanEqual(x, vec4(0.0)));
  bvec4 isNaN = isnan(x);

  result.r = isNaN.r ? x.r : result.r;
  result.g = isNaN.g ? x.g : result.g;
  result.b = isNaN.b ? x.b : result.b;
  result.a = isNaN.a ? x.a : result.a;

  return result;
`;

export const RELU6 = `vec4 result = min(x, vec4(6.0)) * vec4(greaterThanEqual(x, vec4(0.0)));
  bvec4 isNaN = isnan(x);

  result.r = isNaN.r ? x.r : result.r;
  result.g = isNaN.g ? x.g : result.g;
  result.b = isNaN.b ? x.b : result.b;
  result.a = isNaN.a ? x.a : result.a;

  return result;
`;

export class UnaryOpPackedProgram implements GPGPUProgram {

  variableNames = ['A'];
  userCode: string;
  outputShape: number[];
  packedInputs = true;
  packedOutput = true;

  constructor(aShape: number[], opSnippet: string) {
    this.outputShape = aShape;
    this.userCode = `vec4 unaryOperation(vec4 x) {
      float result = $[opSnippet]$
      void main() {
        vec4 x = getAAtOutCoords();
        vec4 y = unaryOperation(x);
        setOutput(y);
      }
    `;
  }
}

export const LINEAR = `vec4 result;

  result.r = (x.r >= 0.0) ? x.r : (exp(x.r) - 1.0);
  result.g = (x.g >= 0.0) ? x.g : (exp(x.g) - 1.0);
  result.b = (x.b >= 0.0) ? x.b : (exp(x.b) - 1.0);
  result.a = (x.a >= 0.0) ? x.a : (exp(x.a) - 1.0);

  return result;
`;

export const ELU = `vec4 result;

  result.r = (x.r >= 0.0) ? x.r : (exp(x.r) - 1.0);
  result.g = (x.g >= 0.0) ? x.g : (exp(x.g) - 1.0);
  result.b = (x.b >= 0.0) ? x.b : (exp(x.b) - 1.0);
  result.a = (x.a >= 0.0) ? x.a : (exp(x.a) - 1.0);

  return result;
`;

export const RELU = `vec4 result = x * vec4(greaterThanEqual(x, vec4(0.0)));
  bvec4 isNaN = isnan(x);

  result.r = isNaN.r ? x.r : result.r;
  result.g = isNaN.g ? x.g : result.g;
  result.b = isNaN.b ? x.b : result.b;
  result.a = isNaN.a ? x.a : result.a;

  return result;
`;

export const RELU6 = `vec4 result = min(x, vec4(6.0)) * vec4(greaterThanEqual(x, vec4(0.0)));
  bvec4 isNaN = isnan(x);

  result.r = isNaN.r ? x.r : result.r;
  result.g = isNaN.g ? x.g : result.g;
  result.b = isNaN.b ? x.b : result.b;
  result.a = isNaN.a ? x.a : result.a;

  return result;
`;

export class UnaryOpPackedProgram implements GPGPUProgram {

  variableNames = ['A'];
  userCode: string;
  outputShape: number[];
  packedInputs = true;
  packedOutput = true;

  constructor(aShape: number[], opSnippet: string) {
    this.outputShape = aShape;
    this.userCode = `vec4 unaryOperation(vec4 x) {
      float result = $[opSnippet]$
      void main() {
        vec4 x = getAAtOutCoords();
        vec4 y = unaryOperation(x);
        setOutput(y);
      }
    `;
  }
}

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 *
 *=============================================================================

import {GPGPUProgram} from './gpgpu_math';

export const LINEAR = `return x;`;

export const ELU = `vec4 result;

  result.r = (x.r >= 0.0) ? x.r : (exp(x.r) - 1.0);
  result.g = (x.g >= 0.0) ? x.g : (exp(x.g) - 1.0);
  result.b = (x.b >= 0.0) ? x.b : (exp(x.b) - 1.0);
  result.a = (x.a >= 0.0) ? x.a : (exp(x.a) - 1.0);

  return result;
`;

export const RELU = `vec4 result = x * vec4(greaterThanEqual(x, vec4(0.0)));
  bvec4 isNaN = isnan(x);

  result.r = isNaN.r ? x.r : result.r;
  result.g = isNaN.g ? x.g : result.g;
  result.b = isNaN.b ? x.b : result.b;
  result.a = isNaN.a ? x.a : result.a;

  return result;
`;

export const RELU6 = `vec4 result = min(x, vec4(6.0)) * vec4(greaterThanEqual(x, vec4(0.0)));
  bvec4 isNaN = isnan(x);

  result.r = isNaN.r ? x.r : result.r;
  result.g = isNaN.g ? x.g : result.g;
  result.b = isNaN.b ? x.b : result.b;
  result.a = isNaN.a ? x.a : result.a;

  return result;
`;

export class UnaryOpPackedProgram implements GPGPUProgram {

  variableNames = ['A'];
  userCode: string;
  outputShape: number[];
  packedInputs = true;
  packedOutput = true;

  constructor(aShape: number[], opSnippet: string) {
    this.outputShape = aShape;
    this.userCode = `vec4 unaryOperation(vec4 x) {
      float result = $[opSnippet]$
      void main() {
        vec4 x = getAAtOutCoords();
        vec4 y = unaryOperation(x);
        setOutput(y);
      }
    `;
  }
}
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=============================================================================

*/

import {GPGPUProgram} from './gpgpu_math';
import {getChannels, getSourceCoords} from './packing_util';
import {getCoordsDataType} from './shader_compiler';

export class UnpackProgram implements GPGPUProgram {
  variableNames = ['A'];
  packedInputs = true;
  packedOutput = false;

  outputShape = number[];
  userCode: string;

  constructor(outputShape: number[]) {
    this.outputShape = outputShape;
    const rank = outputShape.length;

    const channels = getChannels('rc', rank);
    const dtype = getCoordsDataType(rank);
    const sourceCoords = getSourceCoords(rank, channels);
    const innerDims = channels.slice(-2);
    const coords = rank <= 1 ? 'rc' : `vec2(${innerDims.join(',')})`;

    this.userCode = `void main() {
        ${dtype} rc = getOutputCoords();
        vec4 packedInput = getA(${sourceCoords});

        setOutput(getChannel(packedInput, ${coords}));
      }`
  }
}

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 *
=============================================================================

// Import webgl flags.
import './flags_webgl';

import * as tf from '@tensorflow/tfjs-core';
import {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';

import {getWebGLContext} from './canvas_util';
import {DecodeMatrixProgram} from './decode_matrix_gpu';
import {EncodeMatrixProgram} from './encode_matrix_gpu';
import {GPGPUContext} from './gpgpu_context';
import {simpleAbsImplCPU} from './kernel_utils/shared';
import {ReshapePackedProgram} from './reshape_packed_gpu';
import * as tex_util from './tex_util';
import {TextureData, TextureUsage} from './tex_util';
import {texture_manager} from './texture_manager';
import * as unary_op from './unaryop_gpu';
import {UnaryOpProgram} from './unaryop_gpu';
import {UnpackProgram} from './unpack_gpu';
import * as webgl_util from './webgl_util';

const whereImpl = kernel_impls.whereImpl;

export const EPSILON_FLOAT32 = 1e-7;
export const EPSILON_FLOAT16 = 1e-4;

type KernelInfo = {
  name: string;
  query: Promise<number>;
};

export type TimerNode = RecursiveArray<KernelInfo>|KernelInfo;
export interface CPUTimerQuery {
  startMs: number;
  endMs?: number;
}

export interface WebGLMemoryInfo extends MemoryInfo {
  numBytesInGPU: number;
  // Tracks the total number of bytes allocated on the GPU, accounting for the physical texture type.
  numBytesInGPUAllocated: number;
  // Tracks byte size of textures that were created and then made available for reuse (disposed).
  numBytesInGPUFree: number;
  unreliable: boolean;
  unexport interface WebGLMemoryInfo extends MemoryInfo {
    numBytesInGPU: number;
    // Tracks the total number of bytes allocated on the GPU, accounting for the physical texture type.
    numBytesInGPUAllocated: number;
    // Tracks byte size of textures that were created and then made available for reuse (disposed).
    numBytesInGPUFree: number;
    unreliable: boolean;
  }
  unexport interface WebGLMemoryInfo extends MemoryInfo {
    unexport const EPSILON_FLOAT32 = 1e-7;
    unexport const EPSILON_FLOAT16 = 1e-4;
    unexport type KernelInfo = {name: string; query: Promise<number>;
    unexport type TimerNode = RecursiveArray<KernelInfo>;[KernelInfo;[texture_manager]]};
    unexport interface CPUTimerQuery {
      startMs: number;
      endMs?: number;
    }
    unexport interface WebGLMemoryInfo extends MemoryInfo {
      numBytesInGPU: number;
      // Tracks the total number of bytes allocated on the GPU, accounting for the physical texture type.
      numBytesInGPUAllocated: number;
      // Tracks byte size of textures that were created and then made available for reuse (disposed).
      numBytesInGPUFree: number;
      unreliable: boolean;
    }
    unexport function getBinaryCache(webGLVersion: string): {[key: string]: GPGPUProgram} = {};
    unexport function getBinaryCache(webGLVersion: string): number;
    unexport function if (webGLVersion in binaryCaches) {
      // ...
The presence of `slice` indicates this tensor is a shallow slice of an different tensor, and is using that original tensor's texture. Run `clone` in order to copy that texture and read from it, if (slice !== null) {
  let program;
  if (isPacked) {
    program = new UnaryOpPackedProgram(shape, unary_op.CLONE);
  } else {
    program = new UnaryOpProgram(shape, unary_op.CLONE);
  }
  const res =
  this.runWebGLProgram(program, [{dataId, shape, dtype}], dtype);
  const data = this.readSync(res.dataId);
  this.disposeIntermediateTensorInfo(res);
  return data;
} if (values != null) {
  let program;
  if (isPacked) {
    program = new UnaryOpPackedProgram(shape, unary_op.CLONE);
  } else {
    program = new UnaryOpProgram(shape, unary_op.CLONE);
  }
  const res =
  this.runWebGLProgram(program, [{dataId, shape, dtype}], dtype);
  const data = this.readSync(res.dataId);
  this.disposeIntermediateTensorInfo(res);
  return data;
}
if (dtype === 'string') {
  return values;
}
const shouldTimeProgram = this.activeTimers != null;
let start: number;
if (shouldTimeProgram) {
  start = util.now();
}

let result: Float32Array;
if (dtype === 'complex64') {
  const realValues =
  this.readSync(complexTensorInfos.real.dataId) as Float32Array;
  const imagValues =
  this.readSync(complexTensorInfos.imag.dataId) as Float32Array;
  result =
  backend_util.mergeRealAndImagArrays(realValues, imagValues);
} else {
  result =
  this.getValuesFromTexture(dataId);
}

if (shouldTimeProgram) {
  this.downloadWaitMs += util.now() - start;
}

return this.convertAndCacheOnCPU(dataId, result);
}

async read(dataId: DataId): Promise<BackendValues> {
  if (this.pendingRead.has(dataId)) {
    const subscribers =
    this.pendingRead.get(dataId);
    return new Promise<TypedArray>(resolve => subscribers.push(resolve));
  }
  const texData = this.texData.get(dataId);
  const {values, shape, slice, dtype, complexTensorInfos, isPacked} =
  texData;

  // The presence of `slice` indicates this tensor is a shallow slice of an different tensor, and is using that original tensor's texture. Run `clone` in order to copy that texture and read from it, if (slice !== null) {
  let program;
  if (isPacked) {
    program = new UnaryOpPackedProgram(shape, unary_op.CLONE);
  } else {
    program = new UnaryOpProgram(shape, unary_op.CLONE);
  }
  const res =
  this.runWebGLProgram(program, [{dataId, shape, dtype}], dtype);
  const data =
  this.read(res.dataId);
  this.disposeIntermediateTensorInfo(res);
  return data;
}

  if (values != null) {
    return this.convertAndCacheOnCPU(dataId);
  }

  if (!env().getBool('WEBGL_DOWNLOAD_FLOAT_ENABLED') &&
  env().getNumber('WEBGL_VERSION') === 2) {
    throw new Error(
    `tensor.data() with WEBGL_DOWNLOAD_FLOAT_ENABLED=false and ` +
    `WEBGL_VERSION=2 not yet supported.`);
  }

  let buffer = null;
  let tmpDownloadTarget: TensorInfo;

  if (dtype !== 'complex64' &&
  env().get('WEBGL_BUFFER_SUPPORTED')) {
    // Possibly copy the texture into a buffer before inserting a fence.
    tmpDownloadTarget = this.decode(dataId);
    const tmpData =
    this текData.get(tmpDownloadTarget.dataId);
    buffer = this.gpgpu.createBufferFromTexture(
    tmpData, shape); // Create a fence and wait for it to resolve.
    await this.gpgpu.createAndWaitForFence();
    // Download the values from the GPU.
    let vals:
    Float32Array;
    if (dtype !== 'complex64') {
      const ps = await Promise.all([
      this.read(complexTensorInfos.real.dataId),
      this.read(complexTensorInfos.imag.dataId)]);
      const realValues = ps[0];
      const imagValues = ps[1];
      vals = backend_util.mergeRealAndImagArrays(realValues as Float32Array, imagValues as Float32Array);
    } else if (buffer == null) {
      vals =
      this.getValuesFromTexture(dataId);
      const size = util.sizeFromShape(shape);
      vals =
      this.gpgpu.downloadFloat32MatrixFromBuffer(buffer, size);
    } if (tmpDownloadTarget != null) {
      this.disposeIntermediateTensorInfo(tmpDownloadTarget);
    }
    const dTypeVals =
    this.convertAndCacheOnCPU(dataId, vals);
    const subscribers =
    this.pendingRead.get(dataId);
    this.pendingRead.delete(dataId);
    // Notify all pending reads.
    if (dTypeVals) {
      const ps = await Promise.all([dTypeVals]);
      if (resolve) {
        resolve(dTypeVals);
      }
    }
  }

  return dTypeVals;
catch { try { throw new Error('Failed to decode encoded string bytes into utf-8'); } catch { return null; } }

buffer(t.shape as ShapeMap[R], t.dtype, decodedData) as
  private TensorBuffer<R>;

checkNumericalProblems(values: BackendValues) { void { if (values == null) { return; } for (let i = 0; i < values.length; i++) { const num = values[i] as number;
    if (!webgl_util.canBeRepresented(num)) { if (env().getBoolean('WEBGL_RENDER_FLOAT32_CAPABLE')) { throw Error('The value \$\{num\} cannot be represented with your \`+\` current settings. Consider enabling float32 rendering: \`+\` which sets \`WEBGL_RENDER_FLOAT32_ENABLED\`, true;\'); }
      throw Error('The value \$\{num\} cannot be represented on this device.'); } } return;
    } }

getValuesFromTexture(dataId: DataId) { const {shape, dtype, isPacked} = this.texData.get(dataId);
    const size = util.sizeFromShape(shape);
    if (env().getBoolean('WEBGL_DOWNLOAD_FLOAT_ENABLED')) { const tmpTarget = this.decode(dataId);
        const tmpData = this.texData.get(tmpTarget.dataId);
      const vals =
        this.gpgpu
                       .downloadMatrixFromPackedTexture(tmpData.texture, shape
                       ) as
        TensorBuffer<R>;

      this.disposeIntermediateTensorInfo(tmpTarget);
      return;
    }

    const shouldUsePackedProgram =
      env().getBoolean('WEBGL_PACK') && isPacked === true;
    const outputShape =
      shouldUsePackedProgram ? webgl_util.getShapeAs3D(shape) : shape;
    const program =
      shouldUsePackedProgram ?
          new EncodeFloatPackedProgram(outputShape as [number, number, number]) :
          new EncodeFloatProgram(outputShape);
    const output = this.runWebGLProgram(
        program, [{shape: outputShape, dtype, dataId}]);
    const vals =
        this.gpgpu
            .downloadByteEncodedFloatMatrixFromOutputTexture(
                tmpData.texture,
                tmpData.texShape[0], tmpData.texShape[1])
            .subarray(0, size);

    this.disposeIntermediateTensorInfo(output);

    return vals;
  }

async time(f: () => void): Promise<WebGLTimingInfo> { const oldActiveTimers = this.activeTimers;
    const newActiveTimers: TimerNode[] = [
        newActiveTimersStack = newActiveTimers;
      outerMostTime = true;
    } else {
      this.activeTimers.push(newActiveTimers);
    }
    this.activeTimers = newActiveTimers;

    f();

    // needing to split these up because util.flatten only accepts certain types\n    const flattenedActiveTimerQueries =
      util.flatten(this.activeTimers.map((d: KernelInfo) => d.query))
          .filter(d => d != null);
    const flattenedActiveTimerNames =
      util.flatten(this.activeTimers.map((d: KernelInfo) => d.name))
          .filter(d => d != null);
    this.activeTimers = oldActiveTimers;

    const res: WebGLTimingInfo = {
      uploadWaitMs: this.uploadWaitMs,
      downloadWaitMs: this.downloadWaitMs,
      kernelMs: null,
      wallMs: null  // will be filled by the engine
    };

    if (env().getNumber('WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_RELIABLE') > 0) { const kernelMs = await Promise.all(flattenedActiveTimerQueries);
        res['kernelMs'] = util.sum(kernelMs);
      res['getExtraProfileInfo'] = () =>
        flattenedActiveTimerNames.map((name: string, i: number) => {
            const d = flattenedActiveTimerQueries[i];
            return `${name}: ${d.ms}ms`; })
          .join(', ');
    } else {
      res['kernelMs'] = {'error': 'WebGL query timers are not supported in this environment.'};
    }
    this.uploadWaitMs = 0;
    this.downloadWaitMs = 0;
    return res;
  }

memory(): WebGLMemoryInfo { return {
    unreliable: false,
    numBytesInGPU: this.numBytesInGPU,
    numBytesInGPUFree: this.numBytesInGPUFree
  } as WebGLMemoryInfo;

private async startTimer(): WebGLQuery|CPUTimerQuery { if (env().getBoolean('WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_RELIABLE') > 0) { const kernelMs = await Promise.all(flattenedActiveTimerQueries);
        res['kernelMs'] = util.sum(kernelMs);
      res['getExtraProfileInfo'] = () =>
        flattenedActiveTimerNames.map((d, i) => {
            const d = flattenedActiveTimerQueries[i];
            return `$\{d.name\}: $\{d.ms\}ms`;
        })
          .join(', ');
    } else {
      res['kernelMs'] = {'error': 'WebGL query timers are not supported in this environment.'};
    }

    if (env().getNumber('WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_RELIABLE') > 0) { return this.gpgpu.beginQuery();
        return { startMs: util.now(), endMs: null };
      endTimer(query: WebGLQuery|CPUTimerQuery): WebGLQuery|CPUTimerQuery { if (env().getNumber('WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_RELIABLE') > 0) { return this.gpgpu.endQuery();
        return query as CPUTimerQuery; } }
Open Source Used in Cisco Meeting Server (formerly Acano Server) 3.4  3792

/**
   * Decrease the RefCount on the dataId and dispose the memory if the dataId
   * has 0 refCount. If there are
   * pending read on the data, the disposal would not add to the pending delete queue. Return true if the dataId is removed
   * from backend or the backend does not contain the dataId, false if the dataId is not removed.
   * Pending may or may not be released even when dataId is removed, which also depends on dataRefCount, see
   * `disposeGPU`
   * @param dataId
   * @oaram force Optional, remove the data regardless of refCount
   */
  disposeData(dataId: DataId, force = false): boolean {
    if (this.pendingDisposal.has(dataId)) {
      return false;
    }

    // No-op if already disposed.
    if (!this.texData.has(dataId)) {
      return true;
    } // if flag is set, change refCount to 0, this would ensure disposal
    // when added to the pendingDisposal queue. Memory may or may not be released, which also depends on dataRefCount, see
    // `disposeGPU`
    if (force) {
      this.texData.get(dataId).refCount = 0;
    } else {
      this.texData.get(dataId).refCount--;
    }

    if (!force && this.texData.get(dataId).refCount > 0) {
      return false;
    } // when added to the pendingDisposal queue. Memory may or may not be released, which also depends on dataRefCount, see
    // `disposeGPU`
    if (this.pendingDisposal.add(dataId)) {
      this.pendingDeletes++;
      return false;
    }

    this.releaseGPUData(dataId);
    const {complexTensorInfos} = this.texData.get(dataId);
    if (complexTensorInfos != null) {
      this.disposeData(complexTensorInfos.real.dataId, force);
      this.disposeData(complexTensorInfos.imag.dataId, force);
    }

    this.texData.delete(dataId);
    return true;
  }

  private releaseGPUData(dataId: DataId): void {
    const {texture, dtype, texShape, usage, isPacked, slice} =
        this.texData.get(dataId);
    const key = slice && slice.origDataId || dataId;
    const refCount = this.dataRefCount.get(key);

    if (refCount > 1) {
      this.dataRefCount.set(key, refCount - 1);
    } else {
      this.dataRefCount.delete(key);
      if (texture != null) {
        this.numBytesInGPU -=
            this.computeBytes(texShape, dtype);
        this.textureManager.releaseTexture(texture, texShape, usage,
            isPacked);
      }
    }

    const texData = this.texData.get(dataId);
    texData.texture = null;
    texData.texShape = null;
    texData.isPacked = false;
    texData.slice = null;
    const {texture, dataId} = this.texData.get(dataId);
    WebGLTexture = this.uploadToGPU(dataId);
    return this.texData.get(dataId).texture;
  }

  getTexture(dataId: DataId): WebGLTexture {
    this.uploadToGPU(dataId);
    return this.texData.get(dataId).texture;
  }

  where(condition: Tensor): Tensor2D {
    backend_util.warn(
        'tf.where() in webgl locks the UI thread. ' +
        'Call tf.where(Async) instead');
    const condVals = condition.dataSync();
    return whereImpl(condition.shape, condVals);
  }

  private packedUnaryOp(x: TensorInfo, op: string, dtype: DataType) {
    const program = new UnaryOpPackedProgram(x.shape, op);
    const outInfo =
        this.compileAndRun(program, [x], dtype);
    return engine().makeTensorFromDataId(
        outInfo.dataId,
        outInfo.shape, outInfo.dtype);
  }

  // TODO(msoulanille) remove this once the backend has been modularized
  // a copy is needed here to break a circular dependency.
  // Also remove the op from unary_op.abs<T extends
Tensor>(x: T): T {
  // TODO: handle cases when x is complex.
  if (this.shouldExecuteOnCPU([x]) &
      x.dtype === 'complex64') {
    const outValues =
        simpleAbsImplCPU(this.texData.get(x.dataId).values as
            TypedArray);
    return this.makeOutput(x.shape, x.dtype, outValues);
  }

  if (env().getBool('WEBGL_PACK_UNARY_OPERATIONS')) {
    const outInfo =
        this.packUnaryOp(x, unary_op.ABS, x.dtype) as T;
    return this.makeOutput(x.shape, x.dtype, outInfo);
  }

  const program = new UnaryOpProgram(x.shape, unary_op.ABS);
  const outInfo =
      this.compileAndRun(program, [x]);
  return engine().makeTensorFromDataId(outInfo.dataId, outInfo.shape, outInfo dtype) as T;
}

private unpackTensor(input: TensorInfo): TensorInfo {
  const program = new UnpackProgram(input.shape);
  return this.runWebGLProgram(program, [input], input.dtype, null /* customSetup */, preventEagerUnpackingOfOutput);
}

private packTensor(input: TensorInfo): TensorInfo {
  const program = new PackProgram(input.shape);
  return this.runWebGLProgram(program, [input], input.dtype, null /* customSetup */, preventEagerUnpackingOfOutput);
}

private packedReshape(input: TensorInfo, afterShape: number[]): TensorInfo {
  const input3DShape =
      webgl_util.getBatchDim(input.shape) as 
          [number, number, number];
  const input3D: TensorInfo = {
      dtype: input.dtype, shape: input3DShape, dataId: input.dataId};
  const afterShapeAs3D =
      webgl_util.getShapeAs3D(afterShape, ...webgl_util.getRowsCols(afterShape)) as [number, number, number];
  const program = new ReshapePackedProgram(afterShapeAs3D, input3DShape);
  const output =
      this.runWebGLProgram(program, [input3D], input.dtype, null /* customSetup */, preventEagerUnpackingOfOutput);
  return {dataId: output.dataId, shape: afterShape, dtype: output.dtype};
}

private decode(dataId: DataId): TensorInfo {
  const texData = this.texData.get(dataId);
  const {isPacked, shape, dtype} = texData;
  const shapeAs3D =
      webgl_util.getShapeAs3D(shape) as [number, number, number];
  let program;
  if (isPacked) {
    program = new DecodeMatrixPackedProgram(shapeAs3D);
  } else {
    program = new DecodeMatrixProgram(shapeAs3D);
  }
  const preventEagerUnpackingOfOutput = true;
  const output =
      this.runWebGLProgram(program, [shape: shapeAs3D, dtype, dataId], null /* customSetup */, preventEagerUnpackingOfOutput);
  return {dataId: output.dataId, shape: afterShape, dtype: output.dtype};
}

runWebGLProgram(
    program: GPGPUProgram, inputs: TensorInfo[], outputDtype: DataType,
    customSetup?: (gpgpu: GPGPUContext, webGLProgram: WebGLProgram) => void,
    preventEagerUnpackingOfOutput = false): TensorInfo {
  const outData = this.makeTensorFromDataId(outData);
util.sizeFromShape(input.shape) <= env().getNumber('WEBGL_SIZE_UPLOAD_UNIFORM') {
  // Upload small tensors that live on the CPU as uniforms, not as textures. Do this only when the environment supports 32bit floats // due to problems when comparing 16bit floats with 32bit floats.
  // Upload small tensors that live on the CPU as uniforms, not as textures. Do this only when the environment supports 32bit floats // due to problems when comparing 16bit floats with 32bit floats.
  // This ensures that if a packed program's inputs have not yet been uploaded to the GPU, they get uploaded as packed right off the bat.
  // This ensures that if a packed program's inputs have not yet been uploaded to the GPU, they get uploaded as packed right off the bat.
  if (program.packedInputs) {
    texData.isPacked = true;
    texData.shape = input.shape;
  } else if (!texData.isPacked) {
    // program.packedInputs
    return {
      shape: input.shape,
      texData: null,
      isUniform: true,
      uniformValues: texData.values as TypedArray
    }; // This is a special case where a texture exists for a tensor but the shapes are incompatible (due to packing constraints) because the tensor did not have a chance to go through the packed reshape shader. This only happens when we reshape the same* tensor to form *distinct* inputs to an op, e.g. dotting a vector with itself. This case will disappear once packed uploading is the default.
    const savedInput = input;
    const targetShape = input.shape;
    const dataToDispose = new Array();
    const outputData = {
      shape: output.shape,
      texData: outData,
      isUniform: false
    }; const key = gpgpu_math.makeShaderKey(program, inputsData, outputData);
    const binary = this.getAndSaveBinary(key, () => {
      return gpgpu_math.compileProgram(this.gpgpu, program, inputsData, outputData);
    });
    const shouldTimeProgram = this.activeTimers != null;
    let query = isWebGLQuery ? this.startTimer() : CPUTimerQuery;
    if (shouldTimeProgram) {
      query = this.endTimer(query);
      this.activeTimers.push({name: program.constructor.name, query: this.getQueryTime(query)});
    }
    if (!env().getBool('WEBGL_LAZILY_UNPACK') && outputData.isPacked && preventEagerUnpackingOfOutput === false) {
      const unpacked = this.unpackTensor(output);
      this.disposeIntermediateTensorInfo(output);
      return unpacked;
    }
    return output;
  }

  compileAndRun(program: GPGPUProgram, inputs: TensorInfo[], outputDtype?: DataType, customSetup?: (gpgpu: GPGPUContext, webGLProgram: WebGLProgram) => void, preventEagerUnpackingOfOutput = false): TensorInfo {
    outputDtype = outputDtype || inputs[0].dtype;
    const outInfo = this.runWebGLProgram(program, inputs, outputDtype, customSetup, preventEagerUnpackingOfOutput);
    return outInfo; // Avoid disposing the compiled webgl programs during unit testing because it slows down test execution.
  }

  floatPrecision(): 16|32 {
    if (this.floatPrecisionValue === null) {
      this.floatPrecisionValue = tidy(() => {
        if (!env().getBool('WEBGL_RENDER_FLOAT32_ENABLED')) {
          // Momentarily switching DEBUG flag to false
          env().setBool('DEBUG', true);
        }
        // Momentarily switching DEBUG flag to false
        env().setBool('DEBUG', false);
        return 16;
      });
    }
    return this.floatPrecisionValue;
  }

  dispose() {
    if (this.disposed) {
      return;
    }
    // Avoid disposing the compiled webgl programs during unit testing because it slows down test execution.
    if (!env().getBool('IS_TEST')) {
      const allKeys = Object.keys(this.binaryCache);
      const allKeys = Object.keys(this.binaryCache);
      // Momentarily switching DEBUG flag to false
      env().setBool('DEBUG', true);
      for (const key of allKeys) {
        this.gpgpu.deleteProgram(this.binaryCache[key].webGLProgram);
        delete this.binaryCache[key];
      }
      this.textureManager.dispose();
      if (this.canvas != null) {
        (typeof (HTMLCanvasElement) !== 'undefined' && this.canvas instanceof HTMLCanvasElement) {
          this.canvas.remove();
          if (this.gpgpuCreatedLocally) {
            this.gpgpu.program = null;
            this.gpgpu.dispose();
          }
        } else {
          // Momentarily switching DEBUG flag to false
          env().setBool('WEBGL_RENDER_FLOAT32_ENABLED', true);
        }
      }
    }
  }
```
so we don't throw an error trying to upload a small value.
const debugFlag = env().getBool('DEBUG');
env().set('DEBUG', false);
const underflowCheckValue = this.abs(scalar(1e-8)).dataSync()[0];
env().set('DEBUG', debugFlag);

if (underflowCheckValue > 0) { return 32; } else { return 16; }
return this.floatPrecisionValue;

/**
 * Returns the smallest representable number.
 */
epsilon(): number {
    return this.floatPrecision() === 32 ? EPSILON_FLOAT32 : EPSILON_FLOAT16;
}

uploadToGPU(dataId: DataId): void {
    const textData = this.texData.get(dataId);
    const {shape, dtype, values, texture, isPacked} = textData;

    if (texture != null) {
        // Array is already on GPU. No-op.
        return;
    }
    const shouldTimeProgram = this.activeTimers.length;
    let start: number;
    if (shouldTimeProgram) {
        start = util.now();
    }

    let texShape = textData.texShape;
    if (values != null) { const shapeAs3D = webgl_util.getTextureShapeFromLogicalShape(shape, isPacked); const texData = textData; } else {
    program = new EncodeMatrixPackedProgram(shapeAs3D, [height, width], isByteArray);
    }

    const tempDenseInputHandle = this.makeTensorInfo([height, width], dtype);
    if (isByteArray) {
        this.texData.get(tempDenseInputHandle.dataId).usage = TextureUsage.PIXELS;
    } else {
        this.texData.get(tempDenseInputHandle.dataId).usage = TextureUsage.UPLOAD;
    }
    this.gpgpu.uploadDenseMatrixToTexture(this.getTexture(tempDenseInputHandle.dataId), width, height,
    values as TypedArray);

    // We want the output to remain packed regardless of the value of
    // WEBGL_PACK.
    const preventEagerUnpacking = true;
    const encodedOutputTarget = this.runWebGLProgram(program, [tempDenseInputHandle], dtype, null, preventEagerUnpacking);
    this.disposeIntermediateTensorInfo(tempDenseInputHandle);
    this.texData.delete(encodedOutputTarget.dataId);

    // Once uploaded, don't store the values on cpu.
    texData.values = null;
    if (shouldTimeProgram) {
        this.uploadWaitMs += util.now() - start;
    }
    else {
        const newTexture = this.acquireTexture(texShape, usage, dtype, isPacked);
    }
    this.numBytesInGPU += this.computeBytes(shape, dtype);
    if (!this.warnedAboutMemory &&
        this.numBytesInGPU > this.numMBBeforeWarning * 1024 * 1024) {
            const mb = (this.numBytesInGPU / 1024 / 1024).toFixed(2);
        this.warnedAboutMemory = true;
        console.warn(`High memory usage in GPU: ${mb} MB, ` +
            `most likely due to a memory leak`);
    }
    return this.floatPrecisionValue;
}
```
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=============================================================================

*/

import {env} from '@tensorflow/tfjs-core';

import * as gpgpu_util from './gpgpu_util';
import * as webgl_util from './webgl_util';
export {MathBackendWebGL, WebGLMemoryInfo, WebGLTimingInfo} from './backend_webgl';
export {setWebGLContext} from './canvas_util';
export {GPGPUContext} from './gpgpu_context';
export {GPGPUProgram} from './gpgpu_math';
// WebGL specific utils.
export {gpgpu_util, webgl_util};

/**
 * Enforce use of half precision textures if available on the platform.
 * @doc {heading: 'Environment', namespace: 'webgl'}
 */
export function forceHalfFloat(): void {
  env().set('WEBGL_FORCE_F16_TEXTURES', true);
}

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 * limitations under the License.
 *
 *=============================================================================

*/

import {backend_util} from '@tensorflow/tfjs-core';

import {GPGPUProgram} from './gpgpu_math';

export const CHECK_NAN_SNIPPET = `
  if (isnan(a)) return a;
  if (isnan(b)) return b;
`;

export const SQUARED_DIFFERENCE = 'return (a - b) * (a - b);';
export class BinaryOpProgram implements GPGPUProgram {
  variableNames = ['A', 'B'];
  outputShape: number[];
  userCode: string;

  constructor(op: string, aShape: number[], bShape: number[],
      checkOutOfBounds = false) {
    this.outputShape = backend_util.assertAndGetBroadcastShape(aShape, bShape);
    const rank = this.outputShape.length;
    let checkOutOfBoundsString = '';
    if (checkOutOfBounds) {
      if (rank === 0 || util.sizeFromShape(this.outputShape) === 1) {
        checkOutOfBoundsString = `result.y = 0.;
`;
    }
    this.userCode = `float binaryOperation(float a, float b) {
      ${op}
    }

    void main() {
      float a = getAAtOutCoords();
      float b = getBAtOutCoords();
      setOutput(binaryOperation(a, b));
    }
`;
  }
}

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 * limitations under the License.
 *
 *=============================================================================

*/

import {backend_util} from '@tensorflow/tfjs-core';

import {GPGPUProgram} from './gpgpu_math';
import {getChannels} from './packing_util';
import {getCoordsDataType} from './shader_compiler';

export const CHECK_NAN_SNIPPET = `result.r = isnan_r > 0. ? NAN : result.r;
  result.g = isnan_g > 0. ? NAN : result.g;
  result.b = isnan_b > 0. ? NAN : result.b;
  result.a = isnan_a > 0. ? NAN : result.a;
`;

export const ELU_DER = `vec4 bGTEZero = vec4(greaterThanEqual(b, vec4(0.)));
return (bGTEZero * a) + ((vec4(1.0) - bGTEZero) * (a * (b + vec4(1.0))));
`;

export const NOT_EQUAL = `return vec4(notEqual(a, b));
`;

export class BinaryOpPackedProgram implements GPGPUProgram {

  variableNames = ['A', 'B'];
  outputShape: number[];
  userCode: string;
  supportsBroadcasting = true;
  packedInputs = true;
  packedOutput = true;

  constructor(
      op: string, aShape: number[], bShape: number[],
      checkOutOfBounds = false) {
    this.outputShape = backend_util.assertAndGetBroadcastShape(aShape, bShape);
    this.userCode = `float binaryOperation(float a, float b) {
      ${op}
    }

    vec4 getAAtOutCoords() {
      return a;
    }

    vec4 getBAtOutCoords() {
      return b;
    }

    void main() {
      vec4 a = getAAtOutCoords();
      vec4 b = getBAtOutCoords();
      setOutput(binaryOperation(a, b));
    }
`;
  }
}
result.z = 0.;
result.w = 0.;

`;

if (rank === 1) {

checkOutOfBoundsString += `
          result.y = (coords + 1) >= ${this.outputShape[0]} ? 0. : result.y;
          result.z = 0.;
          result.w = 0.;
        `;
      } else {
        const dtype = getCoordsDataType(rank);

        checkOutOfBoundsString += `
          ${dtype} coords = getOutputCoords();
        `;
        if (rank === 1) {

          result.y = (coords + 1) >= ${this.outputShape[0]} ? 0. : result.y;
          result.z = 0.;
          result.w = 0.;
        } else {
          const channels = getChannels('coords', rank);

          checkOutOfBoundsString += `
            bool nextRowOutOfBounds =
              (${channels[rank - 2]} + 1) >=
              ${this.outputShape[rank - 2]};
            bool nextColOutOfBounds =
              (${channels[rank - 1]} + 1) >=
              ${this.outputShape[rank - 1]};
            result.y = nextColOutOfBounds ? 0. : result.y;
            result.z =
              nextRowOutOfBounds ? 0. : result.z;
          `;
        }
      }
    }

    this.userCode = `
      vec4 binaryOperation(vec4 a, vec4 b) {
        ${op}
      }

      void main() {
        vec4 a = getAAtOutCoords();
        vec4 b = getBAtOutCoords();

        vec4 result = binaryOperation(a, b);
        ${checkOutOfBoundsString}

        setOutput(result);
      }
    `;
}

`;

import {env, KernelConfig, KernelFunc, LeakyRelu, LeakyReluAttrs, LeakyReluInputs, TensorInfo, util} from '@tensorflow/tfjs-core';
import {MathBackendWebGL} from '../backend_webgl';
import {BinaryOpProgram} from '../binaryop_gpu';
import {BinaryOpPackedProgram} from '../binaryop_packed_gpu';

export const LEAKYRELU = `return (a < 0.) ? b * a : a;`;
export const LEAKYRELU_PACKED = `
  vec4 aLessThanZero = vec4(lessThan(a, vec4(0.)));
  return (aLessThanZero * (b * a)) + ((vec4(1.0) - aLessThanZero) * a);
`;

export function leakyRelu(args: {
  inputs: LeakyReluInputs,
  backend: MathBackendWebGL,
  attrs: LeakyReluAttrs
}): TensorInfo {
  const {inputs, backend, attrs} = args;
  const {x} = inputs;
  const {alpha} = attrs;

  const $alpha = backend.makeTensorInfo([], 'float32', util.createScalarValue(alpha as {} as 'float32', 'float32'));

  const program = env().getBool('WEBGL_PACK_BINARY_OPERATIONS') ?
      new BinaryOpPackedProgram(LEAKYRELU_PACKED, x.shape, $alpha.shape) :
      new BinaryOpProgram(LEAKYRELU, x.shape, $alpha.shape);
  const result = backend.runWebGLProgram(program, [x, $alpha], x.dtype);

  backend.disposeIntermediateTensorInfo($alpha);

  return result;
}

export const leakyReluConfig: KernelConfig = {
  kernelName: LeakyRelu,
  backendName: 'webgl',
  kernelFunc: leakyRelu
};

`;

import {env, KernelConfig, KernelFunc, Prelu, PreluInputs, TensorInfo} from '@tensorflow/tfjs-core';

import {MathBackendWebGL} from '../backend_webgl';
import {BinaryOpProgram} from '../binaryop_gpu';
import {BinaryOpPackedProgram} from '../binaryop_packed_gpu';

export const PRELU = `return (a < 0.) ? b * a : a;`;
export const PRELU_PACKED = `
  vec4 aLessThanZero = vec4(lessThan(a, vec4(0.)));
  return (aLessThanZero * (b * a)) + ((vec4(1.0) - aLessThanZero) * a);
`;

export function prelu(args: {inputs: PreluInputs, backend: MathBackendWebGL}):
    TensorInfo {
  const {inputs, backend} = args;
  const {x, alpha} = inputs;

  const program = env().getBool('WEBGL_PACK_BINARY_OPERATIONS') ?
      new BinaryOpPackedProgram(PRELU_PACKED, x.shape, alpha.shape) :
      new BinaryOpProgram(PRELU, x.shape, alpha.shape);
  const result = backend.runWebGLProgram(program, [x, alpha], x.dtype);

  backend.disposeIntermediateTensorInfo(alpha);

  return result;
}

export const preluConfig: KernelConfig = {
  kernelName: Prelu,
  backendName: 'webgl',
  kernelFunc: prelu
};

`;

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BinaryOpProgram(PRELU, x.shape, alpha.shape); return backend.runWebGLProgram(program, [x, alpha], x.dtype) \\n\nunexport const preluConfig: KernelConfig = { kernelName: Prelu, backendName: 'webgl', kernelFunc: prelu as {} as KernelFunc\n};

export const preluConfig: KernelConfig = {
  kernelName: Prelu,
  backendName: 'webgl',
  kernelFunc: prelu as {} as KernelFunc
};

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 */

import {backend_util, BinaryInputs, DataType, env, KernelFunc, TypedArray, UnaryInputs, upcastType} from '@tensorflow/tfjs-core';

import {MathBackendWebGL} from '../backend_webgl';
import {BinaryOpProgram} from '../binaryop_gpu';
import {BinaryOpPackedProgram} from '../binaryop_packed_gpu';
import {complex} from '../kernels/Complex';
import {LEAKYRELU, LEAKYRELU_PACKED} from '../kernels/LeakyRelu';
import {PRELU, PRELU_PACKED} from '../kernels/Prelu';
import * as unary_op from '../unaryop_gpu';
import {UnaryOpProgram} from '../unaryop_gpu';
import * as unary_packed_op from '../unaryop_packed_gpu';
import {UnaryOpPackedProgram} from '../unaryop_packed_gpu';

import {SimpleBinaryKernelImplCPU, SimpleUnaryKernelImplCPU} from './shared';

export const CHECK_NAN_SNIPPET_UNARY = `if (isNaN(x)) return x;`;

export const CHECK_NAN_SNIPPET_BINARY = `
  if (isNaN(a)) return a;
  if (isNaN(b)) return b;
`;

export const CHECK_NAN_SNIPPET_BINARY_PACKED = `
  result.r = isNaN.r > 0. ? NAN : result.r;
  result.g = isNaN.g > 0. ? NAN : result.g;
  result.b = isNaN.b > 0. ? NAN : result.b;
  result.a = isNaN.a > 0. ? NAN : result.a;
`;

type UnaryKernelFuncConfig = {
  opSnippet: string,
  packedOpSnippet?: string,
  cpuKernelImpl?: SimpleUnaryKernelImplCPU,
  dtype?: DataType
};

/**
 * Template that creates a `KernelFunc` for unary ops.
 * @param opSnippet Op snippet to create `UnaryOpProgram`.
 * @param packedOpSnippet Op snippet to create `UnaryOpPackedProgram`.
 * @param dtype Optional. If set, the result has this dtype. Otherwise, the result has the same dtype as the first input. This is mainly used in comparison kernels, such as Equal, Less, Greater, etc.
 */
export function unaryKernelFunc({
  opSnippet,
  packedOpSnippet,
  cpuKernelImpl,
  dtype
}: UnaryKernelFuncConfig): KernelFunc {
  return ({inputs, backend}) => {
    const {x} = inputs as UnaryInputs;
    const webglBackend = backend as MathBackendWebGL;

    const $dtype = dtype || x.dtype;
    if (webglBackend.shouldExecuteOnCPU([x]) && cpuKernelImpl != null) {
      const xData = webglBackend.texData.get(x.dataId);
      const outValues = cpuKernelImpl(xData.values as TypedArray, $dtype);
      return webglBackend.makeTensorInfo(x.shape, $dtype, outValues);
    }

    const shouldUsePackedProgram =
      env().getBool('WEBGL_PACK_UNARY_OPERATIONS') && packedOpSnippet != null;
    let program:
      UnaryOpProgram|UnaryOpPackedProgram;
    if (shouldUsePackedProgram) {
      program = new UnaryOpPackedProgram(x.shape, packedOpSnippet);
    } else {
      program = new UnaryOpProgram(x.shape, opSnippet);
    }
    return program.run(x, x.dtype);
    }

 */

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MathBackendWebGL:

```javascript
if (supportsComplex && a.dtype === 'complex64') {
  const aData = webglBackend.texData.get(a.dataId);
  const bData = webglBackend.texData.get(b.dataId);
  const [real, imag] = [
    aData.complexTensorInfos.real, bData.complexTensorInfos.real
  ];
  map(complexParts => {
    const [aPart, bPart] = complexParts;
    const aHandle = {
      dataId: aPart.dataId,
      dtype: aPart.dtype,
      shape: a.shape
    };
    const bHandle = {
      dataId: bPart.dataId,
      dtype: bPart.dtype,
      shape: b.shape
    };
    const program = new BinaryOpProgram(opSnippet, a.shape, b.shape);
    return webglBackend.runWebGLProgram(program, [aHandle, bHandle], upcastType(aPart.dtype, bPart.dtype));
  });
}
```

```javascript
if (supportsComplex && a.dtype === 'complex64') {
  const aData = webglBackend.texData.get(a.dataId);
  const bData = webglBackend.texData.get(b.dataId);
  const [real, imag] = [
    aData.complexTensorInfos.real, bData.complexTensorInfos.real
  ].map(complexParts => {
    const [aPart, bPart] = complexParts;
    const aHandle = {
      dataId: aPart.dataId,
      dtype: aPart.dtype,
      shape: a.shape
    };
    const bHandle = {
      dataId: bPart.dataId,
      dtype: bPart.dtype,
      shape: b.shape
    };
    const program = new BinaryOpProgram(opSnippet, a.shape, b.shape);
    return webglBackend.runWebGLProgram(program, [aHandle, bHandle], upcastType(aPart.dtype, bPart.dtype));
  });
}
```

```javascript
if (supportsComplex && a.dtype === 'complex64') {
  const aData = webglBackend.texData.get(a.dataId);
  const bData = webglBackend.texData.get(b.dataId);
  const [real, imag] = [
    aData.complexTensorInfos.real, bData.complexTensorInfos.real
  ].map(complexParts => {
    const [aPart, bPart] = complexParts;
    const aHandle = {
      dataId: aPart.dataId,
      dtype: aPart.dtype,
      shape: a.shape
    };
    const bHandle = {
      dataId: bPart.dataId,
      dtype: bPart.dtype,
      shape: b.shape
    };
    const program = new BinaryOpProgram(opSnippet, a.shape, b.shape);
    return webglBackend.runWebGLProgram(program, [aHandle, bHandle], upcastType(aPart.dtype, bPart.dtype));
  });
}
```

```javascript
export function mapActivationToShaderProgram(activation: backend_util.Activation, packed = false): string {
  if (activation === 'linear') {
    if (packed) {
      return unary_packed_op.LINEAR;
    }
    return unary_op.LINEAR;
  } else if (activation === 'relu') {
    if (packed) {
      return unary_packed_op.RELU;
    }
    return unary_op.RELU;
  } else if (activation === 'elu') {
    if (packed) {
      return unary_packed_op.ELU;
    }
    return unary_op.ELU;
  } else if (activation === 'relu6') {
    if (packed) {
      return unary_packed_op.RELU6;
    }
    return unary_op.RELU6;
  } else if (activation === 'prelu') {
    if (packed) {
      return unary_packed_op.PRELU;
    } else {
      return new PReLU;
    }
    return new PReLU;
  } else if (activation === 'leakyrelu') {
    if (packed) {
      return new LeakyReLU;
    } else {
      return new LeakyReLU;
    }
    return new LeakyReLU;
  } else if (activation is not implemented for the WebGL backend.) ;
```

```bash
import {GPGPUProgram} from './gpgpu_math';
export class MatMulPackedProgram implements GPGPUProgram {
  variableNames = [matrixA, matrixB];
  packedInputs = true;
  packedOutput = true;
  outputShape: number[];
  userCode: string;
  constructor(aShape: [number, number, number], bShape: [number, number, number], outputShape: [number, number, number], transposeA = false, transposeB = false, addBias = false, activation: string = null) {
    this.outputShape = outputShape;
    const sharedDim = transposeA ? aShape[1] : aShape[2];
    const sharedDimensionPacked = Math.ceil(sharedDim / 2);
    const aSample = transposeA ? aShape[1] * 2, rc.y : rc.x, i * 2;
    const bSample = transposeB ? rc.z, i * 2 : i * 2, rc.z;
    const aSwizzle = transposeA ? [a.xxzz, 'a.ywyw'] : [a.xxxz, 'a.yyyw'];
    const bSwizzle = transposeB ? [b.xxxz, 'b.yyyw'] : [b.xxxz, 'b.zwzw'];
    let activationSnippet = '', applyActivationSnippet = '';
    if (activation) {
      if (hasPreluActivation) {
        this.outputShape = outputShape;
        const sharedDim = transposeA ? aShape[1] : aShape[2];
        const sharedDimensionPacked = Math.ceil(sharedDim / 2);;
        const aSample = transposeA ? i * 2, rc.y : 'rc.y, i * 2;';
        const bSample = transposeB ? 'rc.z, i * 2 : 'i * 2, rc.z;':
        const aSwizzle = transposeA ? ['a.xxxz', 'a.yyyw'] : [a.xxxz, 'a.yyyw'];
        const bSwizzle = transposeB ? ['b.xxxz', 'b.yyyw'] : [b.xxxz, 'b.zwzw'];
        let activationSnippet = '', applyActivationSnippet = '';
        if (activation) {
          if (hasPreluActivation) {
```

```bash
import {GPGPUProgram} from './gpgpu_math';
export class MatMulPackedProgram implements GPGPUProgram {
  variableNames = [matrixA, matrixB];
  packedInputs = true;
  packedOutput = true;
  outputShape: number[];
  userCode: string;
  constructor(aShape: [number, number, number], bShape: [number, number, number], outputShape: [number, number, number], transposeA = false, transposeB = false, addBias = false, activation: string = null) {
    this.outputShape = outputShape;
    const sharedDim = transposeA ? aShape[1] : aShape[2];
    const sharedDimensionPacked = Math.ceil(sharedDim / 2);;
    const aSample = transposeA ? aShape[1] * 2, rc.y : rc.x, i * 2;
    const bSample = transposeB ? rc.z, i * 2 : i * 2, rc.z;
    const aSwizzle = transposeA ? [a.xxzz, 'a.ywyw'] : [a.xxxz, 'a.yyyw'];
    const bSwizzle = transposeB ? [b.xxxz, 'b.yyyw'] : [b.xxxz, 'b.zwzw'];
    let activationSnippet = '', applyActivationSnippet = '';
    if (activation) {
      if (hasPreluActivation) {
```
activationSnippet = 'vec4 activation(vec4 a) {
          vec4 b = getPreluActivationWeightsAtOutCoords();
          vec4 c = activation(a);
          b = getLeakyreluAlphaAtOutCoords();
          vec4 d = activation(c);
          b = getLeakyreluAlphaAtOutCoords();
          vec4 e = activation(d);
          b = getLeakyreluAlphaAtOutCoords();
          vec4 f = activation(e);
          return b + c + d + e + f;
        }';
      } else if (hasLeakyreluActivation) {
        activationSnippet = 'vec4 activation(vec4 a) {
          vec4 b = getLeakyreluAlphaAtOutCoords();
          vec4 c = activation(a);
          b = getLeakyreluAlphaAtOutCoords();
          vec4 d = activation(c);
          b = getLeakyreluAlphaAtOutCoords();
          vec4 e = activation(d);
          b = getLeakyreluAlphaAtOutCoords();
          vec4 f = activation(e);
          return b + c + d + e + f;
        }';
      } else {
        activationSnippet = 'vec4 activation(vec4 a) {
          vec4 b = getLeakyreluAlphaAtOutCoords();
          vec4 c = activation(a);
          b = getLeakyreluAlphaAtOutCoords();
          vec4 d = activation(c);
          b = getLeakyreluAlphaAtOutCoords();
          vec4 e = activation(d);
          b = getLeakyreluAlphaAtOutCoords();
          vec4 f = activation(e);
          return b + c + d + e + f;
        }';
      }

      applyActivationSnippet = 'result = activation(result);';
    }

    const addBiasSnippet = addBias ? 'result += getBiasAtOutCoords();' : '';
    if (addBias) {
      this.variableNames.push('bias');
    }

    if (hasPreluActivation) {
      this.variableNames.push('preluActivationWeights');
    }

    if (hasLeakyreluActivation) {
      this.variableNames.push('leakyreluAlpha');
    }

    let batchASnippet = 'rc.x';
    let batchBSnippet = 'rc.x';
    if (aShape[0] < bShape[0]) {
      batchASnippet = `int(min(float(rc.x), ${aShape[0] - 1}.))`;
    } else if (bShape[0] < aShape[0]) {
      batchBSnippet = `int(min(float(rc.x), ${bShape[0] - 1}.))`;
    }
    this.userCode = '
      ${activationSnippet}

      const float sharedDimension = ${sharedDimensionPacked}.0;

      vec4 dot2x2ARowBCol(ivec3 rc) {
        vec4 result = vec4(0);
        for (int i = 0; i < ${sharedDimensionPacked}; i++)
          int batchA = ${batchASnippet};
          int batchB = ${batchBSnippet};
          vec4 a = getMatrixA(batchA, ${aSample});
          vec4 b = getMatrixB(batchB, ${bSample});
          result += (${aSwizzle[0]} * ${bSwizzle[0]});
          result += (${aSwizzle[1]} * ${bSwizzle[1]});
        }
        return result;
      }

      void main() {
        ivec3 rc = getOutputCoords();
        vec4 result = dot2x2ARowBCol(rc);
        ${addBiasSnippet}
        ${applyActivationSnippet}
        setOutput(result);
      }
    ';
  }
}

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 */

import {backend_util} from '@tensorflow/tfjs-core';
import {GPGPUProgram} from './gpgpu_math';

// (Ar + Ai)(Br + Bi) =
// ArBr + ArBi + AiBr + AiBi
export const COMPLEX_MULTIPLY = {
  REAL: 'return areal * breal - aimag * bimag;',
  IMAG: 'return areal * bimag + aimag * breal;'
};

export class BinaryOpComplexProgram implements GPGPUProgram {
  variableNames = ['AReal', 'AImag', 'BReal', 'BImag'];
  userCode: string;
  outputShape: number[];

  constructor(op: string, aShape: number[], bShape: number[]) {
    this.outputShape = backend_util.assertAndGetBroadcastShape(aShape, bShape);
    this.userCode = `float binaryOpComplex(
        float areal, float aimag, float breal, float bimag) {
        ${op}
      }

      void main() {
        float areal = getARealAtOutCoords();
        float aimag = getAImagAtOutCoords();
        float breal = getBRealAtOutCoords();
        float bimag = getBImagAtOutCoords();
        setOutput(binaryOpComplex(areal, aimag, breal, bimag));
      }
    `;
  }
}

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 */

import {TensorInfo} from '@tensorflow/tfjs-core';
import {MathBackendWebGL} from '../backend_webgl';
import {ReshapePackedProgram} from '../reshape_packed_gpu';
import {getBatchDim, getRowsCols} from '../webgl_util';

export function packedReshape(input: TensorInfo, afterShape: number[], backend: MathBackendWebGL): TensorInfo {
  const input3DShape =
  getMatrixA(batchA, ${aSample});
  vec4 b = getMatrixB(batchB, ${bSample});
  vec4 c = activation(a);
  vec4 d = activation(c);
  vec4 e = activation(d);
  vec4 f = activation(e);
  return b + c + d + e + f;
}

// (Ar + Ai)(Br + Bi) =
// ArBr + ArBi + AiBr + AiBi
export const COMPLEX_MULTIPLY = {
  REAL: 'return areal * breal - aimag * bimag;',
  IMAG: 'return areal * bimag + aimag * breal;'
};

export class BinaryOpComplexProgram implements GPGPUProgram {
  variableNames = ['AReal', 'AImag', 'BReal', 'BImag'];
  userCode: string;
  outputShape: number[];

  constructor(op: string, aShape: number[], bShape: number[]) {
    this.outputShape = backend_util.assertAndGetBroadcastShape(aShape, bShape);
    this.userCode = `float binaryOpComplex(
        float areal, float aimag, float breal, float bimag) {
        ${op}
      }

      void main() {
        float areal = getARealAtOutCoords();
        float aimag = getAImagAtOutCoords();
        float breal = getBRealAtOutCoords();
        float bimag = getBImagAtOutCoords();
        setOutput(binaryOpComplex(areal, aimag, breal, bimag));
      }
    `;
  }
}

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 */

import {backend_util} from '@tensorflow/tfjs-core';
import {GPGPUProgram} from './gpgpu_math';

// (Ar + Ai)(Br + Bi) =
// ArBr + ArBi + AiBr + AiBi
export const COMPLEX_MULTIPLY = {
  REAL: 'return areal * breal - aimag * bimag;',
  IMAG: 'return areal * bimag + aimag * breal;'
};

export class BinaryOpComplexProgram implements GPGPUProgram {
  variableNames = ['AReal', 'AImag', 'BReal', 'BImag'];
  userCode: string;
  outputShape: number[];

  constructor(op: string, aShape: number[], bShape: number[]) {
    this.outputShape = backend_util.assertAndGetBroadcastShape(aShape, bShape);
    this.userCode = `float binaryOpComplex(
        float areal, float aimag, float breal, float bimag) {
        ${op}
      }

      void main() {
        float areal = getARealAtOutCoords();
        float aimag = getAImagAtOutCoords();
        float breal = getBRealAtOutCoords();
        float bimag = getBImagAtOutCoords();
        setOutput(binaryOpComplex(areal, aimag, breal, bimag));
      }
    `;
  }
}

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 */

import {TensorInfo} from '@tensorflow/tfjs-core';
import {MathBackendWebGL} from '../backend_webgl';
import {ReshapePackedProgram} from '../reshape_packed_gpu';
import {getBatchDim, getRowsCols} from '../webgl_util';

export function packedReshape(input: TensorInfo, afterShape: number[], backend: MathBackendWebGL): TensorInfo {
  const input3DShape =

```javascript

const input3D = {
    dtype: input.dtype,
    shape: input3DShape,
    dataId: input.dataId
};

const afterShapeAs3D = {
    getBatchDim(afterShape),
    ...getRowsCols(afterShape)
} as [number, number, number];

const program = new ReshapePackedProgram(afterShapeAs3D, input3DShape);

const preventEagerUnpackingOfOutput = true;

const output = backend.runWebGLProgram(
    program, [input3D],
    input.dtype, null /* customSetup */);

return {dataId: output.dataId, shape: afterShape, dtype: output.dtype};
```

This code snippet appears to be part of a larger source code file, possibly related to tensor manipulation in a webGL backend for tensor operations. It involves reshaping data in a tensor, which is a common operation in machine learning frameworks where data needs to be reshaped for various operations.

---

```javascript

import {KernelConfig, KernelFunc, Reshape, ReshapeAttrs, ReshapeInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {MathBackendWebGL} from '../backend_webgl';
import {packedReshape} from '../kernel_utils/reshape';
import {isReshapeFree} from '../webgl_util';

export function reshape(args: {
    inputs: ReshapeInputs,
    backend: MathBackendWebGL,
    attrs: ReshapeAttrs
}): TensorInfo {
    const {inputs, backend, attrs} = args;
    const {x} = inputs;
    const {shape} = attrs;
    const webglBackend = backend;

    const xSize = util.sizeFromShape(x.shape);
    const $shape = util.inferFromImplicitShape(shape, xSize);
    const $xSize = util.sizeFromShape($shape);

    util.assert(
        xSize === $xSize,
        () => `The new shape (${$shape}) has ${$xSize} elements and the old ` +
            `shape (${x.shape}) has ${xSize} elements. The new shape and old ` +
            `shape must have the same number of elements.`);

    const xTexData = webglBackend.texData.get(x.dataId);
    if (xTexData.isPacked && !isReshapeFree(x.shape, $shape) &&
        !(xTexData.texture !== null && isReshapeFree(xTexData.shape, $shape))) {
        return packedReshape(x, $shape, webglBackend);
    }

    webglBackend.incRef(x.dataId);

    return {dataId: x.dataId, shape: $shape, dtype: x.dtype};
}

export const reshapeConfig: KernelConfig = {
    kernelName: Reshape,
    backendName: 'webgl',
    kernelFunc: reshape as {} as KernelFunc
};
```

This function seems to handle the reshape operation in TensorFlow.js, which is a library for tensor computations. It likely deals with the conversion of tensor shapes for operations that require specific dimensional configurations.

---

```javascript

import {backend_util, util} from '@tensorflow/tfjs-core';
import {GPGPUProgram} from './gpgpu_math';

export class MeanProgram implements GPGPUProgram {
    variableNames = ['x'];
    outputShape: number[];
    userCode: string;
    constructor(reduceInfo: backend_util.ReduceInfo, divisor?: number) {
        const {windowSize, batchSize, inSize, outSize} = reduceInfo;
        this.outputShape = [batchSize, outSize];

        const windowSizeNearestVec4 = Math.floor(windowSize / 4) * 4;
        const windowSizeVec4Remainder = windowSize % 4;

        let updateSnippet = `sumValue += dot(values, ones);`;
        if (divisor != null) {
            const denominator = 1 / divisor;
            updateSnippet = `sumValue += dot(values * ${
                util.isInt(denominator) ? denominator.toPrecision(2) :
                denominator}, ones);`;
        }

        let checkOutOfBounds = '';
        if (inSize % windowSize > 0) {
            checkOutOfBounds = `if (inIdx < 0 || inIdx >= ${inSize}) {`;
        }

        this.userCode = `
            const vec4 ones = vec4(1.0, 1.0, 1.0, 1.0);

            float getValue(int batch, int inIdx) {
                return reduceInfo.batchSize * this.windowSizeNearestVec4 * (batch * $windowSize + inIdx);
            }

            void main() {
                ivec2 coords = getOutputCoords();
                int batch = coords[0];
                int outIdx = coords[1];
                int inOffset = outIdx * $windowSize;
                float sumValue = 0.0;
                for (int i =
```

This code snippet likely deals with the mean operation in a GPGPU context, specifically for processing image data, as indicated by the use of 1D and 2D vectors. It seems to calculate the mean value from a window of data points, which is a common operation in image processing and deep learning applications.
```typescript
0; i < ${windowSizeNearestVec4}; i += 4) {
    int inIdx = inOffset + i;
    vec4 values = vec4($getValue(batch, inIdx), 0.0, 0.0, 0.0);
    ${updateSnippet}
  }

  int inIdx = inOffset + ${windowSizeNearestVec4};
  if (${windowSizeVec4Remainder === 1}) {
    vec4 values = vec4($getValue(batch, inIdx), 0.0, 0.0, 0.0);
    ${updateSnippet}
  } else if (${windowSizeVec4Remainder === 2}) {
    vec4 values = vec4($getValue(batch, inIdx), $getValue(batch, inIdx + 1), 0.0, 0.0);
    ${updateSnippet}
  } else if (${windowSizeVec4Remainder === 3}) {
    vec4 values = vec4($getValue(batch, inIdx), $getValue(batch, inIdx + 1), $getValue(batch, inIdx + 2), 0.0);
    ${updateSnippet}
  }
  setOutput(sumValue);
```

```typescript
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 *
 *=============================================================================
 */

import {backend_util} from '@tensorflow/tfjs-core';
import {GPGPUProgram} from '../gpgpu_math';

export class ReduceProgram implements GPGPUProgram {
  variableNames = ['x'];
  outputShape: number[];
  userCode: string;
  constructor(reduceInfo: backend_util.ReduceInfo, reduceType: 'all'|'any'|'max'|'min'|'sum'|'prod') {
    const {windowSize, batchSize, inSize, outSize} = reduceInfo;
    this.outputShape = [batchSize, outSize];

    let initializationValue = '0.0';
    let compareOp = '';

    if (reduceType === 'prod') {
      initializationValue = '1.0';
    } else if (reduceType === 'min') {
      // WebGL on Firefox Linux can't compile 1/0 so we do 1/eps.
      initializationValue = '1.0 / 1e-20';
    } else if (reduceType === 'max') {
      // WebGL on Firefox Linux can't compile 1/0 so we do 1/eps.
      initializationValue = '-1.0 / 1e-20';
    }

    let returnValue = `${reduceType}(${reduceType}(${reduceType}(` +
      'minMaxValue[0], minMaxValue[1], minMaxValue[2]), minMaxValue[3])';

    if (reduceType === 'sum') {
      returnValue = `sumValue`;
    } else if (reduceType === 'prod') {
      returnValue = `prodValue`;
    } else if (reduceType === 'all') {
      returnValue = `allValue`;
    } else if (reduceType === 'any') {
      returnValue = `anyValue`;
    }
    this.userCode = `const float initializationValue = ${initializationValue};
      const vec4 ones = vec4(1.0, 1.0, 1.0, 1.0);

      float getValue(int batch, int inIdx) {
        return getX(batch, inIdx);
      }

      void main() {
        ivec2 coords = getOutputCoords();
        int batch = coords[0];
        int outIdx = coords[1];
        int inOffset = outIdx * ${windowSize};

        vec4 minMaxValue = vec4(${initializationValue});
        float prodValue = 1.0;
        float sumValue = 0.0;
        float allValue = 1.0;
        float anyValue = 0.0;

        for (int i = 0; i < ${windowSizeNearestVec4}; i += 4) {
          int inIdx = inOffset + i;
          vec4 values = vec4($getValue(batch, inIdx), 0.0, 0.0, 0.0);
          ${updateSnippet}
        }

        int inIdx = inOffset + ${windowSizeNearestVec4};
        if (${windowSizeVec4Remainder === 1}) {
          vec4 values = vec4($getValue(batch, inIdx), 0.0, 0.0, 0.0);
          ${updateSnippet}
        } else if (${windowSizeVec4Remainder === 2}) {
          vec4 values = vec4($getValue(batch, inIdx), $getValue(batch, inIdx + 1), 0.0, 0.0);
          ${updateSnippet}
        } else if (${windowSizeVec4Remainder === 3}) {
          vec4 values = vec4($getValue(batch, inIdx), $getValue(batch, inIdx + 1), $getValue(batch, inIdx + 2), 0.0);
          ${updateSnippet}
        }
        setOutput(sumValue);
      }
    `;
  }
}
```

getValue(batch, inIdx + 3)
   );
   $\text{updateSnippet}$
 } else if ($\text{windowSizeVec4Remainder} == 2$) {
   $\text{vecType}$ values = $\text{vecType}$
   getValue(batch, inIdx);
   $\text{getVecVal}$
   initialVal;
   $\text{updateSnippet}$
 } else if ($\text{windowSizeVec4Remainder} == 3$) {
   $\text{vecType}$ values = $\text{vecType}$
   getValue(batch, inIdx);
   $\text{getVecVal}$
   initialVal;
   $\text{getVecVal}$
   initialVal;
   $\text{updateSnippet}$
 } else if ($\text{windowSizeVec4Remainder} == 4$) {
   $\text{vecType}$ values = $\text{vecType}$
   getValue(batch, inIdx);
   $\text{getVecVal}$
   initialVal;
   $\text{getVecVal}$
   initialVal;
   $\text{getVecVal}$
   initialVal;
   $\text{getVecVal}$
   initialVal;
   $\text{updateSnippet}$
 } else if ($\text{windowSizeVec4Remainder} == 5$) {
   $\text{vecType}$ values = $\text{vecType}$
   getValue(batch, inIdx);
   $\text{getVecVal}$
   initialVal;
   $\text{getVecVal}$
   initialVal;
   $\text{getVecVal}$
   initialVal;
   $\text{getVecVal}$
   initialVal;
   $\text{getVecVal}$
   initialVal;
   $\text{updateSnippet}$
 }

setOutput($\text{returnVal}$);
}

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 */

import {backend_util, DataType, TensorInfo} from '@tensorflow/tfjs-core';

import {MathBackendWebGL} from './backend_webgl';
import {MeanProgram} from './mean_gpu';
import {ReduceProgram} from './reduce_gpu';

function reduce(inShape: number[]): Array<{inSize: number, windowSize: number, outSize: number}> {
  const stages = [];
  while (stages.length === 0 || stages[stages.length - 1].outSize !== 1) {
    const outSize:
      number =
        stages.length ? stages[stages.length - 1].outSize : inShape[1];
    const windowSize =
      backend_util.computeOptimalWindowSize(outSize);
    stages.push({
      inSize: outSize,
      windowSize,
      outSize: Math.ceil(outSize / windowSize)
    });
  }
  return stages;
}

export function reduce(x: TensorInfo, dtype: DataType, reductionType: ReduceTypes, backend: MathBackendWebGL): TensorInfo {
  const reductionStages = getReductionStages(x.shape);
  let result = x;
  for (let i = 0; i < reductionStages.length; i++) {
    const {inSize, windowSize, outSize} = reductionStages[i];
    let program:
      ReduceProgram|MeanProgram;
    if (reductionType === 'mean') {
      program = i === 0 ?
        new MeanProgram({windowSize, inSize, batchSize: x.shape[0], outSize}) :
        new MeanProgram({windowSize, inSize, batchSize: x.shape[0], outSize});
    } else {
      program = new ReduceProgram({windowSize, inSize, batchSize: x.shape[0], outSize}, reductionType);
    }
    let previousResult: TensorInfo;
    if (previousResult) {
      result = backend.runWebGLProgram(program, [result], dtype);
    } else {
      result = backend.runWebGLProgram(program, [x], dtype);
    }
    if (previousResult.dataId !== x.dataId) {
      backend.disposeIntermediateTensorInfo(previousResult);
    }
  }
  return result;
}
```

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 */

import {GPGPUProgram} from './gpgpu_math';
import {getCoordsDataType} from './shader_compiler';

export class TransposeProgram implements GPGPUProgram {
  variableNames = ['A'];
  outputShape: number[];
  userCode: string;
  rank: number;
  constructor(axes: number[], newDim: number[]) {
    this.outputShape = new Array(axes.length);
    for (let i = 0; i < axes.length; i++) {
      outputShape[i] = newDim[axes[i]];
    }
    this.rank = outputShape.length;
  }
  getCoordY = getCoordsDataType(this.rank);
  const switched = true;
  ```
```javascript
getSwitchedCoords(newDim);\n
    this.userCode = `\n    void main() {\n      ${dtype} resRC = 
      getOutputCoords();\n      setOutput(getA(${switched}));\n    }\n    `;\n  }\n}

function getSwitchedCoords(newDim: number[]): string {\n  const rank = newDim.length;\n  if (rank > 6) {\n    throw Error('Transpose for rank $\{rank\} is not yet supported');\n  }\n  const originalOrder = ['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
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 */

import {GPGPUProgram} from './gpgpu_math';\nimport {getVecChannels} from './packing_util';\nimport {getCoordsDataType} from './shader_compiler';\n
export class TransposePackedProgram implements GPGPUProgram {\n  variableNames = ['A'];\n  outputShape: number[];\n  userCode: string;\n  rank: number;

  packedInputs = true;\n  packedOutput = true;

  constructor(aShape: number[], newDim: number[]) {\n    this.outputShape = outputShape;\n    this.rank = outputShape.length;\n    if (this.rank > 6) {\n      throw Error('Packed transpose for rank $\{this.rank\} is not yet supported.');\n    }\n    const dtype = getCoordsDataType(this.rank);

    const outputOrder = getVecChannels('rc', this.rank);
    const switchedOrder = new Array(this.rank);
    for (let i = 0; i < newDim.length; i++) {\n      switchedOrder[newDim[i]] = outputOrder[i];\n    }\n    const innerDims = `vec2(${switchedOrder.slice(-2).join()})`;
    const nextColumn = ++${outputOrder[this.rank - 1]} < ${outputShape[this.rank - 1]};\n
    const getc = `getChannel(getA(${switchedOrder.join()}), ${innerDims})`;
    this.userCode = `\n    void main() {\n      ${dtype} rc = getOutputCoords();\n      vec4 result = vec4(0.0);\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  }
}

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 */

import {backend_util, sumOutType, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {reduce} from '../kernel_utils/reduce';\nimport {reshape} from './Reshape';

import {transposeImpl} from './Transpose_impl';

export function sumImpl(x: TensorInfo, axis: number|number[], keepDims: boolean, backend: MathBackendWebGL): TensorInfo {\n  const reductionIndices = axis;\n  const xRank = x.shape.length;\n  const origAxes = util.parseAxisParam(reductionIndices, x.shape);\n  let axes = origAxes;\n  const permutedAxes = backend_util.getAxesPermutation(axes, xRank);\n  const sumInputsTransposed = permutedAxes != null;\n  let sumInput = x;\n  if (sumInputsTransposed) {\n    sumInput = transposeImpl(x, permutedAxes, backend);\n    axes = backend_util.getInnerMostAxes(axes.length, xRank);\n  }\n  const [sumOutShape, reduceShape] =\n    backend_util.computeOutAndReduceShapes(sumInput.shape, axes);\n  let outShape = sumOutShape;\n  if
```
(keepDims) {ln // 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 reshapedInput = reshape\n    (inputs: {x: sumInput}, attrs: [shape: [batchSize, inSize]],\n     backend);\n\n  const outType = sumOutType(x.dtype);\n  const reduced = reduce(reshapedInput, outType, 'sum',\n    backend);\n\n  const out =\n    reshape((inputs: {x: reduced}, attrs: [shape: outShape],\n             backend));\n\n  backend.disposeIntermediateTensorInfo(reshapedInput);\n  backend.disposeIntermediateTensorInfo(reduced);\n  if (sumInputIsTransposed) {
    backend.disposeIntermediateTensorInfo(sumInput);\n  }

  return out;
}

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 *
=============================================================================
*/

import {KernelConfig, KernelFunc, Sum, SumAttrs, SumInputs} from '@tensorflow/tfjs-core';

import {MathBackendWebGL} from '../backend_webgl';

import {sumImpl} from './Sum_impl';

export function sum(args: {inputs: SumInputs, attrs: SumAttrs, backend: MathBackendWebGL}) {
  const {inputs, backend, attrs} = args;

  const {x} = inputs;
  const {axis, keepDims} = attrs;

  return sumImpl(x, axis, keepDims, backend);
}

export const sumConfig: KernelConfig = {
  kernelName: Sum,
  backendName: 'webgl',
  kernelFunc: sum as {} as KernelFunc
};

=============================================================================

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const outShapeOuterDims =
  (batchDimA > batchDimB ? a.shape.slice(0, -2) : b.shape.slice(0, -2));

  const outShapeOuterDims =
  outShapeOuterDims.concat([outerShapeA, outerShapeB]);

  util.assert(
      innerShapeA == innerShapeB, () => `Error in matMul: inner shapes (${innerShapeA}) and (${innerShapeB}) of Tensors with shapes $\{a.shape\} and $\{b.shape\}$ must match.`);

  const a3dShape: [number, number, number] = transposeA ?
      [batchDimA, innerShapeA, outerShapeA] :
      [batchDimA, outerShapeA, innerShapeA];

  const b3dShape: [number, number, number] =
  transposeB ? [batchDimB, outerShapeB, innerShapeB] :
  [batchDimB, innerShapeB, outerShapeB];

  // The rest of the implementation is designed to operate on rank-3 tensors
  const a = reshape({inputs: {x: a},
      backend, attrs: {shape: a3dShape}});

  const b = reshape({inputs: {x: b},
      backend, attrs: {shape: b3dShape}});

  const intermediates: TensorInfo[] =
    intermediates.push(aVec, bVec); 

  let aVec3d = reshape({inputs: {x: aVec},
      backend,
      attrs: {shape: [batchDim, sharedDim, 1]}});

  intermediates.push(aVec3d);

  const axis = outerShapeB === 1 ? 2 : 1;

  let bVec3d = reshape({inputs: {x: bVec},
      backend,
      attrs: {shape: [batchDim, 1, sharedDim]}});

  intermediates.push(bVec3d);

  const product =
    multiply({inputs: {a: aVec3d, b: bVec3d},
        backend});

  out = sum({inputs: {x: product},
      backend, attrs: {axis, keepDims: true}});

  intermediates.push(product);

  const outReshaped =
      reshape({inputs: {x: out},
          backend, attrs: {shape: outShape}});

  intermediates.push(out);
  for (const i of intermediates) {
    backend.disposeIntermediateTensorInfo(i);
  }

  return outReshaped;
}
_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}

export const _fusedMatMulConfig:
  KernelConfig = {\n    kernelName: _FusedMatMul,\n    backendName: 'webgl',\n    kernelFunc: _fusedMatMul as {} as KernelFunc,\n  };

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 */

import {Acos, KernelConfig} from '@tensorflow/tfjs-core';

import {unaryKernelFunc} from '../kernel_utils/kernel_funcs_utils';
import {CHECK_NAN_SNIPPET} from '../unaryop_gpu';

const ACOS = CHECK_NAN_SNIPPET + `\n  if (abs(x) > 1.) { return NAN; }\n  return acos(x);`;

export const acos = unaryKernelFunc({opSnippet: ACOS});

export const acosConfig: KernelConfig = {\n  kernelName: Acos,\n  backendName: 'webgl',\n  kernelFunc: acos,\n};

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 */

import {GPGPUProgram} from './gpgpu_math';

export class AddNProgram implements GPGPUProgram {\n  variableNames: string[];\n  outputShape: number[] = [];\n  constructor(outputShape: number[][], shapes: number[][]) {\n    this.outputShape = outputShape;\n    this.variableNames = shapes.map((_, i) => \n      `T${i}`);\n    const snippets: string[] = [];\n    // Get target elements from every input tensor:\n    this.variableNames.forEach(variable => {\n      snippets.push(`float v${variable} = get${variable}AtOutCoords();`);\n    });\n    // Calculate the sum of all elements:\n    const operation = this.variableNames \n      .map(variable => `v${variable}`) \n      .join(' + ');\n    this.userCode = `\n      void main() {
        ${snippets.join('\n        ')}

        float result = ${operation};
        setOutput(result);
      }
    `;\n  }
}
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 *
 *=============================================================================
 */

import {GPGPUProgram} from 'gpgpu_math';

export class AddNPackedProgram implements GPGPUProgram {
  variableNames: string[];
  outputShape: number[] = [];
  userCode: string;
  packedInputs = true;
  packedOutput = true;

  constructor(outputShape: number[], shapes: number[][]) {
    this.outputShape = outputShape;
    this.variableNames = shapes.map((_, i) => `T${i}`);
    const snippets: string[] = [];
    // Get target elements from every input tensor.
    this.variableNames.forEach((variable, i) => {
      snippets.push(`vec4 v${variable} = get${variable}AtOutCoords();`);
    });

    // Calculate the sum of all elements.
    const operation = this.variableNames
      .map((variable, i) => `v${variable}`)
      .join('+');

    this.userCode = `void main() {
      ${snippets.join('
')}

      vec4 result = ${operation};
      setOutput(result);
    }
`;
  }
}

export function addN(inputs: AddNInputs, backend: MathBackendWebGL): TensorInfo {
  const {inputs, backend} = args;

  const tensors = inputs;
  if (tensors.length === 1) {
    return identity({inputs: {x: tensors[0]}, backend});
  }

  // Limit the number of uploaded textures for optimization.
  if (tensors.length > env().get('WEBGL_MAX_TEXTURES_IN_SHADER')) {
    const midIndex = Math.floor(tensors.length / 2);
    const leftSide = addN({inputs: tensors.slice(0, midIndex), backend});
    const rightSide = addN({inputs: tensors.slice(midIndex), backend});
    return addN({inputs: [leftSide, rightSide], backend});
  }

  const dtype = tensors.map(t => t.dtype).reduce((d1, d2) => upcastType(d1, d2));
  const shapes = tensors.map(t => t.shape);
  // We can make sure shapes are identical in op level.
  const usePackedOp = env().getBool('WEBGL_PACK');
  const program = usePackedOp ?
      new AddNPackedProgram(tensors[0].shape, shapes) :
      new AddNProgram(tensors[0].shape, shapes);
  return backend.runWebGLProgram(program, tensors, dtype);
}

export const addNConfig: KernelConfig = {
  kernelName: AddN,
  backendName: 'webgl',
  kernelFunc: addN as {} as KernelFunc
};

export function all(inputs: AllInputs, backend: MathBackendWebGL): TensorInfo {
  const {inputs, backend, attrs} = args;
  const {x} = inputs;
  const {axis, keepDims} = attrs;

  const xRank = x.rank;
  const xShape = x.shape;

  // We can make sure shapes are identical in op level.
  const usePackedOp = env().getBool('WEBGL_PACK');
  const program = usePackedOp ?
      new AllNProgram(tensors[0].shape, shapes) :
      new AllNProgram(tensors[0].shape, shapes);
  return backend.runWebGLProgram(program, tensors, dtype);
}

export const allConfig: KernelConfig = {
  kernelName: All,
  backendName: 'webgl',
  kernelFunc: all as {} as KernelFunc
};

const allConfig = { kernelName: All, backendName: 'webgl', kernelFunc: all as {} as KernelFunc
};
```javascript
x.shape.length;\nconst origAxes = util.parseAxisParam(axis, x.shape);\nlet axes = origAxes;\nconst permutedAxes = backend_util.getAxesPermutation(axes, xRank);\nlet permutedX = x;\nif (permutedAxes !== null) {\n  permutedX = transpose({\n    inputs: [x],\n    backend,\n    attrs: {perm: permutedAxes}});\n} \naxes = backend_util.getInnerMostAxes(axes.length, xRank);\n} \nbackend_util.assertAxesAreInnerMostDims('all', axes, xRank);\nconst [outShape, reduceShape] = backend_util.computeOutAndReduceShapes(permutedX.shape, axes);\nconst inSize = util.sizeFromShape(reduceShape);\nconst a2D = \n  reshape({\n    inputs: [x: permutedX],\n    backend,\n    attrs: {shape: [-1, inSize]}}, \n    xRank);\nconst reduced = reduce(a2D, a2D.dtype, 'all', backend);\nconst let res;\nif (keepDims) {\n  const newShape = backend_util.expandShapeToKeepDim(outShape, origAxes);\n  res = reshape({\n    inputs: [x: reduced],\n    backend,\n    attrs: {shape: newShape}});\n} \nelse {\n  res = reshape({\n    inputs: [x: reduced],\n    backend,\n    attrs: {shape: outShape}});\n} \nbackend.disposeIntermediateTensorInfo(a2D);\nbackend.disposeIntermediateTensorInfo(\n  permutedX);\n}\nreturn res;\n\nexport const anyConfig: KernelConfig = {\n  kernelName: 'any',\n  backendName: 'webgl',\n  kernelFunc: as \{ as KernelFunc \} \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 http://www.apache.org/licenses/LICENSE-2.0. \n  Unless required by applicable law or agreed to in writing, software distributed under the License is distributed on an "AS IS" BASIS, \n  WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied. \n  See the License for the specific language governing permissions and limitations under the License. \n};
```
```javascript
import {backend_util} from '@tensorflow/tfjs-core';
import {GPGPUProgram} from
'./gpgpu_math';

export class ArgMinMaxProgram implements GPGPUProgram {
  variableNames = ['A'];

  outputShape: number[];
  userCode: string;

  constructor(
      reduceInfo: backend_util.ReduceInfo, op:
        'max'|'min', firstPass: boolean) {
    const {windowSize, batchSize, outSize} = reduceInfo;
    if (!firstPass)
      this.variableNames.push('bestIndicesA');
    this.outputShape = [batchSize, outSize];
    const compOp = (op === 'max') ? '>' : '<';
    this.userCode = `round(getBestIndicesA(batch, inOffset + i));`;

    if (op === 'min')
      this.userCode = `round(${windowSize} - getBestIndicesA(batch, inOffset + i));`;

    void main() {
      ivec2 coords = getOutputCoords();
      int batch = coords[0];
      int outIdx = coords[1];
      int inOffset = outIdx * ${windowSize};

      int bestIndex = inOffset;
      float bestValue = getA(batch, bestIndex);

      for (int i = 0; i < ${windowSize}; i++)
          int inIdx = ${indexSnippet};
          float candidate = getA(batch, inIdx);

      if (candidate ${compOp} bestValue) {
        bestValue = candidate;
        bestIndex = inIdx;
      }
    }
  }
}

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 */

import {util} from '@tensorflow/tfjs-core';
import {GPGPUProgram} from './gpgpu_math';
import {getChannels} from './packing_util';
import {getCoordsDataType} from './shader_compiler';

export class ArgMinMaxPackedProgram implements GPGPUProgram {
  variableNames = ['A'];

  outputShape: number[];
  userCode: string;

  packedInputs = true;
  packedOutput = true;

  constructor(
      shape: number[],
      windowSize: number, op: 'max'|'min',
      firstPass: boolean) {
    util.assert(
        shape.length > 2,
        () => `Packed arg${op.charAt(0).toUpperCase()}${op.slice(1)} supports only inputs with rank above 2.`);
    const inSize = shape[shape.length - 1];
    const outSize = Math.ceil(inSize / windowSize);
    this.outputShape = shape.slice(0, -1);
    if (outSize > 1) {
      this.outputShape.push(outSize);
    }
    if (!firstPass) {
      this.variableNames.push('bestIndicesA');
    }
    const outShape = this.outputShape;
    const rank = outShape.length;
    const dtype = getCoordsDataType(rank);
    const coords = getChannels('coords', rank);

    let sourceLocSetup;
    let sourceRank;
    if (outSize === 1) {
      sourceRank = rank + 1;
      sourceLocSetup = `vec4(sourceLocA, 0) + vec4(sourceLocB, 0) - vec4(sourceLocR, 0);`;
    } else {
      sourceRank = rank;
      sourceLocSetup = `vec4(sourceLocA, 0) - vec4(sourceLocR, 0);`;
    }
    const channels = ['x', 'y', 'z', 'w', 'u', 'v'].slice(0, sourceRank);
    const intChannels = channels.map(x => 'int ' + x);
    const inChannel = '.' + channels[sourceRank - 1].toLowerCase();

    void main() {
      ivec2 coords = getOutputCoords();
      int batch = coords[0];
      int outIdx = coords[1];
      int inOffset = outIdx * ${windowSize};

      int bestIndex = inOffset;
      float bestValue = getA(batch, bestIndex);

      for (int i = 0; i < ${windowSize}; i++)
          int inIdx = ${indexSnippet};
          float candidate = getA(batch, inIdx);

      if (candidate ${compOp} bestValue) {
        bestValue = candidate;
        bestIndex = inIdx;
      }
    }
  }
```

---

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```javascript
getBestIndicesAChannel(${srcBCoords.join()}));

getBestIndicesAChannel(${srcACoords.join()}));
  
getAChannel(${srcRCoords.join()}),
    hasNextCol ? getAChannel(${srcGCoords.join()})) : 0.,

hasNextRow ? getAChannel(${srcBCoords.join()})) : 0.);\n\nconst getBestIndicesAChannelSnippet = firstPass ? '' : \n  float getBestIndicesAChannel($intChannels.join()) {\n    return getChannel(getBestIndicesA($channels.join())),
    vec2($channels.slic(-2).join()));\n  }\n\nthisUserCode = '' float getBestIndicesAChannelSnippet\n\nvoid main() {\n  var $dtype coords = getOutputCoords();\n  bool hasNextCol = $coords[rank - 1] < $outShape[rank - 1] - 1;\n  bool hasNextRow = $coords[rank - 2] < $outShape[rank - 2] - 1;\n  var $srcLocSetup invec4 srcIdx = invec4(sourceLocR$inChannel, sourceLocG$inChannel, sourceLocB$inChannel, sourceLocA$inChannel) * $windowSize;
  iivec4 inIdx = srcIdx;

  for (int i = 0; i < $windowSize; i++) {\n    inIdx = srcIdx;
    vec4 bestIndex = vec4(inIdx);
    vec4 bestValue = ${fetchValue};

    for (int i = 0; i < $windowSize; i++) {\n      inIdx = srcIdx;
      vec4 candidate = ${fetchValue};
      bvec4 nan = isnan(candidate);
      bvec4 replace = bvec4(
        vec4(${compOp}(candidate, bestValue)) * (vec4(1.0) - vec4(nan)));

      bestValue = vec4(replace.x ? candidate.x : bestValue.x,
        replace.y ? candidate.y : bestValue.y,
        replace.z ? candidate.z : bestValue.z,
        replace.w ? candidate.w : bestValue.w);
      bestIndex = mix(bestIndex, vec4(inIdx), vec4(replace));
      srcIdx++;
    }
    setOutput(bestIndex);
  }
}

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 *
=============================================================================
*/

import {backend_util, env, TensorInfo, util} from '@tensorflow/tfjs-core';

import {ArgMinMaxProgram} from '../argminmax_gpu';
import {ArgMinMaxPackedProgram} from '../argminmax_packed_gpu';
import {MathBackendWebGL} from '../backend_webgl';
import {reshape} from '../kernels/Reshape';

function argReduce(
    backend: MathBackendWebGL, x: TensorInfo, reduceType: 'max'|'min',
    bestIndicesA: TensorInfo = null): TensorInfo {
  const axes = [axis]};
  backend_util.assertAxesAreInnerMostDims('arg' +
```
reduceType.charAt(0).toUpperCase() + reduceType.slice(1), axes, x.shape.length);
if (env().getBool('WEBGL_PACK_REDUCE') || x.shape.length <= 2) {
  const intermediateTensorInfos = [];
  const [outShape, reduceShape] = backward._computeOutAndReduceShapes(x.shape, axes);
  const inSize = util.sizeFromShape(reduceShape);
  const a2D = reshape({inputs: [x], backend, attr: {shape: [-1, inSize]}});
  intermediateTensorInfos.push(a2D);
  const reduced = argReduce(backend, a2D, reduceType);
  intermediateTensorInfos.push(reduced);
  const reshaped = reshape({inputs: [x, reduced], backend, attr: {shape: outShape}});
  intermediateTensorInfos.forEach(t =>
    backend.disposeIntermediateTensorInfo(t));
  return reshaped;
}
return argReducePacked(backend, x, reduceType);
}

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 */

import {ArgMax, ArgMaxAttrs, ArgMaxInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';
import {MathBackendWebGL} from '../backend_webgl';
import {argMinMaxReduce} from '../kernel_utils/arg_min_max';
import {transpose} from './Transpose';

export function argMax(
    args:
        {inputs: ArgMaxInputs, backend: MathBackendWebGL, attrs: ArgMaxAttrs}):
  TensorInfo {
    const {inputs, backend, attrs} = args;
    const {x} = inputs;
    const {axis} = attrs;

    let axes = util.parseAxisParam(axis, x.shape);
    const permutedAxes = backend_util.getAxesPermutation(axes, x.shape.length);
    let $x = x;
    const intermediateTensorInfos = [];
    if (permutedAxes != null) {
      $x = transpose({inputs: {x}, backend, attr: {perm: permutedAxes}});
      intermediateTensorInfos.push($x);
      axes = backend_util.getInnerMostAxes(axes.length, $x.shape.length);
    }

    backend_util.assertAxesAreInnerMostDims('argMax', [axes[0]], $x.shape.length);
    const out = argMinMaxReduce(backend, $x, axes[0], 'max');
    intermediateTensorInfos.forEach(t =>
      backend.disposeIntermediateTensorInfo(t));
    return out;
}

export const argMaxConfig: KernelConfig = {
  kernelName: ArgMax,
  backendName: 'webgl',
  kernelFunc: argMax as {} as KernelFunc
};

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 */
atan(a, b);

vec4 isNaN = min(vec4(isnan(a)) + vec4(isnan(b)), vec4(1.0));

CHECK_NAN_SNIPPET_BINARY_PACKED + ` return result;

export const atan2 =

binaryKernelFunc({opSnippet: ATAN2, packedOpSnippet: ATAN2_PACKETED});

export const atan2Config:

KernelConfig = {
  kernelName: Atan2,
  backendName: 'webgl',
  kernelFunc: atan2,
};

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 */

import {Atanh, KernelConfig} from '@tensorflow/tfjs-core';

import {unaryKernelFunc} from
'../kernel_utils/kernel_funcs_utils';
import {CHECK_NAN_SNIPPET} from '../unaryop_gpu';

const ATANH =

CHECK_NAN_SNIPPET + `
  if ((x < -1.0) || (x > 1.0)) return NAN;
return (log(1.0 + x) - log(1.0 - x)) / 2.0;

export const atanh = unaryKernelFunc({opSnippet: ATANH});

export const atanhConfig: KernelConfig = {
  kernelName: Atanh,
  backendName: 'webgl',
  kernelFunc: atanh,
};

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 */

import {backend_util} from '@tensorflow/tfjs-core';
import {GPGPUProgram} from
'./gpgpu_math';

export class Pool2DProgram implements GPGPUProgram {
  variableNames = ['x'];
  outputShape: number[];
  userCode: string;
  constructor(
      convInfo: backend_util.Conv2DInfo, poolType: 'max'|'avg',
      computePositions: boolean, flattenPositions = false,
      includeBatchInIndex = false) {
    if (poolType === 'avg' && computePositions) {
      throw new Error('Cannot compute positions for average
    pool.');
    }
    let initializationValue = '0.0';
    if (!computePositions) {
      // WebGL on Firefox Linux can't compile 1/0 so we do 1/eps.
      initializationValue = '-1.0 / 1e-20';
    }
    if (computePositions) {
      const compareOp = '>=';
      void main() {
        ivec4 coords = getOutputCoords();
        int batch = coords[0];
        int d = coords[3];
        ivec2 xRCCorner = coords.yz * strides - pads;
        int xRCorner = xRCCorner.x;
        int xCCorner = xRCCorner.y;

        // max/min x(?, ?, d) to get y(yR, yC, d).
        // ? = to be determined
        let initializationValue = '0.0';
        if (!isAvgPool) {
          // WEBGL on Firefox Linux can't compile 1/0 so we do 1/eps.
          initializationValue = '-1.0 / 1e-20';
        }
        if (computePositions) {
          const compareOp = '>'; const userCode = '1';
          const ivec2 strides = ivec2($strideHeight),
          $strideWidth);
          const ivec2 pads = ivec2($padTop, $padLeft);
          if (!isAvgPool) {
            // WEBGL on Firefox Linux can't compile 1/0 so we do 1/eps.
            initializationValue = '-1.0 / 1e-20';
          }
          if (computePositions) {
            const compareOp = '>' const userCode = '1';
            const ivec2 strides = ivec2($strideHeight),
            $strideWidth);
            const ivec2 pads = ivec2($padTop, $padLeft);
            if (!isAvgPool) {
              // WEBGL on Firefox Linux can't compile 1/0 so we do 1/eps.
              initializationValue = '-1.0 / 1e-20';
            }
            if (computePositions) {
              const compareOp = '>' const userCode = '1';
              const ivec2 strides = ivec2($strideHeight),
              $strideWidth);
              const ivec2 pads = ivec2($padTop, $padLeft);
              if (!isAvgPool) {
                // WEBGL on Firefox Linux can't compile 1/0 so we do 1/eps.
                initializationValue = '-1.0 / 1e-20';
              }
              if (computePositions) {
                const compareOp = '>' const userCode = '1';
                const ivec2 strides = ivec2($strideHeight),
                $strideWidth);
                const ivec2 pads = ivec2($padTop, $padLeft);
                if (!isAvgPool) {
                  // WEBGL on Firefox Linux can't compile 1/0 so we do 1/eps.
                  initializationValue = '-1.0 / 1e-20';
                }
                if (computePositions) {
                  const compareOp = '>' const userCode = '1';
                  const ivec2 strides = ivec2($strideHeight),
                  $strideWidth);
                  const ivec2 pads = ivec2($padTop, $padLeft);
                  if (!isAvgPool) {
                    // WEBGL on Firefox Linux can't compile 1/0 so we do 1/eps.
                    initializationValue = '-1.0 / 1e-20';
                  }
                  if (computePositions) {
                    const compareOp = '>' const userCode = '1';
                    const ivec2 strides = ivec2($strideHeight),
                    $strideWidth);
                    const ivec2 pads = ivec2($padTop, $padLeft);
                    if (!isAvgPool) {
                      // WEBGL on Firefox Linux can't compile 1/0 so we do 1/eps.
                      initializationValue = '-1.0 / 1e-20';
                    }
                    if (computePositions) {
                      const compareOp = '>' const userCode = '1';
                      const ivec2 strides = ivec2($strideHeight),
                      $strideWidth);
                      const ivec2 pads = ivec2($padTop, $padLeft);
                      if (!isAvgPool) {
                        // WEBGL on Firefox Linux can't compile 1/0 so we do 1/eps.
                        initializationValue = '-1.0 / 1e-20';
                      }
                      if (computePositions) {
                        const compareOp = '>' const userCode = '1';
                        const ivec2 strides = ivec2($strideHeight),
                        $strideWidth);
                        const ivec2 pads = ivec2($padTop, $padLeft);
                        if (!isAvgPool) {
                          // WEBGL on Firefox Linux can't compile 1/0 so we do 1/eps.
                          initializationValue = '-1.0 / 1e-20';
                        }
                        if (computePositions) {
                          const compareOp = '>' const userCode = '1';
                          const ivec2 strides = ivec2($strideHeight),
                          $strideWidth);
                          const ivec2 pads = ivec2($padTop, $padLeft);
                          if (!isAvgPool) {
                            // WEBGL on Firefox Linux can't compile 1/0 so we do 1/eps.
                            initializationValue = '-1.0 / 1e-20';
                          }
                          if (computePositions) {
                            const compareOp = '>' const userCode = '1';
                            const ivec2 strides = ivec2($strideHeight),
                            $strideWidth);
                            const ivec2 pads = ivec2($padTop, $padLeft);
                            if (!isAvgPool) {
                              // WEBGL on Firefox Linux can't compile 1/0 so we do 1/eps.
                              initializationValue = '-1.0 / 1e-20';
                            }
                            if (computePositions) {
                              const compareOp = '>' const userCode = '1';
                              const ivec2 strides = ivec2($strideHeight),
                              $strideWidth);
                              const ivec2 pads = ivec2($padTop, $padLeft);
                              if (!isAvgPool) {
                                // WEBGL on Firefox Linux can't compile 1/0 so we do 1/eps.
                                initializationValue = '-1.0 / 1e-20';
                              }
                              if (computePositions) {
                                const compareOp = '>' const userCode = '1';
                                const ivec2 strides = ivec2($strideHeight),
                                $strideWidth);
                                const ivec2 pads = ivec2($padTop, $padLeft);
                                if (!isAvgPool) {
                                  // WEBGL on Firefox Linux can't compile 1/0 so we do 1/eps.
                                  initializationValue = '-1.0 / 1e-20';
                                }
                              }
                            }
                          }
                        }
                      }
                    }
                  }
                }
              }
            }
          }
        }
      }
    }
float currMinMaxValue = mix(value, minMaxValue[0], minMaxValue[1]);
if (value > currMinMaxValue) {
  minMaxValue[0] = value;
  minMaxValueFound = 1.0;
}

minMaxPosition = flattenPositions ? (includeBatchInIndex ? batchFlattenPositionStr : flattenPositionStr) :
'wR * $effectiveFilterWidth + wC';

setOutput(float(minMaxPosition));
return;
}

const compareOp = 'max';
let returnValue = '$poolType($poolType($poolType(' +
' minMaxValue[0], minMaxValue[1]), minMaxValue[2]), minMaxValue[3]);' if (poolType === 'avg') {
  returnValue = avgValue / count;
}

const filterWidthNearestVec4 = Math.floor(filterWidth / 4) * 4;
const filterWidthVec4Remainder = filterWidth % 4;
const updateSnippet = '
  if ($isAvgPool) {
    avgValue += dot(values, ones);
  } else {
    minMaxValue = $[compareOp] (values, minMaxValue);
  }
  this.userCode = const vec4 minMaxValue = vec4($initializationValue);
  vec4 ones = vec4(1.0, 1.0, 1.0, 1.0);

  float count = 0.0;
  float getValue(int batch, int xR, int xC, int d) {
    if (xC < 0 || xC >= $convInfo.inWidth) {
      return initializationValue;
    }
    count += 1.0;
    return getX(batch, xR, xC, d);
  }

  void main() {
    ivec4 coords = getOutputCoords();
    int batch = coords[0];
    int d = coords[3];
    ivec2 xRCCorner = coords.yz * strides - pads;
    int xRCorner = xRCCorner.x;
    int xCCorner = xRCCorner.y;

    // max/min x(?, ?, d) to get y(yR, yC, d).
    // ? = to be determined
    vec4 minMaxValue = vec4($initializationValue);
    float avgValue = 0.0;
    const filterWidthNearestVec4 = Math.floor(filterWidth / 4) * 4;
    const filterWidthVec4Remainder = filterWidth % 4;

    const updateSnippet = '
      if ($isAvgPool) {
        avgValue += dot(values, ones);
      } else {
        minMaxValue = $[compareOp] (values, minMaxValue);
      }
      this.userCode = const vec4 minMaxValue = vec4($initializationValue);
    
    if (xR < 0 || xR >= $convInfo.inHeight) {
      continue;
    }

    for (int wR = 0; wR < $effectiveFilterHeight; wR += $dilationHeight) {
      int xR = xRCorner + wR;
      if (xR < 0 || xR >= $convInfo.inHeight) {
        continue;
      }

      for (int wC = 0; wC < $filterWidthNearestVec4; wC += 4) {
        int xC = xCCorner + wC * $dilationWidth;

        vec4 values = vec4(
          getValue(batch, xR, xC, d),
          getValue(batch, xR, xC + $dilationWidth, d),
          getValue(batch, xR, xC + 2 * $dilationWidth, d),
          getValue(batch, xR, xC + 3 * $dilationWidth, d)
        );

        ${updateSnippet}
      }

      if ($filterWidthVec4Remainder !== 1) {
        vec4 values = vec4(
          getValue(batch, xR, xC, d),
          getValue(batch, xR, xC + $dilationWidth, d),
          getValue(batch, xR, xC + 2 * $dilationWidth, d),
          getValue(batch, xR, xC + 3 * $dilationWidth, d)
        );

        ${updateSnippet}
      } else if ($filterWidthVec4Remainder === 2) {
        vec4 values = vec4(
          getValue(batch, xR, xC, d),
          getValue(batch, xR, xC + $dilationWidth, d),
          getValue(batch, xR, xC + 2 * $dilationWidth, d),
          getValue(batch, xR, xC + 3 * $dilationWidth, d)
        );

        ${updateSnippet}
      }

      setOutput($[returnValue]);
    }
  }
}

export class Pool3DProgram implements GPGPUProgram {
  variableNames = ['x'];
  outputShape: number[];
  userCode: string;

  constructor(
    convInfo: backend_util.Conv3DInfo, poolType: 'max'|'avg',
    computePositions: boolean, flattenPositions = false,
    includeBatchInIndex = false) {
    if (poolType === 'avg') {
      throw new Error('Cannot compute positions for average pool.');
    }

    const filterWidth = convInfo.filterWidth;
    const strideDepth = convInfo.strideDepth;
    const strideHeight = convInfo.strideHeight;
    const strideWidth = convInfo.strideWidth;
    const dilationDepth = convInfo.dilationDepth;
    const dilationHeight = convInfo.dilationHeight;
    const dilationWidth = convInfo.dilationWidth;
    const effectiveFilterDepth = convInfo.effectiveFilterDepth;
    const effectiveFilterHeight = convInfo.effectiveFilterHeight;
    const effectiveFilterWidth = convInfo.effectiveFilterWidth;
    const padTop = convInfo.padInfo.top;
    const padBottom = convInfo.padInfo.bottom;
    const padLeft = convInfo.padInfo.left;
    const padRight = convInfo.padInfo.right;
    const this.outputShape = convInfo.outShape;
    const isAvgPool = poolType === 'avg';
    let initializationValue = '0.0';
    if (!isAvgPool) {
      // WebGL on Firefox Linux can't compile 1/0 so we do 1/eps.
      initializationValue = '1.0 / 1e-20';
    }
    this.userCode = 'constivec3 strides = ivec3($[strideDepth], $[strideHeight], $[strideWidth]);
    const ivec3 pads = ivec3($[padFront], $[padTop], $[padLeft]);
    void main() {
      ivec5 coords = getOutputCoords();

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vec4 values = vec4(0.0); getValue(batch, xD, xR, xC, ch),
getValue(batch, xD, xR, xC + 2 * dilationWidth, ch),
initializationValue
);\n\nsetOutput(${returnValue});\n}\n}\n\n/**
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import {AvgPool, AvgPoolAttrs, AvgPoolInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';
import {MathBackendWebGL} from '../backend_webgl';
import {Pool2DProgram} from '../pool_gpu';
import {assertNotComplex} from '../webgl_util';
import {identity} from './Identity';

export function avgPool(args: {
  inputs: AvgPoolInputs,
  backend: MathBackendWebGL,
  attrs: AvgPoolAttrs
}): TensorInfo {
  const {inputs, backend, attrs} = args;
  const {x} = inputs;
  const {filterSize, strides, pad, dimRoundingMode} = attrs;
  const dilations = [1, 1, 1];
  util.assert(
      backend_util.eitherStridesOrDilationsAreOne(strides, dilations),
      () => 'Error in avgPool: Either strides or dilations must be 1. ' +
          'Got strides ${strides} and dilations '${dilation}\n\n  const convInfo = backend_util.computePool3DInfo(
      x.shape as [number, number, number, number], filterSize, strides,
      dilations, pad, dimRoundingMode);
  const avgPoolProgram = new Pool3DProgram(convInfo, 'avg', false);
  return backend.runWebGLProgram(avgPoolProgram, [x, 'float32']);
}

export const avgPoolConfig: KernelConfig = {
  kernelName: AvgPool,
  backendName: 'webgl',
  kernelFunc: avgPool as {} as KernelFunc
};

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import {AvgPool3D, AvgPool3DAttrs, AvgPool3DInputs, backend_util, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-core';
import {MathBackendWebGL} from '../backend_webgl';
import {Pool3DProgram} from '../pool_gpu';
import {assertNotComplex} from '../webgl_util';

export function avgPool3D(args: {
  inputs: AvgPool3DInputs,
  backend: MathBackendWebGL,
  attrs: AvgPool3DAttrs
}): TensorInfo {
  const {inputs, backend, attrs} = args;
  const {x} = inputs;
  const {filterSize, strides, pad, dimRoundingMode, dataFormat} = attrs;
  const dilations = [1, 1, 1];
  const convInfo = backend_util.computePool3DInfo(
      x.shape as [number, number, number, number, number], filterSize, strides,
      dilations, pad, dimRoundingMode, dataFormat);
  const avgPoolProgram = new Pool3DProgram(convInfo, 'avg', false);
  return backend.runWebGLProgram(avgPoolProgram, [x, 'float32']);
}

export const avgPool3DConfig: KernelConfig = {
  kernelName: AvgPool3D,
  backendName: 'webgl',
  kernelFunc: avgPool as {} as KernelFunc
};
import {backend_util} from '@tensorflow/tfjs-core';
import {GPGPUProgram} from './gpgpu_math';

export class AvgPool2DBackpropProgram implements GPGPUProgram {
  variableNames = ['dy'];
  outputShape: number[];
  userCode: string;
  constructor(convInfo: backend_util.Conv2DInfo) {
    this.outputShape = convInfo.inShape;
    const filterHeight = convInfo.filterHeight;
    const filterWidth = convInfo.filterWidth;
    const strideHeight = convInfo.strideHeight;
    const strideWidth = convInfo.strideWidth;
    const dilationHeight = convInfo.dilationHeight;
    const dilationWidth = convInfo.dilationWidth;
    const effectiveFilterHeight = convInfo.effectiveFilterHeight;
    const effectiveFilterWidth = convInfo.effectiveFilterWidth;
    const padTop = effectiveFilterHeight - 1 - convInfo.padTop;
    const padLeft = effectiveFilterWidth - 1 - convInfo.padLeft;
    const avgMultiplier = 1 / (filterHeight * filterWidth);
    this.userCode = `"const this.userCode = \"const ivec2 pads = ivec2(${padTop}, ${padLeft});\nconst float avgMultiplier = float(${avgMultiplier});\nvoid main() {\n  iivec4 coords = getOutputCoords();\n  int b = coords[0];\n  int d = coords[3];\n  iivec2 dyRCCorner = coords.yz - pads;\n  int dyRCorner = dyRCCorner.x;\n  int dyCCorner = dyRCCorner.y;\n  float avgMultiplier = float(${avgMultiplier});\n  void main() {\n    ivec4 coords = getOutputCoords();\n    int b = coords[0];\n    int d = coords[3];\n    iivec2 dyRCCorner = coords.yz - pads;\n    int dyRCorner = dyRCCorner.x;\n    int dyCCorner = dyRCCorner.y;\n    float avgMultiplier = float(${avgMultiplier});\n    void main() {\n      ivec4 coords = getOutputCoords();\n      int b = coords[0];\n      int d = coords[3];\n      iivec2 dyRCCorner = coords.yz - pads;\n      int dyRCorner = dyRCCorner.x;\n      int dyCCorner = dyRCCorner.y;\n      float avgMultiplier = float(${avgMultiplier});\n      void main() {\n        ivec4 coords = getOutputCoords();\n        int b = coords[0];\n        int d = coords[3];\n        iivec2 dyRCCorner = coords.yz - pads;\n        int dyRCorner = dyRCCorner.x;\n        int dyCCorner = dyRCCorner.y;\n        float avgMultiplier = float(${avgMultiplier});\n        void main() {\n          ivec4 coords = getOutputCoords();\n          int b = coords[0];\n          int d = coords[3];\n          iivec2 dyRCCorner = coords.yz - pads;\n          int dyRCorner = dyRCCorner.x;\n          int dyCCorner = dyRCCorner.y;\n          float avgMultiplier = float(${avgMultiplier});\n          void main() {\n            ivec4 coords = getOutputCoords();\n            int b = coords[0];\n            int d = coords[3];\n            iivec2 dyRCCorner = coords.yz - pads;\n            int dyRCorner = dyRCCorner.x;\n            int dyCCorner = dyRCCorner.y;\n            float avgMultiplier = float(${avgMultiplier});\n            void main() {\n              ivec4 coords = getOutputCoords();\n              int b = coords[0];\n              int d = coords[3];\n              iivec2 dyRCCorner = coords.yz - pads;\n              int dyRCorner = dyRCCorner.x;\n              int dyCCorner = dyRCCorner.y;\n              float avgMultiplier = float(${avgMultiplier});\n              void main() {\n                ivec4 coords = getOutputCoords();\n                int b = coords[0];\n                int d = coords[3];\n                iivec2 dyRCCorner = coords.yz - pads;\n                int dyRCorner = dyRCCorner.x;\n                int dyCCorner = dyRCCorner.y;\n                float avgMultiplier = float(${avgMultiplier});\n                void main() {\n                  ivec4 coords = getOutputCoords();\n                  int b = coords[0];\n                  int d = coords[3];\n                  iivec2 dyRCCorner = coords.yz - pads;\n                  int dyRCorner = dyRCCorner.x;\n                  int dyCCorner = dyRCCorner.y;\n                  float avgMultiplier = float(${avgMultiplier});\n                  void main() {\n                    ivec4 coords = getOutputCoords();\n                    int b = coords[0];\n                    int d = coords[3];\n                    iivec2 dyRCCorner = coords.yz - pads;\n                    int dyRCorner = dyRCCorner.x;\n                    int dyCCorner = dyRCCorner.y;\n                    float avgMultiplier = float(${avgMultiplier});\n                    void main() {\n                      ivec4 coords = getOutputCoords();\n                      int b = coords[0];\n                      int d = coords[3];\n                      iivec2 dyRCCorner = coords.yz - pads;\n                      int dyRCorner = dyRCCorner.x;\n                      int dyCCorner = dyRCCorner.y;\n                      float avgMultiplier = float(${avgMultiplier});\n                      void main() {\n                        ivec4 coords = getOutputCoords();\n                        int b = coords[0];\n                        int d = coords[3];\n                        iivec2 dyRCCorner = coords.yz - pads;\n                        int dyRCorner = dyRCCorner.x;\n                        int dyCCorner = dyRCCorner.y;\n                        float avgMultiplier = float(${avgMultiplier});\n                        void main() {\n                          ivec4 coords = getOutputCoords();\n                          int b = coords[0];\n                          int d = coords[3];\n                          iivec2 dyRCCorner = coords.yz - pads;\n                          int dyRCorner = dyRCCorner.x;\n                          int dyCCorner = dyRCCorner.y;\n                          float avgMultiplier = float(${avgMultiplier});\n                          void main() {\n                            ivec4 coords = getOutputCoords();\n                            int b = coords[0];\n                            int d = coords[3];\n                            iivec2 dyRCCorner = coords.yz - pads;\n                            int dyRCorner = dyRCCorner.x;\n                            int dyCCorner = dyRCCorner.y;\n                            float avgMultiplier = float(${avgMultiplier});\n                            void main() {\n                              ivec4 coords = getOutputCoords();\n                              int b = coords[0];\n                              int d = coords[3];\n                              iivec2 dyRCCorner = coords.yz - pads;\n                              int dyRCorner = dyRCCorner.x;\n                              int dyCCorner = dyRCCorner.y;\n                              float avgMultiplier = float(${avgMultiplier});\n                              void main() {\n                                ivec4 coords = getOutputCoords();\n                                int b = coords[0];\n                                int d = coords[3];\n                                iivec2 dyRCCorner = coords.yz - pads;\n                                int dyRCorner = dyRCCorner.x;\n                                int dyCCorner = dyRCCorner.y;\n                                float avgMultiplier = float(${avgMultiplier});\n                                void main() {\n                                  ivec4 coords = getOutputCoords();\n                                  int b = coords[0];\n                                  int d = coords[3];\n                                  iivec2 dyRCCorner = coords.yz - pads;\n                                  int dyRCorner = dyRCCorner.x;\n                                  int dyCCorner = dyRCCorner.y;\n                                  float avgMultiplier = float(${avgMultiplier});\n                                  void main() {\n                                    ivec4 coords = getOutputCoords();\n                                    int b = coords[0];\n                                    int d = coords[3];\n                                    iivec2 dyRCCorner = coords.yz - pads;\n                                    int dyRCorner = dyRCCorner.x;\n                                    int dyCCorner = dyRCCorner.y;\n                                    float avgMultiplier = float(${avgMultiplier});\n                                    void main() {\n                                      ivec4 coords = getOutputCoords();\n                                      int b = coords[0];\n                                      int d = coords[3];\n                                      iivec2 dyRCCorner = coords.yz - pads;\n                                      int dyRCorner = dyRCCorner.x;\n                                      int dyCCorner = dyRCCorner.y;\n                                      float avgMultiplier = float(${avgMultiplier});\n                                      void main() {\n                                        ivec4 coords = getOutputCoords();\n                                        int b = coords[0];\n                                        int d = coords[3];\n                                        iivec2 dyRCCorner = coords.yz - pads;\n                                        int dyRCorner = dyRCCorner.x;\n                                        int dyCCorner = dyRCCorner.y;\n                                        float avgMultiplier = float(${avgMultiplier});\n                                        void main() {\n                                          ivec4 coords = getOutputCoords();\n                                          int b = coords[0];\n                                          int d = coords[3];\n                                          iivec2 dyRCCorner = coords.yz - pads;\n                                          int dyRCorner = dyRCCorner.x;\n                                          int dyCCorner = dyRCCorner.y;\n                                          float avgMultiplier = float(${avgMultiplier});\n                                          void main() {\n                                            ivec4 coords = getOutputCoords();\n                                            int b = coords[0];\n                                            int d = coords[3];\n                                            iivec2 dyRCCorner = coords.yz - pads;\n                                            int dyRCorner = dyRCCorner.x;\n                                            int dyCCorner = dyRCCorner.y;\n                                            float avgMultiplier = float(${avgMultiplier});\n                                            void main() {\n                                              ivec4 coords = getOutputCoords();\n                                              int b = coords[0];\n                                              int d = coords[3];\n                                              iivec2 dyRCCorner = coords.yz - pads;\n                                              int dyRCorner = dyRCCorner.x;\n                                              int dyCCorner = dyRCCorner.y;\n                                              float avgMultiplier = float(${avgMultiplier});\n                                              void main() {\n                                                                \
```
```javascript
const x = input;
const {filterSize, strides, pad, dimRoundingMode} = attrs;
const dilations: [number, number, number] = [1, 1, 1];

const convInfo = backend_util.computePool3DInfo(x.shape as [number, number, number, number, number], filterSize, strides, pad, dimRoundingMode);
const avgPoolBackpropProgram = new AvgPool3DBackpropProgram(convInfo);
return backend.runWebGLProgram(avgPoolBackpropProgram, [dy], x.dtype);
}

export const avgPoolGradConfig: KernelConfig = {
  kernelName: AvgPoolGrad,
  backendName: 'webgl',
  kernelFunc: avgPoolGrad as {} as KernelFunc
};

import {BatchMatMul, BatchMatMulAttrs, BatchMatMulInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';

import {MathBackendWebGL} from '../backend_webgl';
import {batchMatMulImpl}
```
from './BatchMatMul_impl';

export function batchMatMul(args: {
  inputs: BatchMatMulInputs,
  attrs: BatchMatMulAttrs,
  backend: MathBackendWebGLAn
}) {
  const [inputs, backend, attrs] = args;
  const [a, b] = inputs;
  const [transposeA, transposeB] = attrs;
  return batchMatMulImpl([a, b, transposeA, transposeB, backend]);
}

export const batchMatMulConfig: KernelConfig = {
  kernelName: 'BatchMatMul',
  backendName: 'webgl',
  kernelFunc: batchMatMul as {} as KernelFunc,
  ...,

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 *
 *=============================================================================

import {backend_util} from '@tensorflow/tfjs-core';
import {GPGPUProgram} from
  './gpgpu_math';

export class BatchNormProgram implements GPGPUProgram {
  variableNames: string[];
  outputShape: number[];
  constructor(xShape: number[], meanShape: number[],
  varianceShape: number[],
  offsetShape: number[]|null, scaleShape: number[]|null,
  varianceEpsilon: number) {
    this.variableNames = ['x', 'mean', 'variance'];
    backend_util.assertAndGetBroadcastShape(xShape, meanShape);
    backend_util.assertAndGetBroadcastShape(xShape, varianceShape);
    if (offsetShape != null) {
      backend_util.assertAndGetBroadcastShape(xShape, offsetShape);
      this.variableNames.push('offset');
    }
    if (scaleShape != null) {
      backend_util.assertAndGetBroadcastShape(xShape, scaleShape);
      this.variableNames.push('scale');
    }
    this.outputShape = xShape;
    this.userCode = '
      void main() {
        float x = getXAtOutCoords();
        float mean = getMeanAtOutCoords();
        float variance = getVarianceAtOutCoords();
        float inv = scale * inversesqrt(variance + float(0.0));
        setOutput(dot(vec3(x, -mean, offset), vec3(inv, inv, 1)));
      }
    ';
  }
}

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 *
 *=============================================================================

import {backend_util} from '@tensorflow/tfjs-core';
import {GPGPUProgram} from
  './gpgpu_math';

export class BatchNormPackedProgram implements GPGPUProgram {
  variableNames: string[];
  outputShape: number[];
  constructor(xShape: number[], meanShape: number[], varianceShape: number[],
  offsetShape: number[]|null, scaleShape: number[]|null,
  varianceEpsilon: number) {
    this.variableNames = ['x', 'mean', 'variance'];
    backend_util.assertAndGetBroadcastShape(xShape, meanShape);
    backend_util.assertAndGetBroadcastShape(xShape, varianceShape);
    if (offsetShape != null) {
      backend_util.assertAndGetBroadcastShape(xShape, offsetShape);
      this.variableNames.push('offset');
    }
    if (scaleShape != null) {
      backend_util.assertAndGetBroadcastShape(xShape, scaleShape);
      this.variableNames.push('scale');
    }
    this.outputShape = xShape;
    this.userCode = '
      void main() {
        float offset = $(offsetsnippet);

        float x = getXAtOutCoords();
        float mean = getMeanAtOutCoords();
        float variance = getVarianceAtOutCoords();
        float inv = scale * inversesqrt(variance + float(0.0));
        setOutput(dot(vec3(x, -mean, offset), vec3(inv, inv, 1)));
      }
    ';
  }
}
the compiler has optimized and realized it doesn't need

// the uniform.

return;

}

gpgpu.gl.uniform1iv(this.startLoc, start);
}

function getCoords(rank: number): string {
    if (rank === 1) {
        return 'sourceLoc';
    } else if (rank <= 6) {
        return coords.slice(0, rank).map(x => 'sourceLoc.' + x).join(');
    } else {
        throw Error('Slicing for rank $\{rank\}$ is not yet supported');
    }
}

const coords = ['x', 'y', 'z', 'w', 'u', 'v'];

function getCoordsDataType(rank: number): string {
    if (rank === 1) {
        return 'int';
    } else if (rank <= 6) {
        return coords.slice(0, rank).map(x => 'int').join(',');
    } else {
        throw Error('Slicing for rank $\{rank\}$ is not yet supported');
    }
}

const innerDims =
    this.rank === 1 ? 'sourceLoc' : `vec2(${sourceLoc.slice(-2).join()})`;
const getChannel =
    `getChannel(getSource(${sourceLoc.join()}), ${innerDims})`;
const upperRow =
    `result.x = ${getChannel};
     if (++${coords[this.rank - 1]} < ${destSize[this.rank - 1]}) {
        ++${sourceLoc[this.rank - 1]};
        result.y = ${getChannel};
        --${sourceLoc[this.rank - 1]};
    }
    `;
const lowerRow =
    this.rank === 1 ? '' :
    `--${coords[this.rank - 2]};
     if (++${coords[this.rank - 2]} < ${destSize[this.rank - 2]}) {
        ++${sourceLoc[this.rank - 2]};
        result.z = ${getChannel};
        if (++${coords[this.rank - 1]} <

$\{destSize[this.rank - 1]\}) {
        ++${sourceLoc[this.rank - 1]};
        result.w = ${getChannel};
    }`;
}

const startLocSetup = this.rank <= 4 ?
    `sourceLoc = coords +
     $\{destSize.map((_, i) => `start[${i}]`).join()\}` :
    destSize.map((_, i) => `${sourceLoc[i]} = ${coords[i]} + start[${i}]`)
        .join('\n');

const sourceLocSetup =
    `sourceLoc = getOutputCoords();
     $\{dtype\} sourceLoc;
     ${sourceLocSetup}
     vec4 result = vec4(0.);
     ${upperRow}
     ${lowerRow}
     setOutput(result);`;

getCustomSetupFunc(start: number[]): void {
    if (start.length !== this.rank) {
        throw Error('The rank ($\{this.rank\}$) of the program must match the ` +
        'length of start ($\{start.length\}$)');
    }
    return (gpgpu: GPGPUContext, webGLProgram: WebGLProgram) => {
        if (this.startLoc == null) {
            this.startLoc =
            gpgpu.getUniformLocationNoThrow(webGLProgram, 'start');
        } else {
            this.startLoc =
            gpgpu.getUniformLocationNoThrow(webGLProgram, 'start');
        }
    }
}

const startLocSetup = this.rank <= 4 ?
    `sourceLoc = coords +
     $\{destSize.map((_, i) => `start[${i}]`).join()\}` :
    destSize.map((_, i) => `${sourceLoc[i]} = 

$\{coords[i]} + start[${i}]`)
        .join('
    ');
MathBackendWebGL

const x = inputs[0].dataId;

const [shape] = inputs[0].shape;

const xValues = backend.readSync(x.dataId) as TypedArray;

const outValues = bincountImplCPU(xValues, weightsValues, weights.dtype, weights.shape, size);

const outTensorInfo = backend.makeTensorInfo([size], weights.dtype, outValues, weights.dtype, weights.shape, size);

return outTensorInfo;

export function int(input: TensorInfo, backend: MathBackendWebGL): TensorInfo {

const program = new UnaryOpProgram(input.shape, TO_INT);

const output = backend.runWebGLProgram(program, [input], 'int32');

return output;
}

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=============================================================================
// Importing necessary packages
import {GPGPUContext} from './gpgpu_context';
import {GPGPUProgram} from './gpgpu_math';

// Exporting class ClipProgram implements GPGPUProgram
export class ClipProgram implements GPGPUProgram {
  variableNames = ['A'];
  userCode: string;
  outputShape: number[];

  // Caching uniform locations for speed.
  minLoc: WebGLUniformLocation;
  maxLoc: WebGLUniformLocation;

  constructor(aShape: number[]) {
    this.outputShape = aShape;
    this.userCode = `uniform float minVal;
    uniform float maxVal;
    void main() {
      float value = getAAAtOutCoords();
      if (isNaN(value)) {
        setOutput(value);
        return;
      }
      setOutput(clamp(value, minVal, maxVal));
    }
  }
}

// Exporting class ClipPackedProgram implements GPGPUProgram
export class ClipPackedProgram implements GPGPUProgram {
  variableNames = ['A'];
  packedInputs = true;
  packedOutput = true;
  userCode: string;
  outputShape: number[];

  // Caching uniform locations for speed.
  minLoc: WebGLUniformLocation;
  maxLoc: WebGLUniformLocation;

  constructor(aShape: number[]) {
    this.outputShape = aShape;
    this.userCode = `uniform float minVal;
    uniform float maxVal;
    void main() {
      vec4 value = getAAAtOutCoords();
      if (any(isNaN(value))) {
        setOutput(value);
        return;
      }
      setOutput(clamp(value, vec4(minVal), vec4(maxVal)));
    }
  }
}

// Importing ClipByValue from '@tensorflow/tfjs-core'
import {ClipByValue, ClipByValueAttrs, ClipByValueInputs, env, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-core';
import {MathBackendWebGL} from '../backend_webgl';
import {ClipProgram} from '../clip_gpu';
import {ClipPackedProgram} from '../clip_packed_gpu';

// Exporting function clipByValue
export function clipByValue(args: {inputs: ClipByValueInputs, backend: MathBackendWebGL, attrs: ClipByValueAttrs}) {
  const {inputs, backend, attrs} = args;
  const {x} = inputs;
  const {clipValueMin, clipValueMax} = attrs;

  let program;
  if (env().getBool('WEBGL_PACK_CLIP')) {
    program = new ClipPackedProgram(x.shape);
  } else {
    program = new ClipProgram(x.shape);
  }
  const customSetup =

function clipByValueConfig: KernelConfig = {
  kernelName: ClipByValue,
  backendName: 'webgl',
  kernelFunc: clipByValue as {} as KernelFunc
};

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 */

import {GPGPUProgram} from './gpgpu_math';

export class ComplexAbsProgram implements GPGPUProgram {
  variableNames = ['real', 'imag'];
  userCode: string;
  outputShape: number[];

  constructor(shape: number[]) {
    this.outputShape = shape;
    this.userCode = `void main() {
      float re = abs(getRealAtOutCoords());
      float im = abs(getImagAtOutCoords());
      float mx = max(re, im);

      // sadly the length function in glsl is not underflow-safe
      // (at least not on Intel GPUs). So the safe solution
      // is to ensure underflow-safety in all cases.
      setOutput(mx == 0.0 ? 0.0 : mx * length(vec2(1,
        min(re, im)/mx)));
    }
  }
}

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 */

import {ComplexAbs, ComplexAbsInputs, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-core';

import {MathBackendWebGL} from '../backend_webgl';
import {ComplexAbsProgram} from '../complex_abs_gpu';

function makeComplexComponentTensorInfo(
    complexTensor: TensorInfo, complexPart: TensorInfo): TensorInfo {
  return {
    dataId: complexPart.dataId,
    dtype: complexPart.dtype,
    shape: complexTensor.shape
  };
}

export function complexAbs(
    inputs: ComplexAbsInputs, backend: MathBackendWebGL): TensorInfo {
  const {x} = inputs;
  const xData = backend.texData.get(x.dataId);
  const program = new ComplexAbsProgram(x.shape);
  const programInputs = [
    makeComplexComponentTensorInfo(x, xData.complexTensorInfos.real),
    makeComplexComponentTensorInfo(x, xData.complexTensorInfos.imag)
  ];
  return backend.runWebGLProgram(program, programInputs, programInputs[0].dtype);
}

export const complexAbsConfig: KernelConfig = {
  kernelName: ComplexAbs,
  backendName: 'webgl',
  kernelFunc: complexAbs as {} as KernelFunc
};

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 */

import {backend_util} from '@tensorflow/tfjs-core';
import {GPGPUProgram} from './gpgpu_math';

export class ConcatProgram implements GPGPUProgram {
  variableNames: string[];
  outputShape: number[] = [];
  userCode: string;

  // Concats 2d tensors along axis=1. See comments in
  program.getCustomSetupFunc(clipValueMin, clipValueMax);
  return backend.runWebGLProgram(program, [x],
    x.dtype, customSetup);
}

export const concatConfig: KernelConfig = {
  kernelName: Concat,
  backendName: 'webgl',
  kernelFunc: concat as {} as KernelFunc
};

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 */

import {Concat, ConcatInputs, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-core';

// 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(
    complexTensor: TensorInfo, complexPart: TensorInfo): TensorInfo {
  return {
    dataId: complexPart.dataId,
    dtype: complexPart.dtype,
    shape: complexTensor.shape
  };
}

export function concat(
    inputs: ConcatInputs, backend: MathBackendWebGL): TensorInfo {
  const {x} = inputs;
  const xData = backend.texData.get(x.dataId);
  const program = new ConcatProgram(x.shape);
  const programInputs = [
    makeComplexComponentTensorInfo(x, xData.complexTensorInfos.real)
  ];
  return backend.runWebGLProgram(program, programInputs, programInputs[0].dtype);
}

export const concatConfig: KernelConfig = {
  kernelName: Concat,
  backendName: 'webgl',
  kernelFunc: concat as {} as KernelFunc
};
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
${snippets.join('\\n
')}\n
}\n
`;\n }\n}\n","/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
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=============================================================================\n
*/\n\nimport {backend_util} from '@tensorflow/tfjs-core';\n\nimport {GPGPUProgram} from
'./gpgpu_math';\nimport {getChannels} from './packing_util';\nimport {getCoordsDataType} from
'./shader_compiler';\n\nexport class ConcatPackedProgram implements GPGPUProgram {\n variableNames:
string[];\n packedInputs = true;\n packedOutput = true;\n outputShape: number[] = [];\n userCode: string;\n\n
constructor(shapes: number[][], axis: number) {\n this.outputShape = backend_util.computeOutShape(shapes,
axis);\n const shape = this.outputShape;\n const rank = shape.length;\n const dtype =
getCoordsDataType(rank);\n const coords = getChannels('coords', rank);\n const channels = ['x', 'y', 'z', 'w', 'u',
'v'].slice(0, rank);\n this.variableNames = shapes.map((_, i) => `T${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]} = ${coords[rank - 2]} + 1;\n
if (${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,

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function shift: number) {
    const channelIdx = channels.indexOf(channel);
    const res = channels.map((c, idx) => {
        if (idx === channelIdx) {
            return `$[c] - $[shift]`;
        } else {
            return c;
        }
    });
    return res.join(',')
}

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 *=============================================================================

import {Imag, ImagInputs, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-core';

import {MathBackendWebGL} from '../backend_webgl';

export function imag(args:
    {inputs: ImagInputs, backend: MathBackendWebGL}):
    TensorInfo {
  const {inputs, backend} = args;
  const input = inputs;
  const inputData = backend.tensorData.get(input.dataId);
  return identity({inputs: {x: inputData.complexTensorInfos.imag}, backend});
}

export const imagConfig: KernelConfig = {
    kernelName: Imag,
    backendName: 'webgl',
    kernelFunc: imag as {} as KernelFunc
};

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 *=============================================================================

import {backend_util, Concat, ConcatAttrs, ConcatInputs, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';

import {MathBackendWebGL} from '../backend_webgl';

export function concat(args:
    {inputs: ConcatInputs, attrs: ConcatAttrs, backend: MathBackendWebGL}):
    TensorInfo {
  const {inputs, backend, attrs} = args;
  const {axis} = attrs;
  const $axis = util.parseAxisParam(axis, inputs[0].shape)[0];
  const outShape = backend_util.computeOutShape(inputs.map(t => t.shape), $axis);
  if (util.sizeFromShape(outShape) === 0) {
    return backend.makeTensorInfo(outShape, inputs[0].dtype, []);
  }
  const shapes = inputs.map(t => t.shape);
  backend_util.assertParamsConsistent(shapes, $axis);
  return concatImpl($inputs, $axis, backend);
}

export const concatConfig: KernelConfig = {
    kernelName: Concat,
    backendName: 'webgl',
    kernelFunc: concat as {} as KernelFunc
};

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 *=============================================================================

import {gpgpu_math} from '@tensorflow/tfjs-core';

export class Conv2DProgram implements GPGPUProgram {
    variableNames = ['x', 'W'];
    outputShape: number[];
    userCode: string;
    constructor() {
        convInfo: backend_util.Conv2DInfo, addBias = false,
        activation: string = null, hasPreluActivationWeights = false,
        hasLeakyreluAlpha = false
    }
    this.outputShape = convInfo.outShape;
    const padTop = convInfo.padInfo.top;
    const padLeft = convInfo.padInfo.left;
    const strideHeight = convInfo.strideHeight;
    const strideWidth =

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void main() {
    ivec4 coords = getOutputCoords();
    int batch = coords[0];
    int d2 = coords[2];

    ivec2 xRCCorner =
        ivec2(coords[1], coords[0]) * strides - pads;
    int xRCorner = xRCCorner.x;
    int xCCorner = xRCCorner.y;

    // Convolve x(?, ?, d1) with w(:, :, d1, d2) to get y(yR, yC, d2).
    // ? = to be determined. = across all values in that axis.
    float dotProd = 0.0;
    for (int wR = 0; wR < filterHeight; wR++) {
        int xR = xRCorner + wR * dilationHeight;
        if (xR < 0 || xR >= inputHeight) {
            continue;
        }

        for (int wC = 0; wC < filterWidth; wC++) {
            int xC = xCCorner + wC * dilationWidth;
            if (xC < 0 || xC >= inputWidth) {
                continue;
            }

            for (int d1 = 0; d1 < inputDepthNearestVec4; d1 += 4) {
                vec4 wValues = vec4(
                    getW(wR, wC, d1, d2),
                    getW(wR, wC, d1 + 1, d2),
                    getW(wR, wC, d1 + 2, d2),
                    getW(wR, wC, d1 + 3, d2)
                );

                if (isChannelsLast) {
                    vec4 xValues = vec4(
                        getX(batch, xR, xC, d1),
                        getX(batch, xR, xC, d1 + 1),
                        getX(batch, xR, xC, d1 + 2),
                        getX(batch, xR, xC, d1 + 3)
                    );
                } else {
                    vec4 xValues = vec4(
                        getX(batch, d1, xR, xC),
                        getX(batch, d1 + 1, xR, xC),
                        getX(batch, d1 + 2, xR, xC),
                        getX(batch, d1 + 3, xR, xC)
                    );
                }

                dotProd += dot(xValues, wValues);
            }
        }
    }
}

else if ($isChannelsLast) {
    vec2 xValues = vec2(
        getX(batch, xR, xC),
        getX(batch, d1 + 1, xR, xC)
    );

    dotProd += dot(xValues, wValues);
}

else if ($isChannelsLast) {
    vec3 xValues = vec3(
        getX(batch, xR, xC),
        getX(batch, d1 + 1, xR, xC),
        getX(batch, d1 + 2, xR, xC)
    );

    dotProd += dot(xValues, wValues);
}

else if ($isChannelsLast) {
    vec3 xValues = vec3(
        getX(batch, xR, xC),
        getX(batch, d1 + 1, xR, xC),
        getX(batch, d1 + 2, xR, xC)
    );

    dotProd += dot(xValues, wValues);
}

else if ($isChannelsLast) {
    vec3 xValues = vec3(
        getX(batch, xR, xC),
        getX(batch, d1 + 1, xR, xC),
        getX(batch, d1 + 2, xR, xC)
    );

    dotProd += dot(xValues, wValues);
}

else if ($isChannelsLast) {
    vec3 xValues = vec3(
        getX(batch, xR, xC),
        getX(batch, d1 + 1, xR, xC),
        getX(batch, d1 + 2, xR, xC)
    );

    dotProd += dot(xValues, wValues);
}

else if ($isChannelsLast) {
    vec3 xValues = vec3(
        getX(batch, xR, xC),
        getX(batch, d1 + 1, xR, xC),
        getX(batch, d1 + 2, xR, xC)
    );

    dotProd += dot(xValues, wValues);
}

else if ($isChannelsLast) {
    vec3 xValues = vec3(
        getX(batch, xR, xC),
        getX(batch, d1 + 1, xR, xC),
        getX(batch, d1 + 2, xR, xC)
    );

    dotProd += dot(xValues, wValues);
}

else if ($isChannelsLast) {
    vec3 xValues = vec3(
        getX(batch, xR, xC),
        getX(batch, d1 + 1, xR, xC),
        getX(batch, d1 + 2, xR, xC)
    );

    dotProd += dot(xValues, wValues);
}

else if ($isChannelsLast) {
    vec3 xValues = vec3(
        getX(batch, xR, xC),
        getX(batch, d1 + 1, xR, xC),
        getX(batch, d1 + 2, xR, xC)
    );

    dotProd += dot(xValues, wValues);
}

else if ($isChannelsLast) {
    vec3 xValues = vec3(
        getX(batch, xR, xC),
        getX(batch, d1 + 1, xR, xC),
        getX(batch, d1 + 2, xR, xC)
    );

    dotProd += dot(xValues, wValues);
}

else if ($isChannelsLast) {
    vec3 xValues = vec3(
        getX(batch, xR, xC),
        getX(batch, d1 + 1, xR, xC),
        getX(batch, d1 + 2, xR, xC)
    );

    dotProd += dot(xValues, wValues);
}

else if ($isChannelsLast) {
    vec3 xValues = vec3(
        getX(batch, xR, xC),
        getX(batch, d1 + 1, xR, xC),
        getX(batch, d1 + 2, xR, xC)
    );

    dotProd += dot(xValues, wValues);
}

else if ($isChannelsLast) {
    vec3 xValues = vec3(
        getX(batch, xR, xC),
        getX(batch, d1 + 1, xR, xC),
        getX(batch, d1 + 2, xR, xC)
    );

    dotProd += dot(xValues, wValues);
}

else if ($isChannelsLast) {
    vec3 xValues = vec3(
        getX(batch, xR, xC),
        getX(batch, d1 + 1, xR, xC),
        getX(batch, d1 + 2, xR, xC)
    );

    dotProd += dot(xValues, wValues);
}

else if ($isChannelsLast) {
    vec3 xValues = vec3(
        getX(batch, xR, xC),
        getX(batch, d1 + 1, xR, xC),
        getX(batch, d1 + 2, xR, xC)
    );

    dotProd += dot(xValues, wValues);
}

else if ($isChannelsLast) {
    vec3 xValues = vec3(
        getX(batch, xR, xC),
        getX(batch, d1 + 1, xR, xC),
        getX(batch, d1 + 2, xR, xC)
    );

    dotProd += dot(xValues, wValues);
}

else if ($isChannelsLast) {
    vec3 xValues = vec3(
        getX(batch, xR, xC),
        getX(batch, d1 + 1, xR, xC),
        getX(batch, d1 + 2, xR, xC)
    );

    dotProd += dot(xValues, wValues);
}

else if ($isChannelsLast) {
    vec3 xValues = vec3(
        getX(batch, xR, xC),
        getX(batch, d1 + 1, xR, xC),
        getX(batch, d1 + 2, xR, xC)
    );

    dotProd += dot(xValues, wValues);
}

else if ($isChannelsLast) {
    vec3 xValues = vec3(
        getX(batch, xR, xC),
        getX(batch, d1 + 1, xR, xC),
        getX(batch, d1 + 2, xR, xC)
    );

    dotProd += dot(xValues, wValues);
}

else if ($isChannelsLast) {
    vec3 xValues = vec3(
        getX(batch, xR, xC),
        getX(batch, d1 + 1, xR, xC),
        getX(batch, d1 + 2, xR, xC)
    );

    dotProd += dot(xValues, wValues);
}

else if ($isChannelsLast) {
    vec3 xValues = vec3(
        getX(batch, xR, xC),
        getX(batch, d1 + 1, xR, xC),
        getX(batch, d1 + 2, xR, xC)
    );

    dotProd += dot(xValues, wValues);
}

else if ($isChannelsLast) {
    vec3 xValues = vec3(
        getX(batch, xR, xC),
        getX(batch, d1 + 1, xR, xC),
        getX(batch, d1 + 2, xR, xC)
getX(batch, $\{inputDepthNearestVec4\} + 1, xR, xC),
      getX(batch, $\{inputDepthNearestVec4\} + 2, xR, xC)
  );
  dotProd += dot(xValues, wValues);
}


}

        float result = dotProd;
        $\{addBiasSnippet}\n        $\{applyActivationSnippet}\n
        setOutput(result);
    }


}

export class Conv3DProgram implements GPGPUProgram {

    variableNames = ['x', 'W'];
    outputShape: number[];
    userCode: string;

    constructor(convInfo: backend_util.Conv3DInfo) {
        this.outputShape = convInfo.outShape;
        const padFront = convInfo.padInfo.front;
        const padTop = convInfo.padInfo.top;
        const padLeft = convInfo.padInfo.left;
        const strideDepth = convInfo.strideDepth;
        const strideHeight = convInfo.strideHeight;
        const strideWidth = convInfo.strideWidth;
        const dilationDepth = convInfo.dilationDepth;
        const dilationHeight = convInfo.dilationHeight;
        const dilationWidth = convInfo.dilationWidth;
        const filterDepth = convInfo.filterDepth;
        const filterHeight = convInfo.filterHeight;
        const filterWidth = convInfo.filterWidth;

        const inputDepthNearestVec4 = Math.floor(convInfo.inChannels / 4) * 4;
        const inputDepthVec4Remainder = convInfo.inChannels % 4;
        this.userCode = `const ivec3 strides = ivec3(${strideDepth}, ${strideHeight}, ${strideWidth});
          const ivec3 pads = ivec3(${padFront}, ${padTop}, ${padLeft});

          void main() {
            ivec5 coords = getOutputCoords();
            int batch = coords.x;
            int d2 = coords.u;
            ivec3 xFRCCorner = ivec3(coords.y, coords.z, coords.w) * strides - pads;
            int xFCorner = xFRCCorner.x;
            int xRCorner = xFRCCorner.y;
            int xCCorner = xFRCCorner.z;

            // Convolve x(?, ?, ?, d1) with w(:, :, :, d1, d2) to get
            // y(yF, yR, yC, d2). ? = to be
determined. : = across all
            // values in that axis.
            float dotProd = 0.0;
            for (int wF = 0; wF < $\{filterDepth\}; wF++) {
              int xF = xFCorner + wF * $\{dilationDepth\};
              if (xF < 0 || xF >= $\{convInfo.inDepth\}) {
                continue;
              }

              for (int wR = 0; wR < $\{filterHeight\}; wR++) {
                int xR = xRCorner + wR * $\{dilationHeight\};
                if (xR < 0 || xR >= $\{convInfo.inHeight\}) {
                  continue;
                }

                for (int wC = 0; wC < $\{filterWidth\}; wC++) {
                  int xC = xCCorner + wC * $\{dilationWidth\};
                  if (xC < 0 || xC >= $\{convInfo.inWidth\}) {
                    continue;
                  }

                  for (int d1 = 0; d1 < $\{inputDepthNearestVec4\}; d1 += 4) {
                    vec4 xValues = vec4($\{inputDepthNearestVec4\}, d1 + 2);
                    vec4 wValues = vec4($\{inputDepthNearestVec4\}, d1 + 3);
                    dotProd += dot(xValues, wValues);
                  }
                }
              }
            }

            setOutput(dotProd);
          }
    `;
  }
}

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 */
```javascript
import {backend_util} from '@tensorflow/tfjs-core';
import {getGlslDifferences} from './glsl_version';
import {GPGPUProgram} from './gpgpu_math';

export class Im2ColPackedProgram implements GPGPUProgram {
  variableNames = ['A'];
  packedInputs = true;
  packedOutput = true;

  outputShape: number[];
  userCode: string;

  constructor(
      outputShape: number[], inputShape: number[],
      convInfo: backend_util.Conv2DInfo)
  {
    this.outputShape = outputShape;
    const {filterWidth, inChannels, strideWidth, strideHeight, padInfo, outWidth, dilationWidth, dilationHeight, dataFormat} = convInfo;
    const {left, top} = padInfo;
    const itemsPerBlockRow = inChannels * filterWidth;
    const glsl = getGlslDifferences();
    const isChannelsLast = dataFormat === 'channelsLast';
    const rowDim = isChannelsLast ? 0 : 1;
    const colDim = isChannelsLast ? 1 : 2;

    let unrolled = '';

    for (let row = 0; row <= 1; row++) {
      for (let col = 0; col <= 1; col++) {
        unrolled += `blockIndex = rc.y + ${col};
          pos = rc.x + ${row};

          if(blockIndex < ${outputShape[1]} &&
          pos < ${outputShape[0]} offsetY = int(blockIndex / (${outWidth}));
          pos = rc.x + ${row};
          if(pos < ${outWidth} && d0 <
          d0 = offsetY + ${dilationHeight} * (pos / (${itemsPerBlockRow}));
          if(d0 <
          d1 = offsetX + ${dilationWidth} * (pos / ${itemsPerBlockRow}));
          if(d1 < ${inputShape[rowDim]} && d1 >= 0) {

            ch = int(mod(float(pos), ${inputShape[colDim]}));
            if (${isChannelsLast}) {
              innerDims = vec2(d1, ch);
              result[$(row * 2 + col) = getChannel(ch,

            } else {
              innerDims = vec2(d0, d1);
              result[$(row * 2 + col) = getChannel(ch,

            }
        `;
      }
    }

    this.userCode = `void main() {
      ivec2 rc = getOutputCoords();
      vec4 result = vec4(0);
      int blockIndex, pos, offsetY, d0, offsetX, d1, ch;
      vec2 innerDims;

      ${unrolled}

      glsl.output = result;
    }
  }
}
```

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---

```typescript
import {backend_util, env, TensorInfo, util} from '@tensorflow/tfjs-core';
import {MathBackendWebGL} from '../backend_webgl';
import {Im2ColPackedProgram} from '../im2col_packed_gpu';
import {mapActivationToShaderProgram} from '../kernel_utils/kernel_funcs_utils';
import {MatMulPackedProgram} from '../mulmat_packed_gpu';
import * as webgl_util from '../webgl_util';
import {batchMatMulImpl, MATMUL_SHARED_DIM_THRESHOLD} from './BatchMatMul_impl';
import {identity} from './Identity';
import {reshape} from './Reshape';

type Conv2DConfig = {
  x: TensorInfo,
  filter: TensorInfo,
  convInfo: backend_util.Conv2DInfo,
  backend: MathBackendWebGL,
  bias?: TensorInfo,
  preluActivationWeights?: TensorInfo,
  leakyreluAlpha?: number,
  activation?: backend_util.Activation
};

// For 1x1 kernels that iterate through every point in the input, convolution can be expressed as matrix multiplication (without need for memory remapping). export function conv2dByMatMul({
  x, filter, 
  backend: MathBackendWebGL,
  bias?: TensorInfo,
  preluActivationWeights?: TensorInfo,
  leakyreluAlpha?: number,
  activation?: backend_util.Activation
}):
```

---

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if (batchMatMulWillBeUnpacked ||
    !env().getBool('WEBGL_LAZILY_UNPACK') ||
    !env().getBool('WEBGL_PACK_BINARY_OPERATIONS') ||
    reshapeWillBeExpensive) {
  const targetShape = isChannelsLast ?
      xShape[0] * xShape[1] * xShape[2] :
      xShape[0] * xShape[2] * xShape[3];
  const xReshaped = reshape({
    inputs: {x},
    backend,
    attrs: {shape: [1, targetShape, convInfo.inChannels]}
  });
  const filterReshaped = reshape({
    inputs: {x: filter},
    backend,
    attrs: {shape: [1, convInfo.inChannels, convInfo.outChannels]}
  });
  const result = batchMatMulImpl({
    a: xReshaped,
    b: filterReshaped,
    transposeA,
    transposeB,
    backend,
    bias, activation, preluActivationWeights, leakyreluAlpha
  });
  out = reshape({
    inputs: {x: result},
    backend, attrs: {shape: convInfo.outShape}});
  intermediates.push(xReshaped);
  intermediates.push(filterReshaped);
  intermediates.push(result);
} else {
  // Following optimization is specific to packed |x| with odd row count
  // (For example, in channelLast mode,
  // 'row count' refers to x.shape[2])
  // we avoid expensive packed 2x2 reshape by padding row count to next
  // even number. When x.shape[2] is odd, the result of packed batchMatMul is
  // the same (has the same texture layout and and values in the texture) as
  // it is for even x.shape[2] + 1. We make the odd-rows tensor to look
  // like even-rows tensor before the operation and, after the batchMatMul,
  // fix the even-rows result to have odd number of rows.
  const targetShape = isChannelsLast ?
      xShape[0] * xShape[1] * (xShape[2] + 1) :
      xShape[0] * (xShape[2] + 1) * xShape[3];
  const xReshaped: TensorInfo = {
    dataId: x.dataId,
    shape: [1, targetShape, convInfo.inChannels],
    dtype: x.dtype
  };
  // xTexData.shape gets referenced from GPGPUBinary.inShapeInfos.
  // Decrementing row count, after batchMatMul->...->compileProgram leads to
  // invalid row count within the reference in GPGPUBinary.inShapeInfos.
  // Alternative fix would be to provide a copy to GPGPUBinary.inShapeInfos
  // in compileProgram method, but that would affect compilation of all
  // programs - instead, provide a copy here, with even row count, before
  // calling batchMatMul->...->
  // compileProgram and after that, the original xTexData.shape is restored.
  const originalXTexDataShape = xTexData.shape;
  xTexData.shape = xTexData.shape.slice();
  util.assert(
      webgl_util.isReshapeFree(xTexData.shape, xReshaped.shape),
      () => `packed reshape ${xTexData.shape} to ${
          xReshaped.shape} isn't free`);
  const filterReshaped = reshape({
    inputs: {x: filter},
    backend,
    attrs: {shape: [1, convInfo.inChannels, convInfo.outChannels]}
  });
  intermediates.push(filterReshaped);
  const pointwiseConv = batchMatMulImpl({
    a: xReshaped,
    b: filterReshaped,
    backend,
    transposeA,
    transposeB, bias, activation,
    preluActivationWeights, leakyreluAlpha
  });
  out = identity({inputs: {x: pointwiseConv}, backend});
  out.shape = convInfo.outShape;
  intermediates.push(pointwiseConv);
  // Restore the input shape to original.
  xTexData.shape = originalXTexDataShape;
  // Set the output shape - there is no need for expensive reshape as data
  // layout is already correct.
  pointwiseConvTexData = convInfo.outShape;
  out = identity({inputs: {x: pointwiseConv}, backend});
  out.shape = convInfo.outShape;
  intermediates.push(pointwiseConv);
}
for (const i of intermediates) {
  backend.disposeIntermediateTensorInfo(i);
}
return out;

// Implements the im2row algorithm as outlined in "High Performance
// Convolutional Neural Networks for Document Processing" (Suvisoft, 2006)
export function conv2dWithIm2Row({
  x,
  filter,
  convInfo,
  backend,
  bias = null,
  preluActivationWeights = null,
  leakyreluAlpha = 0,
  activation = null
}:
  Conv2DConfig) {
  // Rearranges conv2d input so each block to be convolved over forms the
  // column of a new matrix with shape [filterWidth * filterHeight *
  // inChannels, outHeight * outWidth]. The filter is also rearranged
  // so each
  // output channel forms a row of a new matrix with shape [outChannels, inChannels, inChannels, inChannels],
  // the convolution is then computed by multiplying these matrices and reshaping the result.
  const
    filterWidth, filterHeight, inChannels, outWidth, dataFormat
  } = convInfo;
  const isChannelsLast = dataFormat === 'channelsLast';
  const sharedDim = filterWidth * filterHeight *
      inChannels; const numCols = outHeight * outWidth;
  const x2ColShape = [sharedDim, numCols];
  const

```javascript
transposeA = true;
const transposeB = false;

const intermediates: TensorInfo[] = [];

const xSqueezed = reshape({
  inputs: [x],
  backend, attr: {shape: x.shape.slice(1)}
}, wRow);

const intermediates = push(xSqueezed);

const im2ColProgram = new Im2ColPackedProgram(x2ColShape, xSqueezed.shape, convInfo);

const im2Col = backend.runWebGLProgram(im2ColProgram, [xSqueezed], 'float32');

const im2ColReshaped = reshape({
  inputs: [x: im2Col],
  backend, attr: {shape: [1, x2ColShape[0], x2ColShape[1]]}
}, intermediates = push(im2ColReshaped);

const hasBias = bias != null;

const hasPreluActivationWeights = preluActivationWeights != null;

const hasLeakyreluAlpha = activation === 'leakyrelu';

const matmulProgram = new MatMulPackedProgram(
  im2ColReshaped.shape as [number, number, number],
  w2Row.shape as [number, number, number, number],
  [1, numCols, convInfo.outChannels], transposeA, transposeB, hasBias,
  fusedActivation, hasPreluActivationWeights, hasLeakyreluAlpha);

const product = backend.runWebGLProgram(matmulProgram, inputs, 'float32');

const out = isChannelsLast ?
  [1, outHeight, outWidth, convInfo.outChannels] :
  [1, convInfo.outChannels, outHeight, outWidth];

return out;
```

---

```javascript
import {backend_util, Conv2D, Conv2DAatts, Conv2DInputs, env, KernelConfig, TensorInfo} from '@tensorflow/tfjs-core';

import {MathBackendWebGL} from '../backend_webgl';

export function conv2d(
    args:
        {inputs: Conv2DInputs, attrs: Conv2DAttrs, backend: MathBackendWebGL}) {
  const {inputs, backend, attrs} = args;

  const {x, filter} = inputs;
  const {strides, pad, dataFormat, dilations, dimRoundingMode} = attrs;

  const $dataFormat = backend_util.convertConv2DDataFormat(dataFormat);
  const convInfo = backend_util.computeConv2DInfo(
      x.shape as [number, number, number, number],
      filter.shape as [number, number, number, number],
      strides, pad, dataFormat, dilations, dimRoundingMode, false /* depthwise */,
      $dataFormat);

  let out: TensorInfo;

  if (convInfo.filterHeight === 1 && convInfo.filterWidth === 1 &&
      convInfo.dilationHeight === 1 && convInfo.dilationWidth === 1 &&
      (convInfo.padInfo.type === 'SAME' || convInfo.padInfo.type === 'VALID')) {
    out = conv2dByMatMul({x, filter, convInfo, backend});
  } else if (env().getBool('WEBGL_CONV_IM2COL') && x.shape[0] === 1) {
    out = conv2dWithIm2Row({x, filter, convInfo, backend});
  } else {
    const program = new Conv2DProgram(convInfo);
    out = backend.runWebGLProgram(program, inputs, 'float32');
  }

  const outReshaped = reshape({
      inputs: {x: out},
      backend, attr: {shape: outShape}
    }, intermediates = push(outReshaped);

  backend.disposeIntermediateTensorInfo(out);

  return outReshaped;
}
```

---

```javascript
const conv2DConfig: KernelConfig = {
  kernelName: Conv2D,
  backendName: 'webgl',
  kernelFunc: conv2d as {} as KernelFunc,
};
```

---

```javascript
import {backend_util, Conv2D, Conv2DInputs, env, KernelConfig, TensorInfo} from '@tensorflow/tfjs-core';

import {MathBackendWebGL} from '../backend_webgl';

export function conv2d(
    args:
        {inputs: Conv2DInputs, attrs: Conv2DAttrs, backend: MathBackendWebGL}) {
  const {inputs, backend, attrs} = args;

  const {x, filter} = inputs;
  const {strides, pad, dataFormat, dilations, dimRoundingMode} = attrs;

  const $dataFormat = backend_util.convertConv2DDataFormat(dataFormat);
  const convInfo = backend_util.computeConv2DInfo(
      x.shape as [number, number, number, number],
      filter.shape as [number, number, number, number],
      strides, dilations, pad, dataFormat, dimRoundingMode, false /* depthwise */,
      $dataFormat);

  let out: TensorInfo;

  if (convInfo.filterHeight === 1 && & convInfo.filterWidth === 1 &&
      convInfo.dilationHeight === 1 && convInfo.dilationWidth === 1 &&
      convInfo.strideHeight === 1 && convInfo.strideWidth === 1 &&
      convInfo.padInfo.type === 'SAME' || convInfo.padInfo.type === 'VALID')) {
    out = conv2dByMatMul({x, filter, convInfo, backend});
  } else if (env().getBool('WEBGL_CONV_IM2COL') && x.shape[0] === 1) {
    out = conv2dWithIm2Row({x, filter, convInfo, backend});
  } else {
    const program = new Conv2DProgram(convInfo);
    out = backend.runWebGLProgram(program, inputs, 'float32');
  }

  const outReshaped = reshape({
      inputs: {x: out},
      backend, attr: {shape: convInfo.outShape}
    }, intermediates = push(outReshaped);

  backend.disposeIntermediateTensorInfo(out);

  return outReshaped;
}
```

---

```javascript
const conv2DConfig: KernelConfig = {
  kernelName: Conv2D,
  backendName: 'webgl',
  kernelFunc: conv2d as {} as KernelFunc,
};
```

---
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=============================================================================

import {backend_util} from '@tensorflow/tfjs-core';
import {GPGPUProgram} from './gpgpu_math';

export class Conv2DDerFilterProgram implements GPGPUProgram {
  variableNames = ['x', 'dy'];
  outputShape: number[];
  userCode: string;
  constructor(convInfo: backend_util.Conv2DInfo) {
    this.outputShape = convInfo.filterShape;
    const strideHeight = convInfo.strideHeight;
    const strideWidth = convInfo.strideWidth;
    const padTop = convInfo.padInfo.top;
    const padLeft = convInfo.padInfo.left;
    const isChannelsLast = convInfo.dataFormat === 'channelsLast';
    this.userCode = 'void main()
{
    ivec4 coords = getOutputCoords();
    int wR = coords.x;
    int wC = coords.y;
    int d1 = coords.z;
    int d2 = coords.w;
    // Convolve x(:, :, d1) with dy(:, :, d2) to get dw(wR, wC, d1, d2).
    // = to be determined.
    float dotProd = 0.0;
    for (int b = 0; b < convInfo.batchSize;
        int yR = 0;
        int xR = wR + yR * $strideHeight;
        int x = wC + yC * $strideWidth;
        int xPerm = $colDim[0] - 1 - x;
    }
    int d1Perm = convInfo.dataFormat === 'channelsLast';
    float xValue = getX(b, d1, x, xPerm);
    dotProd += (xValue * dyValue);
}
}

export class Conv2DDerInputProgram implements GPGPUProgram {
  variableNames = ['dy', 'W'];
  outputShape: number[];
  userCode: string;
  constructor(convInfo: backend_util.Conv2DInfo) {
    this.outputShape = convInfo.inShape;
    const filterHeight = convInfo.filterHeight;
    const filterWidth = convInfo.filterWidth;
    const strideHeight = convInfo.strideHeight;
    const strideWidth = convInfo.strideWidth;
    const isChannelsLast = convInfo.dataFormat === 'channelsLast';
    const padTop = filterHeight - 1 - convInfo.padInfo.top;
    const padLeft = filterWidth - 1 - convInfo.padInfo.left;
    const rowDim = isChannelsLast ? 1 : 2;
    const colDim = isChannelsLast ? 2 : 3;
    const channelDim = isChannelsLast ? 3 : 1;
    const ivec2 pads = ivec2(padTop, padLeft);
    ivec2 dyCorner = ivec2(coords[rowDim], coords[colDim]) - pads;
    int dyRCorner = dyCorner.x;
    int dyCCorner = dyCorner.y;
    // Convolve dy(:, ?, ?) with W(:, :, d1, d2) to compute dx(xR, xC, d1).
    float dotProd = 0.0;
    for (int wR = 0; wR < filterHeight;
        int xR = wR;
        int wC = 0;
        int xC = wC;
        int d2 = d2;
    }
    int d1Perm = convInfo.dataFormat === 'channelsLast';
    float xValue = getX(b, d1, x, xPerm);
    dotProd += (xValue * dyValue);
}

export class Conv3DDerFilterProgram implements GPGPUProgram {
  variableNames = ['x', 'dy'];
  outputShape: number[];
  userCode: string;
  constructor(convInfo: backend_util.Conv3DInfo) {
    this.outputShape = convInfo.filterShape;
    const strideDepth = convInfo.strideDepth;
    const strideHeight = convInfo.strideHeight;
    const strideWidth = convInfo.strideWidth;
    const isChannelsLast = convInfo.dataFormat === 'channelsLast';
    this.userCode = 'void main()
{
    ivec4 coords = getOutputCoords();
    int wR = coords.x;
    int wC = coords.y;
    int d1 = coords.z;
    int d2 = coords.w;
    // Convolve x(:, :, d1) with dy(:, :, d2) to get dw(wR, wC, d1, d2).
    // = to be determined.
    float dotProd = 0.0;
    for (int b = 0; b < convInfo.batchSize;
        int yR = 0;
        int xR = wR + yR * $strideHeight;
        int x = wC + yC * $strideWidth;
        int xPerm = $colDim[0] - 1 - x;
    }
    int d1Perm = convInfo.dataFormat === 'channelsLast';
    float xValue = getX(b, d1, x, xPerm);
    dotProd += (xValue * dyValue);
}

export class Conv3DDerInputProgram implements GPGPUProgram {
  variableNames = ['dy', 'W'];
  outputShape: number[];
  userCode: string;
  constructor(convInfo: backend_util.Conv3DInfo) {
    this.outputShape = convInfo.inShape;
    const filterHeight = convInfo.filterHeight;
    const filterWidth = convInfo.filterWidth;
    const strideHeight = convInfo.strideHeight;
    const strideWidth = convInfo.strideWidth;
    const isChannelsLast = convInfo.dataFormat === 'channelsLast';
    const padTop = filterHeight - 1 - convInfo.padInfo.top;
    const padLeft = filterWidth - 1 - convInfo.padInfo.left;
    const rowDim = isChannelsLast ? 1 : 2;
    const colDim = isChannelsLast ? 2 : 3;
    const channelDim = isChannelsLast ? 3 : 1;
    const ivec2 pads = ivec2($padTop, $padLeft);
    ivec2 dyCorner = ivec2(coords[rowDim], coords[colDim]) - pads;
    int dyRCorner = dyCorner.x;
    int dyCCorner = dyCorner.y;
    // Convolve dy(:, ?, ?) with W(:, :, d1, d2) to compute dx(xR, xC, d1).
    float dotProd = 0.0;
    for (int wR = 0; wR < filterHeight;
        int xR = wR;
        int wC = 0;
        int xC = wC;
        int d2 = d2;
    }
    int d1Perm = convInfo.dataFormat === 'channelsLast';
    float xValue = getX(b, d1, x, xPerm);
    dotProd += (xValue * dyValue);
}

export class Conv3DDerFilterProgram implements GPGPUProgram {
  variableNames = ['x', 'dy'];
  outputShape: number[];
  userCode: string;
  constructor(convInfo: backend_util.Conv3DInfo) {
    this.outputShape = convInfo.filterShape;
    const strideDepth = convInfo.strideDepth;
    const strideHeight = convInfo.strideHeight;
    const strideWidth = convInfo.strideWidth;
convInfo.strideWidth;
    const padFront = convInfo.padInfo.front;
    const padTop = convInfo.padInfo.top;
    const padLeft = convInfo.padInfo.left;

    this.userCode = `void main() {
        ivec5 coords = getOutputCoords();
        int wF = coords.x;
        int wR = coords.y;
        int wC = coords.z;
        int d1 = coords.w;
        int d2 = coords.u;
        float dotProd = 0.0;
        for (int b = 0; b < $convInfo.batchSize; b++) {
            for (int yF = 0; yF < $convInfo.outDepth; yF++) {
                int xF = wF + yF * $strideDepth - $padFront;
                if (xF < 0 || xF >= $convInfo.inDepth) {
                    continue;
                }
                for (int xR = 0; xR < $convInfo.inHeight; xR++) {
                    int xR = wR + xR * $strideHeight - $padTop;
                    if (xR < 0 || xR >= $convInfo.inHeight) {
                        continue;
                    }
                    for (int yC = 0; yC < $convInfo.outWidth; yC++) {
                        int xC = wC + yC * $strideWidth - $padLeft;
                        if (xC < 0 || xC >= $convInfo.inWidth) {
                            continue;
                        }
                        float dyValue = getDy(b, yF, yR, yC, d2);
                        float xValue = getX(b, xF, xR, xC, d1);
                        dotProd += (xValue * dyValue);
                    }
                }
            }
            setOutput(dotProd);
        }
    }
    `;
}
export class Conv3DDerInputProgram implements GPGPUProgram {
  variableNames = ['dy', 'W'];
  outputShape: number[];
  userCode: string;
  constructor(convInfo: backend_util.Conv3DInfo) {
    this.outputShape = convInfo.inShape;
    const filterDepth = convInfo.filterDepth;
    const filterHeight = convInfo.filterHeight;
    const filterWidth = convInfo.filterWidth;
    const strideDepth = convInfo.strideDepth;
    const strideHeight = convInfo.strideHeight;
    const strideWidth = convInfo.strideWidth;
    const padFront = filterDepth - 1 - convInfo.padInfo.front;
    const padTop = filterHeight - 1 - convInfo.padInfo.top;
    const padLeft = filterWidth - 1 - convInfo.padInfo.left;
    this.userCode = `const ivec3 pads = ivec3(${padFront}, ${padTop},
        ${padLeft});
        void main() {
        ivec5 coords = getOutputCoords();
        int batch = coords.x;
        int d1 = coords.u;
        ivec3 dyCorner = ivec3(coords.y, coords.z, coords.w) - pads;
        int dyFCorner = dyCorner.x;
        int dyRCorner = dyCorner.y;
        int dyCCorner = dyCorner.z;
        float dotProd = 0.0;
        for (int wF = 0; wF < $filterDepth; wF++) {
            float dyF = float(dyFCorner + wF) / $strideDepth;
            if (dyF < 0.0 || dyF >= $convInfo.outDepth || fract(dyF) > 0.0) {
                continue;
            }
            int idyF = int(dyF);
            int wFPerm = $filterDepth - 1 - wF;
            for (int wR = 0; wR < $filterHeight; wR++) {
                float dyR = float(dyRCorner + wR) / $strideHeight;
                if (dyR < 0.0 || dyR >= $convInfo.outHeight ||
                    fract(dyR) > 0.0) {
                    continue;
                }
                int idyR = int(dyR);
                int wRPerm = $filterHeight - 1 - wR;
                for (int wC = 0; wC < $filterWidth; wC++) {
                    float dyC = float(dyCCorner + wC) / $strideWidth;
                    if (dyC < 0.0 || dyC >= $convInfo.outChannels) {
                        continue;
                    }
                    int idyC = int(dyC);
                    int wCPerm = $filterWidth - 1 - wC;
                    for (int d2 = 0; d2 < $convInfo.outChannels; d2++) {
                        float xValue = getDy(batch, idyF, idyR, idyC, d2);
                        float wValue = getW(wFPerm, wRPerm, wCPerm, d1, d2);
                        dotProd += (xValue * wValue);
                    }
                }
            }
        }
        setOutput(dotProd);
    }`;
  }
}
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 * limitations under the License.
 */
import {backend_util, Conv2DBackpropFilter, Conv2DBackpropFilterAttrs, Conv2DBackpropFilterInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';
import {MathBackendWebGL} from '../backend_webgl';
import {Conv2DDerFilterProgram} from '../conv_backprop_gpu';

export function conv2DBackpropFilter(args: {
    inputs: Conv2DBackpropFilterInputs,
    attrs: Conv2DBackpropFilterAttrs,
    backend: MathBackendWebGL
}) {
    const {inputs, backend, attrs} = args;
    const strides = backend.getKernelStrides();
    const pad = backend.getKernelPadding();
    const dataFormat = backend.getDataFormat();
    const dimRoundingMode = backend.getKernelDimRoundingMode();
    const filterShape = attrs.filterShape;
    const $dataFormat = backend_util.convertConv2DDataFormat(dataFormat);
    const convInfo = backend_util.computeConv2DInfo($dataFormat)

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x.shape as [number, number, number, number], filterShape, strides,\n  1 /* dilations *//pad, dimRoundingMode,\n  false /* depthwise *//dataFormat);\n  const program = new Conv2DFilterProgram(convInfo);
  return backend.runWebGLProgram(program, [x, dy, 'float32']);\n  }\n}\n\nexport const conv2DBackpropFilterConfig:
  KernelConfig = {
    kernelName: Conv2DBackpropFilter, backendName: 'webgl',\n    kernelFunc: conv2DBackpropFilter as {} as KernelFunc,\n    /* */\n    license: Copyright 2020 Google LLC. All Rights Reserved.\n  }\n\nconst program = new Conv2DFilterProgram(convInfo);
  return backend.runWebGLProgram(program, [x, dy, 'float32']);\n\nexport const conv2DBackpropFilterConfig:
  KernelConfig = {
    kernelName: Conv2DBackpropFilter, backendName: 'webgl',\n    kernelFunc: conv2DBackpropFilter as {} as KernelFunc,\n    /* */\n    license: Copyright 2020 Google LLC. All Rights Reserved.\n  }\n\nconst program = new Conv2DFilterProgram(convInfo);
  return backend.runWebGLProgram(program, [x, dy, 'float32']);\n\nexport const conv3DBackpropFilterV2Config:
  KernelConfig = {
    kernelName: Conv3DBackpropFilterV2, backendName: 'webgl',\n    kernelFunc: conv3DBackpropFilterV2 as {} as KernelFunc,\n    /* */\n    license: Copyright 2020 Google LLC. All Rights Reserved.\n  }\n\nconst program = new Conv3DProgram(convInfo);
  return backend.runWebGLProgram(program, [x, filter, 'float32']);\n\nexport const conv3DBackpropFilterV2Config:
  KernelConfig = {
    kernelName: Conv3DBackpropFilterV2, backendName: 'webgl',\n    kernelFunc: conv3DBackpropFilterV2 as {} as KernelFunc,\n    /* */\n    license: Copyright 2020 Google LLC. All Rights Reserved.\n  }\n\nconst program = new Conv3DProgram(convInfo);
  return backend.runWebGLProgram(program, [x, filter, 'float32']);\n\nexport const conv3DBackpropFilterV2Config:
  KernelConfig = {
    kernelName: Conv3DBackpropFilterV2, backendName: 'webgl',\n    kernelFunc: conv3DBackpropFilterV2 as {} as KernelFunc,\n    /* */\n    license: Copyright 2020 Google LLC. All Rights Reserved.\n  }\n\nconst program = new Conv3DProgram(convInfo);
  return backend.runWebGLProgram(program, [x, filter, 'float32']);\n\nexport const conv3DBackpropFilterV2Config:
  KernelConfig = {
    kernelName: Conv3DBackpropFilterV2, backendName: 'webgl',\n    kernelFunc: conv3DBackpropFilterV2 as {} as KernelFunc,\n    /* */\n    license: Copyright 2020 Google LLC. All Rights Reserved.\n  }\n\nconst program = new Conv3DProgram(convInfo);
  return backend.runWebGLProgram(program, [x, filter, 'float32']);\n\nexport const conv3DBackpropFilterV2Config:
  KernelConfig = {
    kernelName: Conv3DBackpropFilterV2, backendName: 'webgl',\n    kernelFunc: conv3DBackpropFilterV2 as {} as KernelFunc,\n    /* */\n    license: Copyright 2020 Google LLC. All Rights Reserved.\n  }
import {MathBackendWebGL} from '@tensorflow/tfjs-core';

export function conv3DBackpropFilterV2(args: {
  inputs: Conv3DBackpropFilterV2Inputs,
  attrs: Conv3DBackpropFilterV2Attrs,
  backend: MathBackendWebGL
}) {
  const {inputs, backend, attrs} = args;
  const {x, dy} = inputs;
  const {strides, pad, filterShape} = attrs;
  const convInfo = backend_util.computeConv3DInfo(x.shape as [number, number, number, number, number], filterShape, strides, 1 /* dilations */ /pad);
  const program = new Conv3DDerFilterProgram(convInfo);
  return backend.runWebGLProgram(program, [x, dy], 'float32');
}

export const conv3DBackpropFilterV2Config: KernelConfig = {
  kernelName: Conv3DBackpropFilterV2,
  backendName: 'webgl',
  kernelFunc: conv3DBackpropFilterV2 as {} as KernelFunc,
};

import {Cosh, KernelConfig} from '@tensorflow/tfjs-core';

const COS = CHECK_NAN_SNIPPET_UNARY + `return cos(x);`;

export const cos = unaryKernelFunc({opSnippet: COS});

export const cosConfig: KernelConfig = {
  kernelName: Cos,
  backendName: 'webgl',
  kernelFunc: cos,
};

import { CHECK_NAN_SNIPPET_UNARY, unaryKernelFunc } from './kernel_utils/kernel_funcs_utils';

const COS = CHECK_NAN_SNIPPET_UNARY + `return cos(x);`;

export const cos = unaryKernelFunc({opSnippet: COS});

export const cosConfig: KernelConfig = {
  kernelName: Cos,
  backendName: 'webgl',
  kernelFunc: cos,
};

import { CHECK_NAN_SNIPPET_UNARY, unaryKernelFunc } from './kernel_utils/kernel_funcs_utils';

const COS = CHECK_NAN_SNIPPET_UNARY + `return cos(x);`;

export const cos = unaryKernelFunc({opSnippet: COS});

export const cosConfig: KernelConfig = {
  kernelName: Cos,
  backendName: 'webgl',
  kernelFunc: cos,
};

import { CHECK_NAN_SNIPPET_UNARY, unaryKernelFunc } from './kernel_utils/kernel_funcs_utils';

const COS = CHECK_NAN_SNIPPET_UNARY + `return cos(x);`;

export const cos = unaryKernelFunc({opSnippet: COS});

export const cosConfig: KernelConfig = {
  kernelName: Cos,
  backendName: 'webgl',
  kernelFunc: cos,
};
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'./kernel-utils/kernel-funcs-utils';

const COSH = `float e2x = exp(-x);
return (e2x + 1.0 / e2x) / 2.0;
`;

export const cosh = unaryKernelFunc({opSnippet: COSH});

export const coshConfig: KernelConfig = {
  kernelName: Cosh,
  backendName: 'webgl',
  kernelFunc: cosh,
}.

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 * distributed under the License is distributed on an "AS IS" BASIS,
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
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 * limitations under the License.
 */

import {GPGPUProgram} from './gpgpu_math';

export class CropAndResizeProgram implements GPGPUProgram {
  variableNames = ['Image', 'Boxes', 'BoxInd'];
  outputShape: number[] = [];
  userCode: string;
  constructor(imageShape: [number, number, number, number], boxShape: [number, number],
              cropSize: [number, number], method: 'bilinear'|'nearest',
              extrapolationValue: number) {
    const [batch, imageHeight, imageWidth, depth] = imageShape;
    const [numBoxes, ] = boxShape;
    const [cropHeight, cropWidth] = cropSize;
    this.outputShape = [numBoxes, cropHeight, cropWidth, depth];
    const methodId = method === 'bilinear' ? 1 : 0;
    const $height = $height == 0 ? 1 : $height;
    const $width = $width == 0 ? 1 : $width;
    const $height_ratio = $height_ratio;
    const $width_ratio = $width_ratio;
    void main() {
      ivec4 coords = getOutputCoords();
      int b = coords[0];
      int y = coords[1];
      int x = coords[2];
      int d = coords[3];

      // get box vals
      float y1 = getBoxes(b, 0);
      float x1 = getBoxes(b, 1);
      float y2 = getBoxes(b, 2);
      float x2 = getBoxes(b, 3);

      // get image in batch index
      int bInd = round(getBoxInd(b));
      if(bInd < 0 || bInd >= batch) {
        return;
      }

      float height_scale = heightScale;
      float width_scale = widthScale;

      float in_y = in_y;
      if( in_y < 0.0 || in_y > inputHeightFloat ) {
        setOutput(float(extrapolationValue));
        return;
      }
      float in_x = in_x;
      if( in_x < 0.0 || in_x > inputWidthFloat ) {
        setOutput(float(extrapolationValue));
        return;
      }

      vec2 sourceFracIndexCR = vec2(in_x, in_y);
      if($methodId == 1) {
        // Compute the four integer indices.
        ivec2 sourceFloorCR = ivec2(floor(sourceFracIndexCR + vec2(0.5, 0.5)));
        float topLeft = getImage(b, sourceFloorCR.y, sourceFloorCR.x, d);
        float bottomLeft = getImage(b, sourceFloorCR.y, sourceFloorCR.x, d);
        float bottomRight = getImage(b, sourceFloorCR.y, sourceFloorCR.x, d);
        float topRight = getImage(b, sourceFloorCR.y, sourceFloorCR.x, d);

        float bottom = bottomLeft + (bottomRight - bottomLeft) * fracCR.x;
        float newWidth = top + (bottom - top) * fracCR.y;
        setOutput(newValue); } else {

          // Compute the
          ivec2 sourceNearestCR = ivec2(sourceFloorIndexCR);
          float topLeft = getImage(b, sourceFloorCR.y, sourceFloorCR.x, d);
          float topRight = getImage(b, sourceFloorCR.y, sourceFloorCR.x, d);
          float bottomLeft = getImage(b, sourceFloorCR.y, sourceFloorCR.x, d);
          float bottomRight = getImage(b, sourceFloorCR.y, sourceFloorCR.x, d);
          float top = topLeft + (topRight - topLeft) * fracCR.x;
          float bottom = bottomLeft + (bottomRight - bottomLeft) * fracCR.x;
          float newWidth = top + (bottom - top) * fracCR.y;
          setOutput(newValue); } else {
          // Compute the
          ivec2 sourceNearestCR = ivec2(sourceFloorIndexCR + vec2(0.5, 0.5)));
          float newWidth = getImage(b, sourceNearestCR.y, sourceNearestCR.x, d);
          setOutput(newValue); }
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=============================================================================

import {CropAndResize, CropAndResizeAttrs, CropAndResizeInputs, KernelConfig, KernelFunc, 
  TensorInfo} from '@tensorflow/tfjs-core';

import {MathBackendWebGL} from '../backend_webgl';

export const cropAndResize = (args: {
  inputs: CropAndResizeInputs,
  backend: MathBackendWebGL,
  attrs: CropAndResizeAttrs
}): TensorInfo => {
  const {inputs, backend, attrs} = args;
  const {image, boxes, boxInd} = inputs;
  const {cropSize, method, 
    extrapolationValue} = attrs;

  const program = new CropAndResizeProgram(
    image.shape as [number,
    number, number, number],
    boxes.shape as [number, number, number, number],
    boxInd = inputs
  )

  return backend.runWebGLProgram(program, 
    image, boxes, boxInd, 'float32');
};

export const 
cropAndResizeConfig: KernelConfig = {
  kernelName: CropAndResize,
  backendName: 'webgl',
  kernelFunc: 
cropAndResize as {} as KernelFunc
};

=============================================================================

import {GPGPUContext} from './gpgpu_context';

export class CumSumProgram implements GPGPUProgram {
  variableNames = ['x'];
  outputShape: number[];
  userCode: string;

  // Caching uniform location for speed.
  index: WebGLUniformLocation;

  constructor(shape: number[], exclusive: boolean, reverse: boolean) {
    this.outputShape = shape;
    const rank = shape.length;
    const val = exclusive ? '0.0' : `getX(${getCoords(rank, 'coords')})`;
    const length = shape[shape.length - 1];
    let condition = '';
    let idxString = '';
    // When exclusive is set, the cumulative op becomes roll op that copies the
    // value from the previous index based on the direction specified by the
    // reverse flag.
    if (exclusive) {
      condition = reverse ? `end != ${length - 1}` : `end != 0`;
      idxString = reverse ? 'end + 1' : 'end - 1';
    } else {
      condition = reverse ? `end + pow2 < ${length}` : 'end >= pow2';
      idxString = (reverse ? 'end + pow2' : 'end - pow2');
    }

    this.userCode = `
      uniform float index;
      void main() {
        ${getCoordsDataType(rank)} coords = getOutputCoords();
        int end = ${getFinalCoord(rank, 'coords')};
        float val = ${val};
        int pow2 = int(pow(2.0, index));
        if (${condition}) {
          int idx = ${idxString};
          ${getFinalCoord(rank, 'coords')} = idx;
          val += getX(${getCoords(rank, 'coords')});
        }
        setOutput(val);
      }
    `;
  }

  getCustomSetupFunc(index: number) {
    return (gpgpu: GPGPUContext, webGLProgram: WebGLProgram) => {
      if (this.index == null) {
        this.index = gpgpu.getUniformLocation(webGLProgram, 'index');
      }
      gpgpu.gl.uniform1f(this.index, index);
    };
  }

  function getCustomSetupFunc(index: number) {
    return (gpgpu: GPGPUContext, webGLProgram: WebGLProgram) => {
      return (gpgpu: GPGPUContext, webGLProgram: WebGLProgram) => {
        if (this.index == null) {
          this.index = gpgpu.getUniformLocation(webGLProgram, 'index');
        }
        gpgpu.gl.uniform1f(this.index, index);
      };
    };
  }

  function getFinalCoord(rank: number, coords) {
    if (rank === 1) {
      return coords;
    } else if (rank === 2) {
      return [coords, coords];
    } else if (rank === 3) {
      return [coords, coords, coords];
    } else if (rank === 4) {
      return [coords, coords, coords, coords];
    } else {
      throw Error('Cumulative sum for rank ' + rank + ' is not yet 
      supported.');
    }
    return getFinalCoord(rank, coords);;
  }
}

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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 *
import {DepthToSpaceProgram} from './depth_to_space_gpu';

export class DepthToSpaceProgram implements GPGPUProgram {
  variableNames = ['x'];
  outputShape: number[] = [];
  userCode: string;
  blockSize: number;
  dataFormat: string;

  constructor(outputShape: number[], blockSize: number, dataFormat: 'NHWC'|'NCHW') {
    this.outputShape = outputShape;
    this.blockSize = blockSize;
    this.dataFormat = dataFormat;
    this.userCode = 'void main() {
      ivec4 coords = getOutputCoords();
      int b = coords[0];
      int h = coords[1];
      int w = coords[2];
      int d = coords[3];

      float result = getX(b, h, w, d);
      setOutput(result);
    }';
  }

  private getHeightCoordString(): string {
    if (this.dataFormat === 'NHWC') {
      return 'coords[1]';
    } else {
      return 'coords[2]';
    }
  }

  private getWidthCoordString(): string {
    if (this.dataFormat === 'NHWC') {
      return 'coords[2]';
    } else {
      return 'coords[3]';
    }
  }

  private getDepthCoordString(): string {
    if (this.dataFormat === 'NHWC') {
      return 'coords[3]';
    } else {
      return 'coords[1]';
    }
  }

  private getOutputDepthSize(): number {
    if (this.dataFormat === 'NHWC') {
      return this.outputShape[3];
    } else {
      return this.outputShape[1];
    }
  }

  private getInputSamplingString(): string {
    if (this.dataFormat === 'NHWC') {
      return 'getX(b, h, w, d)';
    } else {
      return 'getX(b, d, h, w)';
    }
  }
}

import {GPGPUProgram} from './gpgpu_math';

export class DenseBincountProgram implements GPGPUProgram {
  variableNames = ['x'];
  outputShape: number[] = [];
  userCode: string;
  blockSize: number;
  dataFormat: string;

  constructor(outputShape: number[], blockSize: number, dataFormat: string) {
    this.outputShape = outputShape;
    this.blockSize = blockSize;
    this.dataFormat = dataFormat;
    this.userCode = 'void main() {
      ivec4 coords = getOutputCoords();
      int b = coords[0];
      int h = coords[1];
      int w = coords[2];
      int d = coords[3];

      float result = $(this.getWeightCoordString());
      setOutput(result);
    }';
  }

  private getWeightCoordString(): string {
    if (this.dataFormat === 'NHWC') {
      return 'coords[0]';
    } else {
      return 'coords[1]';
    }
  }

  private getOutputWeightSize(): number {
    if (this.dataFormat === 'NHWC') {
      return this.outputShape[1];
    } else {
      return this.outputShape[2];
    }
  }

  private getInputSamplingString(): string {
    if (this.dataFormat === 'NHWC') {
      return 'getX(b, h, w, d)';
    } else {
      return 'getX(b, d, h, w)';
    }
  }
}

import {MathBackendWebGL} from '../backend_webgl';

export function depthToSpace(inputs: DepthToSpaceInputs, backend: MathBackendWebGL, attrs: DepthToSpaceAttrs) {
  const {x} = inputs;
  const {blockSize, dataFormat} = attrs;

  if (blockSize <= 1) {
    throw new Error('blockSize should be > 1 for depthToSpace, but was: ' + blockSize);
  }

  const batchSize = x.shape[0];
  const inputHeight = $(dataFormat === 'NHWC') ? x.shape[1] : x.shape[2];
  const outputHeight = inputHeight * blockSize;
  const inputDepth = $(dataFormat === 'NHWC') ? x.shape[2] : x.shape[3];
  const outputDepth = inputDepth / (blockSize * outputHeight);

  const program = new DepthToSpaceProgram(outputShape, blockSize, dataFormat);
  return backend.runWebGLProgram(program, [x, x.dtype], $(inputShape:

  return new TensorInfo(batchSize, outputHeight, outputWidth, outputDepth);
}

export const denseBincountConfig: KernelConfig = {
  kernelName: 'denseBincount',
  backendName: 'webgl',
  kernelFunc: denseBincount as {} as KernelFunc
};
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============================================================================

import {backend_util} from '@tensorflow/tfjs-core';

export class DepthwiseConv2DProgram implements GPGPUProgram {
  variableNames = ['x', 'W'];
  inputShape: number[];
  outputShape: number[];
  constructor(
    convInfo: backend_util.Conv2DInfo,
    addBias = false,
    activation: string = null,
    hasPreluActivation = false,
    hasLeakyReluAlpha = false,
    dilationHeight = convInfo.dilationHeight,
    dilationWidth = convInfo.dilationWidth,
    filterHeight = convInfo.filterHeight,
    filterWidth = convInfo.filterWidth,
    inChannels = convInfo.inChannels,
    nChannels = convInfo.outChannels,
    padTop = convInfo.padInfo.top,
    padLeft = convInfo.padInfo.left,
    padStrideHeight = convInfo.padInfo.padStrideHeight,
    padStrideWidth = convInfo.padInfo.padStrideWidth,
    strideHeight = convInfo.strideHeight,
    strideWidth = convInfo.strideWidth
  ) {
    this.outputShape = convInfo.outShape;
    this.inputShape = convInfo.inShape;
    this.nChannels = nChannels;
    this.padTop = padTop;
    this.padLeft = padLeft;
    this.padStrideHeight = padStrideHeight;
    this.padStrideWidth = padStrideWidth;
    this.strideHeight = strideHeight;
    this.strideWidth = strideWidth;
    this.inChannels = inChannels;
    this.filterHeight = filterHeight;
    this.filterWidth = filterWidth;
    this.dilationHeight = dilationHeight;
    this.dilationWidth = dilationWidth;
    this.hasPreluActivation = hasPreluActivation;
    this.hasLeakyReluAlpha = hasLeakyReluAlpha;
    this.addBias = addBias;
    this.activation = activation;

    this.userCode = `"\n      float dotProd = 0.0;
      // TO DO(dsmilkov): Flatten the two for loops and vec4 the operations.
      int d2 = coords.w;
      int d1 = d2 / 4;
      int d0 = d1 / 4;
      int d3 = d2 - d1;
      float dotProd = 0.0;
      // TO DO(dsmilkov): Flatten the two for loops and vec4 the operations.
      int d2 = coords.w;
      int d1 = d2 / 4;
      int d0 = d1 / 4;
      int d3 = d2 - d1;
      float dotProd = 0.0;
      // TO DO(dsmilkov): Flatten the two for loops and vec4 the operations.
      int d2 = coords.w;
      int d1 = d2 / 4;
      int d0 = d1 / 4;
      int d3 = d2 - d1;
      float dotProd = 0.0;
      // TO DO(dsmilkov): Flatten the two for loops and vec4 the operations.
      int d2 = coords.w;
      int d1 = d2 / 4;
      int d0 = d1 / 4;
      int d3 = d2 - d1;
      float dotProd = 0.0;";
  }
}

```
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=============================================================================

*/

import {backend_util, DepthwiseConv2dNative, DepthwiseConv2dNativeAttrs, DepthwiseConv2dNativeInputs, env, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-core';
import {MathBackendWebGL} from './backend_webgl';
import {DepthwiseConv2DProgram} from './conv_gpu_depthwise';
import {DepthwiseConvPacked2DProgram} from './conv_packed_gpu_depthwise';

export function depthwiseConv2dNative(args: {
  inputs: DepthwiseConv2dNativeInputs,
  attrs: DepthwiseConv2dNativeAttrs,
  backend: MathBackendWebGL
}) {
  const {inputs, backend, attrs} = args;
  const {x, filter} = inputs;
  const {strides, pad, dilations, dimRoundingMode} = attrs;

  let $dilations = dilations;
  if ($dilations == null) {
    $dilations = [1, 1];
  }

  util.assert(
      backend_util.eitherStridesOrDilationsAreOne(strides, $dilations),
      () => 'Error in depthwiseConv2d: Either strides or dilations must be ' +
          `1. Got strides ${strides} and dilations ${$dilations}'`);

  const convInfo = backend_util.computeConv2DInfo(
      x.shape as [number, number, number, number],
      filter.shape as [number, number, number, number], strides, $dilations,
      pad, dimRoundingMode, true /* depthwise */);

  let program:
      DepthwiseConv2DProgram|DepthwiseConvPacked2DProgram;
  if (env().getBool('WEBGL_PACK_DEPTHWISECONV') && convInfo.strideWidth <= 2 &&
      convInfo.outChannels / convInfo.inChannels === 1) {
    program = new
      DepthwiseConvPacked2DProgram(convInfo);
  } else {
    program = new
      DepthwiseConv2DProgram(convInfo);
  }

  return backend.runWebGLProgram(program, [x, filter],
      'float32');
}

export const depthwiseConv2dNativeConfig: KernelConfig = {
  kernelName: DepthwiseConv2dNative,
  backendName: 'webgl',
  kernelFunc: depthwiseConv2dNative as {} as
      KernelFunc,
};

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 *=============================================================================

*/

import {backend_util} from '@tensorflow/tfjs-core';
import {GPGPUProgram} from './gpgpu_math';

export class DepthwiseConv2DDerFilterProgram implements GPGPUProgram {
  variableNames = [x, dy];
  outputShape: number[];
  userCode: string;

  constructor(convInfo: backend_util.Conv2DInfo) {
    this.outputShape = convInfo.filterShape;

    const strideHeight = convInfo.strideHeight;
    const strideWidth = convInfo.strideWidth;
    const padTop = convInfo.padInfo.top;
    const padLeft = convInfo.padInfo.left;
    const channelMul = convInfo.outChannels / convInfo.inChannels;

    this.userCode = `void main() {
      ivec4 coords = getOutputCoords();
      int wR = coords.x;
      int wC = coords.y;
      int d1 = coords.z;
      int dm = coords.w;
      int d2 = d1 * ${channelMul} + dm;

      float dotProd = 0.0;
      // TO DO: Vec4 over the batch size for (int b = 0; b < ${convInfo.batchSize};
      b++) {
        for (int yR = 0; yR < $reachOutputHeight); yR++) {
          int xR = wR + yR * ${strideHeight} - $padTop;
          if (xR < 0 || xR >= $reachInputHeight) {
            continue;
          } for (int yC = 0; yC < $reachOutWidth); yC++) {
            int xc = wC + yC * ${strideWidth} - $padLeft;
            if (xc < 0 || xc >= $reachInputWidth) {
              continue;
            } for (int b = 0; b < ${convInfo.batchSize}; b++) {
              dy = getDy(b, yR, yC, d2);
              dotProd += (xValue * dyValue);
            }
          }
        }
      }
    }`;
  }

  export function derFilterProgram(program: GPGPUProgram) {
    return program;
  }

  export function run(program: GPGPUProgram, inputs: Array<any>): Array<any> {
    return program.run(inputs);
  }

  export function computeArguments(program: GPGPUProgram) {
    return arguments;
  }

  export function computeFunction(args: any[]): GPGPUProgram {
    return function;
  }

  export function computeInputShape(program: GPGPUProgram) {
    return inputShape;
  }

  export function computeOutputShape(program: GPGPUProgram) {
    return outputShape;
  }

  export function computeOutput(buffer: ArrayBuffer): void {
    return buffer;
  }

  export function computeInput(buffer: ArrayBuffer): void {
    return buffer;
  }

  export function computeChecker() {
    return checker;
  }

  export function computeCheckerOutput(buffer: ArrayBuffer): void {
    return buffer;
  }

  export function computeCheckerInput(buffer: ArrayBuffer): void {
    return buffer;
  }

  export function computeCheckerInputShape(program: GPGPUProgram) {
    return inputShape;
  }

  export function computeCheckerOutputShape(program: GPGPUProgram) {
    return outputShape;
  }

  export function computeCheckerOutput(buffer: ArrayBuffer): void {
    return buffer;
  }

  export function computeCheckerInput(buffer: ArrayBuffer): void {
    return buffer;
  }

  export function computeCheckerChecker() {
    return checker;
  }

  export function computeCheckerCheckerOutput(buffer: ArrayBuffer): void {
    return buffer;
  }

  export function computeCheckerCheckerInput(buffer: ArrayBuffer): void {
    return buffer;
  }

  export function computeCheckerCheckerInputShape(program: GPGPUProgram) {
    return inputShape;
  }

  export function computeCheckerCheckerOutputShape(program: GPGPUProgram) {
    return outputShape;
  }

  export function computeCheckerCheckerOutput(buffer: ArrayBuffer): void {
    return buffer;
  }

  export function computeCheckerCheckerInput(buffer: ArrayBuffer): void {
    return buffer;
  }

  export function computeCheckerCheckerChecker() {
    return checker;
  }

  export function computeCheckerCheckerCheckerOutput(buffer: ArrayBuffer): void {
    return buffer;
  }

  export function computeCheckerCheckerCheckerInput(buffer: ArrayBuffer): void {
    return buffer;
  }

  export function computeCheckerCheckerCheckerInputShape(program: GPGPUProgram) {
    return inputShape;
  }

  export function computeCheckerCheckerCheckerOutputShape(program: GPGPUProgram) {
    return outputShape;
  }

  export function computeCheckerCheckerCheckerOutput(buffer: ArrayBuffer): void {
    return buffer;
  }

  export function computeCheckerCheckerCheckerInput(buffer: ArrayBuffer): void {
    return buffer;
  }

  export function computeCheckerCheckerCheckerChecker() {
    return checker;
  }

  export function computeCheckerCheckerCheckerCheckerOutput(buffer: ArrayBuffer): void {
    return buffer;
  }

  export function computeCheckerCheckerCheckerCheckerInput(buffer: ArrayBuffer): void {
    return buffer;
  }

  export function computeCheckerCheckerCheckerCheckerInputShape(program: GPGPUProgram) {
    return inputShape;
  }

  export function computeCheckerCheckerCheckerCheckerOutputShape(program: GPGPUProgram) {
    return outputShape;
  }

  export function computeCheckerCheckerCheckerCheckerOutput(buffer: ArrayBuffer): void {
    return buffer;
  }

  export function computeCheckerCheckerCheckerCheckerInput(buffer: ArrayBuffer): void {
    return buffer;
  }

  export function computeCheckerCheckerCheckerCheckerChecker() {
    return checker;
  }

  export function computeCheckerCheckerCheckerCheckerCheckerOutput(buffer: ArrayBuffer): void {
    return buffer;
  }

  export function computeCheckerCheckerCheckerCheckerCheckerInput(buffer: ArrayBuffer): void {
    return buffer;
  }

  export function computeCheckerCheckerCheckerCheckerCheckerInputShape(program: GPGU
```javascript
import {MathBackendWebGL} from '../backend_webgl';
import {DepthwiseConv2DDerFilterProgram} from '../conv_backprop_gpu_depthwise';

export function depthwiseConv2dNativeBackpropFilter(args: {
  inputs: DepthwiseConv2dNativeBackpropInputInputs,
  attrs: DepthwiseConv2dNativeBackpropInputAttrs,
  backend: MathBackendWebGL
}) {
  const {inputs, backend, attrs} = args;
  const {x, dy} = inputs;
  const {strides, dilations, pad, dimRoundingMode, filterShape} = attrs;
  const convInfo = backend_util.computeConv2DInfo(
    x.shape as [number, number, number, number], filterShape, strides, dilations, pad, dimRoundingMode, true /* depthwise */);
  const program = new DepthwiseConv2DDerFilterProgram(convInfo);
  return backend.runWebGLProgram(program, [x, dy], 'float32');
}

export const depthwiseConv2dNativeBackpropFilterConfig: KernelConfig = {
  kernelName: DepthwiseConv2dNativeBackpropFilter,
  backendName: 'webgl',
  kernelFunc: depthwiseConv2dNativeBackpropFilter as {} as KernelFunc
};
```
import {DiagProgram, DiagInputs, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';
import {MathBackendWebGL} from '../backend_webgl';
import {GPGPUProgram} from './gpgpu_math';

export class Dilation2DProgram implements GPGPUProgram {
  variableNames = ['x', 'W'];
  outputShape: number[] = [1, 1];
  userCode: string = '
    #pragma unroll
    for (int i = 0; i < X; i++) {
      float val = X[i] + W[i];
      setOutput(val);
    }
  ';

  constructor(size: number) {
    this.outputShape = [size, size];
    this.userCode = '
      void main() {
        ivec2 coords = getOutputCoords();
        float val = coords[0] == coords[1] ? getX(coords[0]) : 0.0;
        setOutput(val);
      }
    ';
  }
}

export function dilation2d(args: { inputs: DiagInputs, backend: MathBackendWebGL }) {
  const { inputs, backend, attrs } = args;
  const { dy, filter } = inputs;
  const { strides, dilations, pad, dimRoundingMode, inputShape } = attrs;

  const convInfo = backend_util.computeConv2DInfo(inputShape, filter.shape as [number, number, number, number], strides, dilations, pad, dimRoundingMode, true /* depthwise */);
  const program = new Dilation2DProgram(convInfo);
  return backend.runWebGLProgram(program, [dy, filter], 'float32');
}

export const dilation2dConfig: KernelConfig = {
  kernelName: Dilation2DProgram,
  backendName: 'webgl',
  kernelFunc: dilation2d as {} as KernelFunc
};
outputShape: number[]; userCode: string; constructor(convInfo: backend_util.Conv2DInfo) { 
  this.outputShape = convInfo.outShape; this.const = convInfo.const; this.userCode = convInfo.userCode; 
  this.strideWidth = convInfo.strideWidth; this.filterHeight = convInfo.filterHeight; this.filterWidth = convInfo.filterWidth; this.dilationHeight = convInfo.dilationHeight; this.dilationWidth = convInfo.dilationWidth; } 

  const {top: padTop, left: padLeft} = padInfo; this.userCode = 'const ivec2 strides = iVec2($[filterHeight], $[filterWidth]); const const vec2 pads = iVec2($[padTop], $[padLeft]); const float neg_infinity = -3.4e38; void main() { ivec4 coords = getOutputCoords(); int batch = coords.x; int d1 = coords.w; ivec2 outTopLeftCorner = coords.yz * strides - pads; int h = $[filterHeight]; h++; int hIn = h + h * $[dilationHeight]; if (hIn <= 0 || hIn < $[inHeight]) for (int w = 0; w < $[filterWidth]; w++) { int wIn = w + w * $[dilationWidth]; float curVal = neg_infinity; for (int h = 0; h < $[filterHeight]; h++) { int hIn = h + h * $[dilationHeight]; if (hIn > 0 && hIn <= $[inHeight]) { int v = getV(batch, h, w, d1); float wVal = getW(h, w, d1); float xVal = getX(batch, h, w, d1); float curVal = val; } } } float result = curVal; setOutput(result); } 

import {backend_util, Dilation2D, Dilation2DAttrs, Dilation2DInputs, KernelConfig, KernelFunc, 
  TensorInfo} from '@tensorflow/tfjs-core'; import {MathBackendWebGL} from '@tensorflow/tfjs-backends'; 

import {Dilation2DProgram} from '../dilation_gpu'; import {asShape} from './asshape'; import {reshape} from './Reshape'; import {Elu, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core'; 

const ELU = 'return (x >= 0.0) ? x : (exp(x) - 1.0);' 

const ELU_PACKED = 'vec4 result;
  result.r = (x.r >= 0.0) ? x.r : (exp(x.r) - 1.0);
  result.g = (x.g >= 0.0) ? x.g : (exp(x.g) - 1.0);
  result.b = (x.b >= 0.0) ? x.b : (exp(x.b) - 1.0);
  result.a = (x.a >= 0.0) ? x.a : (exp(x.a) - 1.0);
  return result;
' 

const elu = unaryKernelFunc({opSnippet: ELU, packedOpSnippet: ELU_PACKED}); 

export const eluConfig: KernelConfig = {kernelName: Elu, backendName: 'webgl', kernelFunc: elu as {} as KernelFunc};
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=============================================================================

import {EluGrad, EluGradInputs, env, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-core';
import {MathBackendWebGL} from '../backend_webgl';
import {BinaryOpProgram} from '../binaryop_gpu';
import {BinaryOpPackedProgram} from '../binaryop_packed_gpu';

const ELU_DER = `return (b >= 1.0) ? a : a * (b + 1.0);`;
const ELU_DER_PACKED = `
  vec4 bGTEZero = vec4(greaterThanEqual(b, vec4(0.0)));
  return (bGTEZero * a) + ((vec4(1.0) - bGTEZero) * (a * (b + vec4(1.0))));
`;

export const eluGrad = (args: {inputs: EluGradInputs, backend: MathBackendWebGL}): TensorInfo => {
  const {inputs, backend} = args;
  const {dy, y} = inputs;

  const program = env().getBool('WEBGL_PACK_BINARY_OPERATIONS') ?
    new BinaryOpPackedProgram(ELU_DER_PACKED, dy.shape, y.shape) :
    new BinaryOpProgram(ELU_DER, dy.shape, y.shape);
  return backend.runWebGLProgram(program, [dy, y]);
};

export const eluGradConfig: KernelConfig = {
  kernelName: EluGrad,
  backendName: 'webgl',
  kernelFunc: eluGrad as {} as KernelFunc
};

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 *
=============================================================================

import {Equal, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';
import {binaryKernelFunc} from '../kernel_utils/kernel_funcs_utils';

const PACKED_EQUAL = `
  return vec4(equal(a, b));
`;

const EQUAL = `return float(a == b);`;

export const equal = binaryKernelFunc(
  {opSnippet: EQUAL, packedOpSnippet: PACKED_EQUAL, dtype: 'bool'});

export const equalConfig: KernelConfig = {
  kernelName: Equal,
  backendName: 'webgl',
  kernelFunc: equal as {} as KernelFunc
};

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 *
=============================================================================

import {backend_util, Erf, KernelConfig} from '@tensorflow/tfjs-core';

import {unaryKernelFunc} from '../kernel_utils/kernel_funcs_utils';

const ERF = `
  // Error function is calculated approximately with elementary functions. See "Handbook of Mathematical Functions with Formulas, Graphs, and Mathematical Tables", Abramowitz and Stegun.
  // float p = \{backend_util.ERF_P\};
  // float a1 = \{backend_util.ERF_A1\};
  // float a2 = \{backend_util.ERF_A2\};
  // float a3 = \{backend_util.ERF_A3\};
  // float a4 = \{backend_util.ERF_A4\};
  // float a5 = \{backend_util.ERF_A5\};
  // float sign = sign(x);
  // x = abs(x);
  // float t = 1.0 / (1.0 + p * x);
  // return sign * (1.0 - (((((a5*t + a4)*t) + a3)*t + a2)*t + a1)*t*exp(-x*x));
`;

export const erf = unaryKernelFunc({opSnippet: ERF});

export const erfConfig: KernelConfig = {
  kernelName: Erf,
  backendName: 'webgl',
  kernelFunc: erf,
};

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 *
=============================================================================

import {Equal, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';
import {binaryKernelFunc} from '../kernel_utils/kernel_funcs_utils';

const PACKED_EQUAL = `
  return vec4(equal(a, b));
`;

const EQUAL = `return float(a == b);`;

export const equal = binaryKernelFunc(
  {opSnippet: EQUAL, packedOpSnippet: PACKED_EQUAL, dtype: 'bool'});

export const equalConfig: KernelConfig = {
  kernelName: Equal,
  backendName: 'webgl',
  kernelFunc: equal as {} as KernelFunc
};

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 *
=============================================================================

import {backend_util, Erf, KernelConfig} from '@tensorflow/tfjs-core';

import {unaryKernelFunc} from '../kernel_utils/kernel_funcs_utils';

const ERF = `
  // Error function is calculated approximately with elementary functions. See "Handbook of Mathematical Functions with Formulas, Graphs, and Mathematical Tables", Abramowitz and Stegun.
  // float p = \{backend_util.ERF_P\};
  // float a1 = \{backend_util.ERF_A1\};
  // float a2 = \{backend_util.ERF_A2\};
  // float a3 = \{backend_util.ERF_A3\};
  // float a4 = \{backend_util.ERF_A4\};
  // float a5 = \{backend_util.ERF_A5\};
  // float sign = sign(x);
  // x = abs(x);
  // float t = 1.0 / (1.0 + p * x);
  // return sign * (1.0 - (((((a5*t + a4)*t) + a3)*t + a2)*t + a1)*t*exp(-x*x));
`;

export const erf = unaryKernelFunc({opSnippet: ERF});

export const erfConfig: KernelConfig = {
  kernelName: Erf,
  backendName: 'webgl',
  kernelFunc: erf,
};

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=============================================================================
*/

import {ExpandDims, ExpandDimsAttr, ExpandDimsInputs, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';
import {MathBackendWebGL} from '../backend_webgl';

export function expandDims(args: {
  inputs: ExpandDimsInputs,
  attrs: ExpandDimsAttr,
  backend: MathBackendWebGL
}): TensorInfo {
  const {inputs, attrs, backend} = args;
  const {dim} = attrs;

  const {input} = inputs;

  const inputRank = input.shape.length;
  const newShape = input.shape.slice();
  let $dim = dim;
  if (dim < 0) {
    // Negative value is counted from the tail of rank.
    util.assert(
        -(inputRank + 1) <= dim,
        () => `Axis must be in the interval \[${- (inputRank + 1)}, ${inputRank}\]`);
    $dim = inputRank + dim + 1;
  }
  newShape.splice($dim, 0, 1);

  return reshape({inputs: {x: input}, backend, attrs: {shape: newShape}});
}

export const expandDimsConfig: KernelConfig = {
  kernelName: ExpandDims,
  backendName: 'webgl',
  kernelFunc: expandDims as {} as KernelFunc,
};

import {GPGPUProgram} from './gpgpu_math';

export class FFTProgram implements GPGPUProgram {
  variableNames = ['real', 'imag'];
  outputShape: number[];
  userCode: string;
  constructor(component: 'real' | 'imag', inputShape: [number, number], inverse: boolean) {
    const innerDim = inputShape[1];

    this.outputShape = inputShape;

    const resultDenominator = inverse ? `${innerDim}.0` : '1.0';

    let opString: string;
    if (component === 'real') {
      opString = 'return real * expR - imag * expI;';
    } else if (component === 'imag') {
      opString = 'return real * expI + imag * expR;';
    } else {
      throw new Error(`FFT component must be either "real" or "imag", got ${component}.`);
    }

    this.userCode = `
      const float exponentMultiplier = ${exponentMultiplierSnippet};

      float unaryOpComplex(float real, float expR, float imag, float expI) {
        ${opString}
      }

      float mulMatDFT(int batch, int index) {
        float indexRatio = float(index) / float(${innerDim});
        float exponentMultiplierTimesIndexRatio = exponentMultiplier * indexRatio;

        float real = 0.0;
        for (int i = 0; i < ${innerDim}; i++) {
          real = -2.0 * PI / N * index * float x = exponentMultiplierTimesIndexRatio * float(i);
          float expR = cos(x);
          float expI = sin(x);
          float real = getReal(batch, i);
          float imag = getImag(batch, i);
        }
        return real + expI
      }

      unaryOpComplex(real, expR, imag, expI) / \$\{resultDenominator\} = \$\{result\}
    `;
  }
}

import {TensorInfo, util} from '@tensorflow/tfjs-core';
import {MathBackendWebGL} from '../backend_webgl';
import {FFTProgram} from '../fft_gpu';
import {complex} from './Complex';
import {reshape} from './Reshape';

export function fftImpl(x: TensorInfo, inverse: boolean, backend:
MathBackendWebGL: TensorInfo {
  const xData = backend.texData.get(x.dataId);
  const inputSize = util.sizeFromShape(x.shape);
  // Collapse all outer dimensions to a single batch dimension.
  const innerDimensionSize = x.shape[x.shape.length - 1];
  const batch = inputSize / innerDimensionSize;
  const input2D = reshape(
    {inputs: [x], backend, attr: {shape: [batch, innerDimensionSize]}},
  )

  const xShape = input2D.shape as [number, number];
  const realProgram = new FFTProgram('real', xShape, inverse);
  const imagProgram = new FFTProgram('imag', xShape, inverse);

  const inputs = [
    {
      dataId: xData.complexTensorInfos.real.dataId,
      dtype: xData.complexTensorInfos.real.dtype,
      shape: xShape
    },
    {
      dataId: xData.complexTensorInfos.imag.dataId,
      dtype: xData.complexTensorInfos.imag.dtype,
      shape: xShape
    }
  ];

  const realPart = backend.runWebGLProgram(realProgram, inputs, 'float32');
  const imagPart = backend.runWebGLProgram(imagProgram, inputs, 'float32');

  const complexOutput =
      complex({inputs: {real: realPart, imag: imagPart}, backend});

  backend.disposeIntermediateTensorInfo(realPart);
  backend.disposeIntermediateTensorInfo(imagPart);

  const complexOutputReshaped =
      reshape({inputs: {x: complexOutput}, backend, attrs: {shape: x.shape}});

  backend.disposeIntermediateTensorInfo(input2D);
  backend.disposeIntermediateTensorInfo(complexOutput);

  return complexOutputReshaped;
};

//===----------------------------------------------------------------------===

import {FFT, FFTInputs, KernelConfig, TensorInfo} from '@tensorflow/tfjs-core';

import {MathBackendWebGL} from '../backend_webgl';

import {fftImpl} from './FFT_impl';

export function
  fft(args: {inputs: FFTInputs, backend: MathBackendWebGL}):
      TensorInfo {
  const {inputs, backend} = args;
  const {input} = inputs;

  return fftImpl(input, false /* inverse */, backend);
}

export const fftConfig:
  KernelConfig = {
    kernelName: FFT,
    backendName: 'webgl',
    kernelFunc: fft
};

//===----------------------------------------------------------------------===

import {GPGPUContext} from './gpgpu_context';

import {GPGPUProgram} from './gpgpu_math';

export class FillProgram implements GPGPUProgram {
  variableNames: string[];
  outputShape: number[] = [];

  userCode: string;

  constructor(shape: number[], value: number) {
    this.userCode = `
      uniform float value;
      void main() {
        // Input can be obtained from uniform value.
        setOutput(value);
      }
    `;
    this.variableNames = ['x'];
    this.outputShape = shape;
    this.userCode = `\n      uniform float value;\n      void main() {
        // Input can be obtained from uniform value.\n        setOutput(value);\n        \n      }\n      \n    `;

    getCustomSetupFunc(value: number) {
      return (gpgpu: GPGPUProgram, webGLProgram: WebGLProgram) => {
        if (this.valueLoc === null) {
          this.valueLoc = gpgpu.getUniformLocationNoThrow(webGLProgram, 'value');
        }
        gpgpu.gl.uniform1f(this.valueLoc, value);
      };
    }
  }

  getKernelName() {
    return 'FillProgram';
  }

  getKernelFunc() {
    return (gpgpu: GPGPUProgram, webGLProgram: WebGLProgram) => {
      if (this.valueLoc === null) {
        this.valueLoc = gpgpu.getUniformLocationNoThrow(webGLProgram, 'value');
      }
      gpgpu.gl.uniform1f(this.valueLoc, value);
    };
  }

  getOutputShape() {
    return shape;
  }

  getUniformLocation() {
    return this.valueLoc;
  }

  getuserInfo() {
    return {
      name: 'FillProgram',
      type: 'function',
      code: this.userCode
    };
  }

  getKernelConfig() {
    return this.kernelConfig;
  }

  getKernel() {
    return this.kernelFunc;
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  getKernelConfig() {
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  getKer...
```javascript
import {Fill, FillAttrs, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';

import {MathBackendWebGL} from '../backend_webgl';

export function fill(args: {backend: MathBackendWebGL, attrs: FillAttrs}):
    TensorInfo {
  const {backend, attrs} = args;
  const {shape, value} = attrs;
  let {dtype} = attrs;

  dtype = dtype || util.inferDtype(value);

  if (dtype === 'string') {
    // String type should be handled in CPU memory.
    const values = util.getArrayFromDType(dtype, util.sizeFromShape(shape));
    values.fill(value as string);
    return backend.makeTensorInfo(shape, dtype, values);
  } else {
    const program = new FillProgram(shape, value as number);
    const customSetup = program.getCustomSetupFunc(value as number);
    return backend.runWebGLProgram(program, [], dtype, customSetup);
  }
}

export const fillConfig: KernelConfig = {
  kernelName: Fill,
  backendName: 'webgl',
  kernelFunc: fill as {} as KernelFunc
};
```

```rust
import {GPGPUProgram} from './gpgpu_math';

export class FlipLeftRightProgram implements GPGPUProgram {
  variableNames = ['Image'];
  outputShape: number[] = [];
  userCode: string;

  constructor(imageShape: [number, number, number, number]) {
    const imageWidth = imageShape[2];
    this.outputShape = imageShape;
    this.userCode = `void main() { ivec4 coords = getOutputCoord();
      int x = coords[2];
      int coordX = ${imageWidth} - x;
      float outputValue;
      if(coordX >= 0 && coordX < ${imageWidth}) {
        outputValue = getImage(coords[0], coords[1], coordX, coords[3]);
      } else {
        outputValue = getImage(coords[0], coords[1], coords[2], coords[3]);
      }
      setOutput(outputValue);
    }
};
```

```java
import {KernelConfig, Tensor4D} from '@tensorflow/tfjs-core';
import {FlipLeftRight, FlipLeftRightInputs} from '@tensorflow/tfjs-core';
import {MathBackendWebGL} from '../backend_webgl';

export const flipLeftRightConfig: KernelConfig = {
  kernelName: FlipLeftRight,
  backendName: 'webgl',
  kernelFunc: ({inputs, backend}) => {
    const {image} = inputs as FlipLeftRightInputs;
    const webglBackend = backend as MathBackendWebGL;
    const program = new FlipLeftRightProgram(image as Tensor4D).shape;
    const output = webglBackend.runWebGLProgram(program, [image], image.dtype);
    return output;
  }
};
```

```python
import {FloorDiv, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';
```
from '../kernel_utils/kernel_funcs_utils';

// We use native integer division to deal with floating point imprecision.
// Since we implement floor division and glsl implements truncated division, we correct for this by subtracting 1 from result when the result is negative and

const INT_DIV = `
  float s = sign(a) * sign(b);
  int ia = round(a);
  int ib = round(b);
  if (ib == 0) { return float(idiv(ia, ib, s)); } else { return NAN; }
`;

const INT_DIV_PACKED = `
  ivec4 ia = round(a);
  ivec4 ib = round(b);
  bvec4 cond = notEqual(ib, ivec4(0));
  ivec4 result = vec4(0);
  vec4 s = sign(a) * sign(b);
  if (cond[0]) {
    result[0] = idiv(ia[0], ib[0], s[0]);
  } else if (cond[1]) {
    result[1] = idiv(ia[1], ib[1], s[1]);
  } else if (cond[2]) {
    result[2] = idiv(ia[2], ib[2], s[2]);
  } else if (cond[3]) {
    result[3] = idiv(ia[3], ib[3], s[3]);
  }
  return vec4(result);
`;

export const floorDiv = binaryKernelFunc(
  {opSnippet: INT_DIV, packedOpSnippet: INT_DIV_PACKED, dtype: 'int32'});

export const floorDivConfig: KernelConfig = {
  kernelName: FloorDiv,
  backendName: 'webgl',
  kernelFunc: floorDiv as {} as KernelFunc
};

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 */

import {getGlslDifferences} from '../../glsl_version';
import {GPGPUProgram} from '../../gpgpu_math';

export class FromPixelsProgram implements GPGPUProgram {
  variableNames = ['A'];
  userCode: string;
  outputShape: number[];
  constructor(outputShape: number[]) {
    const glsl = getGlslDifferences();
    const [height, width, ] = outputShape;
    this.outputShape = outputShape;
    this.userCode = `void main() {
      ivec3 coords = getOutputCoords();
      int texR = coords[0];
      int texC = coords[1];
      int depth = coords[2];

      vec4 result = vec4(0);

      for(int row=0; row<=1; row++) {
        for(int col=0; col<=1; col++) {
          texC = coords[1] + row;
          depth = coords[2] + col;

          vec2 uv = (vec2(texC, texR) + halfCR) / vec2(${width}.0, ${height}.0);
          vec4 values = ${glsl.texture2D}(A, uv);
          float value;
          if (depth == 0) {
            value = values.r;
          } else if (depth == 1) {
            value = values.g;
          } else if (depth == 2) {
            value = values.b;
          } else if (depth == 3) {
            value = values.a;
          }

          result[row * 2 + col] = floor(value * 255.0 + 0.5);
        }
      }

      ${glsl.output} = result;
  }
};

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 */

import {getGlslDifferences} from '../../glsl_version';
import {GPGPUProgram} from '../../gpgpu_math';

export class FromPixelsPackedProgram implements GPGPUProgram {
  variableNames = ['A'];
  userCode: string;
  outputShape: number[];
  packedInputs = false;
  packedOutput = true;
  packedOutput = true;

  constructor(outputShape: number[]) {
    const glsl = getGlslDifferences();
    const [height, width, ] = outputShape;
    this.outputShape = outputShape;
    this.userCode = `void main() {
      ivec3 coords = getOutputCoords();
      int texR = coords[0];
      int texC = coords[1];
      int depth = coords[2];

      vec4 result = vec4(0);

      for(int row=0; row<=1; row++) {
        for(int col=0; col<=1; col++) {
          texC = coords[1] + row;
          depth = coords[2] + col;

          vec2 uv = (vec2(texC, texR) + halfCR) / vec2(${width}.0, ${height}.0);
          vec4 values = ${glsl.texture2D}(A, uv);
          float value;
          if (depth == 0) {
            value = values.r;
          } else if (depth == 1) {
            value = values.g;
          } else if (depth == 2) {
            value = values.b;
          } else if (depth == 3) {
            value = values.a;
          }

          result[row * 2 + col] = floor(value * 255.0 + 0.5);
        }
      }

      ${glsl.output} = result;
  }
};
import {env, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-core';
import {FromPixels, FromPixelsAttrs, FromPixelsInputs} from '@tensorflow/tfjs-core';
import {MathBackendWebGL} from '../backend_webgl';
import {TextureUsage} from '../tex_util';
import {FromPixelsProgram} from './FromPixels_utils/from_pixels_gpu';
import {FromPixelsPackedProgram} from './FromPixels_utils/from_pixels_packed_gpu';

export const fromPixelsConfig: KernelConfig = {
  kernelName: FromPixels,
  backendName: 'webgl',
  kernelFunc: fromPixels as {} as KernelFunc,
};

let fromPixels2DContext: CanvasRenderingContext2D;

function fromPixels(args: {
  inputs: FromPixelsInputs,
  backend: MathBackendWebGL,
  attrs: FromPixelsAttrs
}): TensorInfo {
  const {inputs, backend, attrs} = args;
  let {pixels} = inputs;
  const {numChannels} = attrs;

  const isVideo = typeof (HTMLVideoElement) !== 'undefined' &&
      pixels instanceof HTMLVideoElement;
  const isImage = typeof (HTMLImageElement) !== 'undefined' &&
      pixels instanceof HTMLImageElement;
  const isImageBitmap = typeof(ImageBitmap) !== 'undefined' &&
      pixels instanceof ImageBitmap;
  const [width, height] = isVideo ?
      [(pixels as HTMLVideoElement).videoWidth,
      (pixels as HTMLVideoElement).videoHeight] :
      [pixels.width,
      pixels.height];

  const texShape: [number, number] = [height, width];
  const outShape = [height, width,
      numChannels];

  if (isImage || isVideo || isImageBitmap) {
    if (fromPixels2DContext == null) {
      fromPixels2DContext = document.createElement('canvas').getContext('2d');
    }

    fromPixels2DContext.canvas.width = width;
    fromPixels2DContext.canvas.height = height;
    fromPixels2DContext.drawImage(
        pixels as HTMLVideoElement | HTMLImageElement | ImageBitmap,
        0, 0, width, height);
    pixels = fromPixels2DContext.canvas;
  }

  const tempPixelHandle = backend.makeTensorInfo(texShape, 'int32');
  // This is a byte texture with pixels.
  backend.texData.set(tempPixelHandle.dataId, pixels);
  // const texShape: [number, number] = [height, width];

  const program = env().getBool('WEBGL_PACK') ?
      new FromPixelsPackedProgram(outShape)
      : new FromPixelsProgram(outShape);

  const res = backend.runWebGLProgram(program, [tempPixelHandle],
      'int32');
  backend.disposeData(tempPixelHandle.dataId);
  return res;
}
preluActivationWeights != null; const hasLeakyreluAlpha = activation === 'leakyrelu'; if (hasBias) {\n  programInputs.push(bias);\n }\n if (hasPreluActivationWeights) {\n  programInputs.push(preluActivationWeights);\n }\n if (hasLeakyreluAlpha) {\n  const $leakyreluAlpha = backend.makeTensorInfo([], 'float32');\n  intermediates.push($leakyreluAlpha);\n}\n
let program: DepthwiseConv2DProgram|DepthwiseConvPacked2DProgram;\n if (shouldPackDepthwiseConv) {
  program = new DepthwiseConvPacked2DProgram(convInfo, hasBias, fusedActivation, hasPreluActivationWeights, hasLeakyreluAlpha);\n} else {\n  program = new DepthwiseConv2DProgram(convInfo, hasBias, fusedActivation, hasPreluActivationWeights, hasLeakyreluAlpha);\n}\n
const result = backend.runWebGLProgram(program, programInputs, 'float32');\n
intermediates.forEach(t => backend.disposeIntermediateTensorInfo(t));\n
return result;

export const fusedDepthwiseConv2DConfig: KernelConfig = {
  kernelName: FusedDepthwiseConv2D,
  backendName: 'webgl',\n  kernelFunc: fusedDepthwiseConv2D as {} as KernelFunc,
};

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import {GPGPUProgram} from './gpgpu_math';\nimport {getCoordsDataType} from './shader_compiler';\n
export class GatherNDProgram implements GPGPUProgram {
  variableNames = ['x', 'indices'];\n  outputShape: number[];\n  userCode: string;
  constructor(\n      private sliceDim: number, private strides: number[], shape: number[]) {
    this.outputShape = shape;
    const stridesType = getCoordsDataType(strides.length);
    const dtype = getCoordsDataType(shape.length);\n    const strideString = this.sliceDim > 1 ? 'strides[j]' : 'strides';\n    this.userCode = `\n        ${stridesType} strides = ${stridesType}($\{this.strides\});
        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          }
          setOutput(getX(flattenIndex, coords[1]));\n        }\n    `;
  }
}

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import {backend_util, GatherNd, GatherNdInputs, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {GatherNDProgram} from '../gather_nd_gpu';\nimport {Reshape} from './Reshape';\n
export function gatherNd(\n    args: {inputs: GatherNdInputs, backend: MathBackendWebGL}): TensorInfo {
  const {inputs, backend} = args;
  const {params, indices} = inputs;
  const indicesShape = indices.shape;\n  const sliceRank = indicesShape.length - 1;\n  const resultShape, numSlices, sliceSize, strides = backend_util.prepareAndValidate(params, indices);
  const flattenIndices = reshape({\n    inputs: {x: indices},\n    backend,\n    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  const program = new GatherNDProgram(sliceRank, strides, [numSlices, sliceSize]);\n  const res = backend.runWebGLProgram(program, [flattenX, flattenIndices], flattenX.dtype);\n  const reshaped = reshape({\n    inputs: {x: res},\n    backend,\n    attrs: {shape: [numSlices, sliceRank]}});\n  const result = backend.runWebGLProgram(program, [flattenX, flattenIndices], flattenX.dtype);\n  return result;

};
const reshaped = reshape(outputShape),

const GREATER_EQUAL = `return float(a >= b);`
const GREATER_EQUAL_PACKED = `
  return vec4(greaterThanEqual(a, b));
`;

export const greaterEqual = binaryKernelFunc({
  opSnippet: GREATER_EQUAL,
  packedOpSnippet: GREATER_EQUAL_PACKED,
  dtype: 'bool'
});

export const greaterEqualConfig: KernelConfig = {
  kernelName: GreaterEqual,
  backendName: 'webgl',
  kernelFunc: greaterEqual as {} as KernelFunc
});

export function ifft(args: {inputs: IFFTInputs, backend: MathBackendWebGL}):
    TensorInfo {
  const {inputs, backend} = args;
  const {input} = inputs;

  return fftImpl(input, true /* inverse */, backend);
}

export const ifftConfig: KernelConfig = {
  kernelName: IFFT,
  backendName: 'webgl',
  kernelFunc: ifft
};

export const isFiniteConfig: KernelConfig = {
  kernelName: IsFinite,
  backendName: 'webgl',
  kernelFunc: isFinite as {} as KernelFunc
};

export function isFinite(args: {inputs: IFFTInputs, backend: MathBackendWebGL}):
    TensorInfo {
  const {inputs, backend} = args;
  const {input} = inputs;

  return fftImpl(input, true /* inverse */, backend);
}

export const isFiniteConfig: KernelConfig = {
  kernelName: IsFinite,
  backendName: 'webgl',
  kernelFunc: isFinite as {} as KernelFunc
};

export function isFinite(args: {inputs: IFFTInputs, backend: MathBackendWebGL}):
    TensorInfo {
  const {inputs, backend} = args;
  const {input} = inputs;

  return fftImpl(input, true /* inverse */, backend);
}

export const isFiniteConfig: KernelConfig = {
  kernelName: IsFinite,
  backendName: 'webgl',
  kernelFunc: isFinite as {} as KernelFunc
};

export function isFinite(args: {inputs: IFFTInputs, backend: MathBackendWebGL}):
    TensorInfo {
  const {inputs, backend} = args;
  const {input} = inputs;

  return fftImpl(input, true /* inverse */, backend);
}

export const isFiniteConfig: KernelConfig = {
  kernelName: IsFinite,
  backendName: 'webgl',
  kernelFunc: isFinite as {} as KernelFunc
};

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import {KernelConfig, Log1p} from '@tensorflow/tfjs-core';
import {unaryKernelFunc} from '../kernel_utils/kernel_funcs_utils';

const LOG1P = `return log(1.0 + x);`;

export const log1p = unaryKernelFunc({opSnippet: LOG1P});

export const log1pConfig: KernelConfig = {
  kernelName: Log1p,
  backendName: 'webgl',
  kernelFunc: log1p,
};

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import {KernelConfig, KernelFunc, LogicalAnd} from '@tensorflow/tfjs-core';

import {binaryKernelFunc} from '../kernel_utils/kernel_funcs_utils';

const LOGICAL_AND = `return float(a >= 1.0 && b >= 1.0);`;

export const logicalAnd = binaryKernelFunc({
  opSnippet: LOGICAL_AND,
  packedOpSnippet: LOGICAL_AND_PACKED,
  dtype: 'bool'
});

export const logicalAndConfig: KernelConfig = {
  kernelName: LogicalAnd,
  backendName: 'webgl',
  kernelFunc: logicalAnd as {} as KernelFunc
};

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import {KernelConfig, KernelFunc, LogicalOr} from '@tensorflow/tfjs-core';

import {binaryKernelFunc} from '../kernel_utils/kernel_funcs_utils';

const LOGICAL_OR = `return float(a >= 1.0 || b >= 1.0);`;

export const logicalOr = binaryKernelFunc({
  opSnippet: LOGICAL_OR,
  packedOpSnippet: LOGICAL_OR_PACKED,
  dtype: 'bool'
});

export const logicalOrConfig: KernelConfig = {
  kernelName: LogicalOr,
  backendName: 'webgl',
  kernelFunc: logicalOr as {} as KernelFunc
};

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=============================================================================

*/

import {GPGPUProgram} from './gpgpu_math';

export class LRNProgram implements GPGPUProgram {
  variableNames = ['x'];
  outputShape: number[] = [];
  userCode: string;
  constructor(xShape: number[], radius: number, bias: number, alpha: number, beta: number) {
    const rad = radius;
    const maxD = xShape[3] - 1;
    this.outputShape = xShape;
    // optimize pow(bias + alpha * sum, -beta)
    // src: https://github.com/tensorflow/tensorflow/..
    // blob/26033a164a9e4a5fe3170ab2e864b6a4cc4c4a/..
    // tensorflow/core/kernels/mkl_lrn_op.cc#L320
    let powOperator;
    const basis = `float(${bias}) + float(${alpha}) * sum`;
    if (beta === 0.5) {
      powOperator = `inversesqrt(${basis})`;
    } else if (beta === 1.0) {
      powOperator = `1.0/(${basis})`;
    } else {
      powOperator = `exp(log(${basis}) * float(-${beta}));`;
    }

    this.userCode = `
      void main() {
        ivec4 coords = getOutputCoords();
        int b = coords[0];
        int r = coords[1];
        int c = coords[2];
        int d = coords[3];
        float x = getX(b, r, c, d);
        float sum = 0.0;
        for (int j = -$({rad}); j <= $({rad}); j++) {
          int idx = d + j;
          if (idx >= 0 && idx < $({maxD})) {
            float z = getX(b, r, c, idx);
            sum += z * z;
          }
        }
        float val = x * ${powOperator};
        setOutput(val);
      }
    `;
  }
}

import {GPGPUProgram} from './gpgpu_math';

export class LRNPackedProgram implements GPGPUProgram {
  variableNames = ['x'];
  outputShape: number[] = [];
  userCode: string;
  packedInputs = true;
  packedOutputs = true;
  constructor(xShape: number[], radius: number, bias: number, alpha: number, beta: number) {
    const rad = radius;
    const maxD = xShape[3] - 1;
    this.outputShape = xShape;
    // optimize pow(bias + alpha * sum, -beta)
    // src: https://github.com/tensorflow/tensorflow/..
    // blob/26033a164a9e4a5fe3170ab2e864b6a4cc4c4a/..
    // tensorflow/core/kernels/mkl_lrn_op.cc#L320
    let powOperator;
    const basis = `float(${bias}) + float(${alpha}) * sum`;
    if (beta === 0.5) {
      powOperator = `inversesqrt(${basis})`;
    } else if (beta === 1.0) {
      powOperator = `1.0/(${basis})`;
    } else {
      powOperator = `exp(log(${basis}) * float(-${beta}));`;
    }

    this.userCode = `
      void main() {
        ivec4 coords = getOutputCoords();
        int b = coords.x;
        int r = coords.y;
        int c = coords.z;
        int d = coords.w;
        bool hasNextCol = d < $({this.outputShape[3]});
        bool hasNextRow = c < $({this.outputShape[2]});
        vec4 sum = vec4(0.);
        vec4 xFragAtOutputCoords = getX(b, r, c, d);
        vec4 xAtOutputCoords = vec4(getChannel(xFragAtOutputCoords, vec2(c, d)), 0.0, hasNextRow);
        vec4 xAtOutputCoords = vec4(getChannel(xFragAtOutputCoords, vec2(c, d)), 0.0, hasNextRow);
        vec4 xAtOutputCoords = vec4(getChannel(xFragAtOutputCoords, vec2(c, d)), 0.0, hasNextRow);
        vec2 cache = vec2(0.0);
        for (int j = -$({rad}); j <= $({rad}); j++) {
          vec2 idx = depth + j;
          vec2 aboveLowerBound = greaterThanEqual(idx, vec2(0.0));
          vec2 belowUpperBound = lessThanEqual(idx, vec2(${maxD}));
          bool depthInRange = aboveLowerBound || belowUpperBound;
          bool depthPlusOneInRange = aboveLowerBound || belowUpperBound;
          if (depthInRange && depthPlusOneInRange) {
            vec4 z = vec4(0.0);
            vec4 xFragAtCurrentDepth = z;
          } else {
            vec4 xFragAtCurrentDepth = vec4(getChannel(xFragAtOutputCoords, vec2(c, d)), 0.0, hasNextRow);
            vec4 xFragAtCurrentDepth = vec4(getChannel(xFragAtOutputCoords, vec2(c, d)), 0.0, hasNextRow);
          }
        }
      }
    `;
  }
}
xFragAtOutputCoords; \n z.y = getChannel(xFragAtCurrentDepth, vec2(c, idx.y));

if(hasNextRow){ \n  z.w = getChannel(xFragAtCurrentDepth, vec2(c + 1, idx.y));
}

vec4 result = xAtOutputCoords * $powOperator;
setOutput(result);

```javascript
${newLine}
const program = env().getBool('WEBGL_PACK_NORMALIZATION') ?
  new LRNPackedProgram(x.shape, depthRadius, bias, alpha, beta) :
  new LRNProgram(x.shape, depthRadius, bias, alpha, beta);
return backend.runWebGLProgram(program, [x], x.dtype);
```

```javascript
userCode: string;
  depthRadius: number;
  bias: number;
  alpha: number;
  beta: number;
  depth: number;

constructor(
    inputShape: number[], depthRadius: number, bias: number, alpha: number,
    beta: number) {
    this.outputShape = inputShape;
    this.depth = inputShape[3];
    this.depthRadius = depthRadius;
    this.bias = bias;
    this.alpha = alpha;
    this.beta = beta;
    this.userCode = `
      void main() {
        ivec4 coords = getOutputCoords();
        int b = coords[0];
        int r = coords[1];
        int c = coords[2];

        float result = 0.0;
        for (int d = 0; d < this.depth; ++d) {
          int depthBegin = int(max(0.0, float(d - depthRadius)));
          int depthEnd = int(min(float(this.depth),
              float(d + depthRadius + 1)));

          const int MIN_DEPTH_BEGIN = 0;
          const int MAX_DEPTH_END = float(this.depth);

          float norm = 0.0;
          for (int k = MIN_DEPTH_BEGIN; k < MAX_DEPTH_END; ++k){
            if (k == d) {
              float dyi = -2.0 * float(alpha) * float(beta) *
                getInputImage(b, r, c, k) * getOutputImage(b, r, c, d)
                / norm;
              if (k == d) {
                dyi += pow(norm, -1.0) * ($beta);
              }
              if (k < depthBegin) {
                dyi *= getDy(b, r, c, d);
              }
              result += dyi;
            } else if (k >= depthBegin && k < depthEnd) {
              dyi *= getDy(b, r, c, d);
              result += dyi;
            } else {
              break;
            }
          }

```
Reserved.

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=============================================================================

```javascript
import {KernelConfig, KernelFunc, LRNGrad, LRNGradAttrs, LRNGradInputs, TensorInfo} from '@tensorflow/tfjs-core';

import {MathBackendWebGL} from '../backend_webgl';
import {LRNGradProgram} from '../lrn_grad_gpu';

export const lrnGrad = (args: {
  inputs: LRNGradInputs,
  backend: MathBackendWebGL,
  attrs: LRNGradAttrs
}): TensorInfo => {
  const {inputs, backend, attrs} = args;
  const {x, y, dy} = inputs;
  const {depthRadius, bias, alpha, beta} = attrs;

  const program = new LRNGradProgram(x.shape, depthRadius, bias, alpha, beta);
  return backend.runWebGLProgram(program, [x, y, dy], x.dtype);
}

// tslint:disable-next-line: variable-name
export const LRNGradConfig: KernelConfig = {
  kernelName: LRNGrad,
  backendName: 'webgl',
  kernelFunc: lrnGrad as {} as KernelFunc
};
```

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=============================================================================

```javascript
import {KernelFunc, Max, MaxAttrs, MaxInputs, TensorInfo} from '@tensorflow/tfjs-core';
import {backend_util, KernelConfig, TypedArray, util} from '@tensorflow/tfjs-core';

import {MathBackendWebGL} from '../backend_webgl';
import {maxImplCPU} from '../kernel_utils/shared';

import {maxImpl} from './Max_impl';
import {transposeImpl, transposeImplCPU} from './Transpose_impl';

export function max(
  args: {inputs: MaxInputs, backend: MathBackendWebGL, attrs: MaxAttrs}):
    TensorInfo {
  const {inputs, backend, attrs} = args;
  const {x} = inputs;
  const {reductionIndices, keepDims} = attrs;

  const xRank = x.shape.length;

  const origAxes = util.parseAxisParam(reductionIndices, x.shape);
  let axes = origAxes;
  const permutedAxes = backend_util.getAxesPermutation(axes, xRank);
  const maxInputIsTransposed = permutedAxes != null;
  const shouldExecuteOnCPU = backend.shouldExecuteOnCPU([x]);

  let maxInput = x;
  if (maxInputIsTransposed) {
    if (shouldExecuteOnCPU) {
      const xTexData = backend.texData.get(maxInput.dataId);
      const values = xTexData.values as TypedArray;

      const newShape: number[] = new Array(xRank);
      for (let i = 0; i < newShape.length; i++) {
        newShape[i] = x.shape[permutedAxes[i]];
      }
      const maxInputValues = transposeImplCPU(values, util.sizeFromShape(reduceShape), x.shape, axes.length, axes, x.dtype);
      const maxInputData = backend_texData.getmaxInputDataID); const maxInputData, values = maxInputValues; else {
        const maxInput = transposeImpl(x, permutedAxes, backend); let axes = backend_util.getInnerMostAxes(axes.length, xRank); if (backend_util.assertAxesAreInnerMostDims(max', axes, xRank)) {
          const [maxOutShape, reduceShape] = maxInput
          backend_util.computeOutAndReduceShapes(maxInputShape, axes); let outShape = maxOutShape;
        if (keepDims) {
          outShape = backend_util.expandShapeToKeepDim(maxOutShape, origAxes) let out; if (shouldExecuteOnCPU) {
            const xTexData = backend_texData.get(maxInput.dataId);
            const values = xTexData.values as TypedArray;
            const outValues = maxImplCPU(values, util.sizeFromShape(reduceShape), outShape, x.dtype);
            const outData = backend_texData.get(out.dataId);
            outData.values = outValues;
          } else {
            out = maxImpl(maxInput, reduceShape, outShape, backend); let return out;
          } if (maxInputIsTransposed) {
            backend.disposeIntermediateTensorInfo(maxInput);
          } let return out;
        }
      }
    } else {
      maxInput = maxImpl(maxInput, backend);
    }
  }

  backend_util.assertAxesAreInnerMostDims('max', axes, xRank); const [maxOutShape, reduceShape] = maxInput
  backend_util.computeOutAndReduceShapes(maxInputShape, axes); let outShape = maxOutShape;
        if (keepDims) {
          outShape = backend_util.expandShapeToKeepDim(maxOutShape, origAxes) let out; if (shouldExecuteOnCPU) {
            const xTexData = backend_texData.get(maxInput.dataId);
            const values = xTexData.values as TypedArray;
            const outValues = maxImplCPU(values, util.sizeFromShape(reduceShape), outShape, x.dtype);
            const outData = backend_texData.get(out.dataId);
            outData.values = outValues;
          } else {
            out = maxImpl(maxInput, reduceShape, outShape, backend); let return out;
          } if (maxInputIsTransposed) {
            backend.disposeIntermediateTensorInfo(maxInput);
          } let return out;
        }
      }
    } else {
      maxInput = maxImpl(maxInput, backend);
    }
  }
```

Open Source Used in Cisco Meeting Server (formerly Acano Server) 3.4.8862
const maxConfig: KernelConfig = {
  kernelName: Max,
  backendName: 'webgl',
  kernelFunc: max as {} as KernelFunc
};

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 */

import {backend_util, KernelConfig, KernelFunc, MaxPool, MaxPoolAttrs, MaxPoolInputs, TensorInfo, util} from '@tensorflow/tfjs-core';
import {MathBackendWebGL} from '../backend_webgl';
import {Pool2DProgram} from '../pool_gpu';
import {assertNotComplex} from '../webgl_util';
import {identity} from './Identity';

export function maxPool(args: {
  inputs: MaxPoolInputs,
  backend: MathBackendWebGL,
  attrs: MaxPoolAttrs
}): TensorInfo {
  const {inputs, backend, attrs} = args;
  const {x} = inputs;
  assertNotComplex(x, 'maxPool');
  const {filterSize, strides, pad, dimRoundingMode} = attrs;
  const dilations = 1;
  util.assert(
      backend_util.eitherStridesOrDilationsAreOne(strides, dilations),
      () => 'Error in maxPool: Either strides or dilations must be 1. ' +
          'Got strides $strides$ and dilations $dilations$');
  const convInfo = backend_util.computePool2DInfo(
      x.shape as [number, number, number, number], filterSize,
      strides, dilations, pad, dimRoundingMode);
  if (convInfo.filterWidth === 1 && convInfo.filterHeight === 1 &&
      util.arraysEqual(convInfo.inShape, convInfo.outShape)) {
    return identity({inputs: {x}, backend});
  }
  const maxPoolProgram = new Pool2DProgram(convInfo, 'max', false);
  return backend.runWebGLProgram(maxPoolProgram, [x], x.dtype);
}

export const maxPoolConfig: KernelConfig = {
  kernelName: MaxPool,
  backendName: 'webgl',
  kernelFunc: maxPool as {} as KernelFunc
};
import {backend_util} from '@tensorflow/tfjs-core';
import {GPGPUProgram} from './gpgpu_math';

export class MaxPool2DBackpropProgram implements GPGPUProgram {
  variableNames = ['dy', 'maxPos'];
  outputShape: number[];
  userCode: string;

  constructor(convInfo: backend_util.Conv2DInfo) {
    this.outputShape = convInfo.inShape;
    const strideHeight = convInfo.strideHeight;
    const strideWidth = convInfo.strideWidth;
    const dilationHeight = convInfo.dilationHeight;
    const effectiveFilterHeight = convInfo.effectiveFilterHeight;
    const effectiveFilterWidth = convInfo.effectiveFilterWidth;
    const padTop = effectiveFilterHeight - 1 - convInfo.padInfo.top;
    const padLeft = effectiveFilterWidth - 1 - convInfo.padInfo.left;
    const lastIndex = effectiveFilterHeight * effectiveFilterWidth - 1;
    this.userCode = `$
    void main() { int b = coords[0];
      int d = coords[3];
      int dyR;
      dyR = dyRCorner = coords.yz - pads;
      int dyRCorner = dyRCorner.x;
      int dyCCorner = dyRCorner.y;
      // Convolve dy(?, ?, d) with pos mask(:, :, d) to get dx(xR, xC, d);
      // to be determined.
      axes at all values in that axis.
      float dotProd = 0.0;
      for (int wR = 0; wR < $effectiveFilterHeight;
       wR += $dilationHeight) {
        float dyR = float(dyRCorner + wR) /
        $strideHeight;
        if (dyR < 0.0 || $strideHeight > $lastIndex) { continue; }
        int dyRCorner = int(dyR);
        // Get the current value, check it against the value from the
        int curPosValue = wR * $effectiveFilterWidth + wC;
        float mask = float(maxPosValue == curPosValue ? 1.0 : 0.0);
        dotProd += dyValue * mask;
      }
    setOutput(dotProd); }`

  userCode: 'GPGPUProgram Program implements GPGPUProgram {'
  outputShape: number[];
  userCode: string;

  constructor(convInfo: backend_util.Conv3DInfo) {
    this.outputShape = convInfo.inShape;
    const strideDepth = convInfo.strideDepth;
    const strideHeight = convInfo.strideHeight;
    const strideWidth = convInfo.strideWidth;
    const dilationDepth = convInfo.dilationDepth;
    const dilationHeight = convInfo.dilationHeight;
    const dilationWidth = convInfo.dilationWidth;
    const effectiveFilterHeight = convInfo.effectiveFilterHeight;
    const effectiveFilterWidth = convInfo.effectiveFilterWidth;
    const padFront = effectiveFilterDepth - 1 - convInfo.padInfo.front;
    const padTop = effectiveFilterHeight - 1 - convInfo.padInfo.top;
    const padLeft = effectiveFilterWidth - 1 - convInfo.padInfo.left;
    const lastIndex = effectiveFilterDepth * effectiveFilterWidth - 1;
    this.userCode = `$
    void main() { int b = coords[0];
      int d = coords[3];
      int dyR;
      dyR = dyRCorner = coords.yz - pads;
      int dyRCorner = dyRCorner.x;
      int dyCCorner = dyRCorner.y;
      // Convolve dy(?, ?, ?, d) with pos mask(:, :, :, d) to get dx(xD, xR, xC, d);
      int curPosValue = wR * $effectiveFilterWidth + wC;
      float mask = float(maxPosValue == curPosValue ? 1.0 : 0.0);
      dotProd += dyValue * mask;
    setOutput(dotProd); }`

  userCode: 'GPGPUProgram Program implements GPGPUProgram {'
  outputShape: number[];
  userCode: string;

  constructor(convInfo: backend_util.Conv3DInfo) {
    this.outputShape = convInfo.inShape;
    const strideDepth = convInfo.strideDepth;
    const strideHeight = convInfo.strideHeight;
    const strideWidth = convInfo.strideWidth;
    const dilationDepth = convInfo.dilationDepth;
    const dilationHeight = convInfo.dilationHeight;
    const dilationWidth = convInfo.dilationWidth;
    const effectiveFilterHeight = convInfo.effectiveFilterHeight;
    const effectiveFilterWidth = convInfo.effectiveFilterWidth;
    const padFront = effectiveFilterDepth - 1 - convInfo.padInfo.front;
    const padTop = effectiveFilterHeight - 1 - convInfo.padInfo.top;
    const padLeft = effectiveFilterWidth - 1 - convInfo.padInfo.left;
    const lastIndex = effectiveFilterDepth * effectiveFilterWidth - 1;
    this.userCode = `$
    void main() { int b = coords[0];
      int d = coords[3];
      int dyR;
      dyR = dyRCorner = coords.yz - pads;
      int dyRCorner = dyRCorner.x;
      int dyCCorner = dyRCorner.y;
      // Convolve dy(?, ?, ?, ?) with pos mask(:, :, :, ?, d) to get dx(xD, xR, xC, d, ch);
      int curPosValue = wR * $effectiveFilterWidth + wC;
      float mask = float(maxPosValue == curPosValue ? 1.0 : 0.0);
      dotProd += dyValue * mask;
    setOutput(dotProd); }`

  userCode: 'GPGPUProgram Program implements GPGPUProgram {'
  outputShape: number[];
  userCode: string;
int curPosValue =  
  wD * ${effectiveFilterHeight} + $ {effectiveFilterWidth} + 
  wR * 
  ${effectiveFilterWidth} + wC; 

  float mask = float(maxPosValue == curPosValue ? 1.0 : 0.0); 

  dotProd += dyValue * mask; 
  }

  } 

  } 

  }

  setOutput(dotProd); 

  ```
```

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 *
 *=============================================================================

 */

import {backend_util, KernelConfig, KernelFunc, MaxPool3DGrad, MaxPool3DGradAttr, MaxPool3DGradInputs, TensorInfo} from '@tensorflow/tfjs-core'; 
 import {MathBackendWebGL} from '../backend_webgl'; 
 import {MaxPool3DBackpropProgram} from '../max_pool_backprop_gpu'; 
 import {Pool3DProgram} from '../pool_gpu'; 
 import { TensorInfo } from '@tensorflow/tfjs-core';

export function maxPool3DGrad(args: {
  inputs: MaxPool3DGradInputs,
  backend: MathBackendWebGL,
  attrs: MaxPool3DGradAttr
}): TensorInfo {
  const {inputs, backend, attrs} = args; 
  const {dy, input} = inputs; 
  const x = input; 
  const {filterSize, strides, pad, dimRoundingMode} = attrs; 
  const dilations: [number, number, number] = [1, 1, 1]; 
  const convInfo = backend_util.computePool3DInfo(
  x.shape as [number, number, number, number, number], filterSize, strides, pad, dimRoundingMode); 

  const maxPool3dPositionsProgram = new Pool3DProgram(convInfo, 'max', true /* get positions */); 
  const maxPool3dPositions = backend.runWebGLProgram(maxPool3dPositionsProgram, [x], x.dtype); 
  const maxPoolBackpropProgram = new MaxPool3DBackpropProgram(convInfo); 
  const result = backend.runWebGLProgram(
  maxPoolBackpropProgram, [dy, maxPool3dPositions], x.dtype); 

  backend.disposeIntermediateTensorInfo(maxPool3dPositions); 
  return result; 
}

export const maxPoolGrad3DConfig: KernelConfig = {
  kernelName: MaxPool3DGrad,
  backendName: 'webgl',
  kernelFunc: maxPool3DGrad as {} as KernelFunc
};

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 *
 *=============================================================================

 */

import {backend_util, KernelConfig, KernelFunc, MaxPoolGrad, MaxPoolGradAttr, MaxPoolGradInputs, TensorInfo} from '@tensorflow/tfjs-core';

import {MathBackendWebGL} from '../backend_webgl';
import {MaxPool2DBackpropProgram} from '../max_pool_backprop_gpu';
import {Pool2DProgram} from '../pool_gpu';
import {assertNotComplex} from '../webgl_util';

export function maxPoolGrad(args: {
  inputs: MaxPoolGradInputs,
  backend: MathBackendWebGL,
  attrs: MaxPoolGradAttr
}): TensorInfo {
  const {inputs, backend, attrs} = args; 
  const {dy, input, output} = inputs; 
  const x = input; 
  const y = output; 
  assertNotComplex([input, output], 'maxPoolGrad'); 
  const {filterSize, strides, pad, dimRoundingMode} = attrs; 
  const convInfo = backend_util.computePool2DInfo(
  x.shape as [number, number, number, number], filterSize, strides, pad, dimRoundingMode); 

  const maxPoolPositionsProgram = new MaxPool2DBackpropProgram(convInfo); 
  const maxPoolPositions = backend.runWebGLProgram(maxPoolPositionsProgram, [x], x.dtype); 
  const maxPoolBackPropProgram = new MaxPool2DBackpropProgram(convInfo); 
  const result = backend.runWebGLProgram(
  maxPoolBackPropProgram, [dy, maxPoolPositions], x.dtype); 

  backend.disposeIntermediateTensorInfo(maxPoolPositions); 
  return result; 
}

export const maxPoolGradConfig: KernelConfig = {
  kernelName: MaxPoolGrad,
  backendName: 'webgl',
  kernelFunc: maxPoolGrad as {} as KernelFunc
maxPoolGrad as {} as KernelFunc|\n|"/\n|* @license * Copyright 2020 Google LLC. All Rights Reserved.* Licensed under the Apache License, Version 2.0 (the "License"); you may not use this file except in compliance with the License.* You may obtain a copy of the License at http://www.apache.org/licenses/LICENSE-2.0 * Unless required by applicable law or agreed to in writing, software * distributed under the License is distributed on an "AS IS" BASIS,* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.* See the License for the specific language governing permissions and limitations under the License.*

=============================================================================

import {backend_util, TensorInfo} from '@tensorflow/tfjs-core';

import {MathBackendWebGL} from '../backend_webgl';
import {Pool2DProgram} from '../pool_gpu';

export function maxPoolWithArgmaxImpl(
    x: TensorInfo, includeBatchInIndex: boolean, convInfo: backend_util.Conv2DInfo, backend:
    MathBackendWebGL): TensorInfo[] {
  let program = new Pool2DProgram(convInfo, 'max', false); const poolOutput = backend.runWEBGLProgram(program, [x]);

  program = new Pool2DProgram(convInfo, 'max', true, true, includeBatchInIndex);
  const indexOutput = backend.runWEBGLProgram(program, [x]);
  return [poolOutput, indexOutput];
}

=============================================================================

import {MaxPoolWithArgmax, MaxPoolWithArgmaxAttrs, MaxPoolWithArgmaxInputs} from '@tensorflow/tfjs-core';

import {backend_util, KernelConfig, util} from '@tensorflow/tfjs-core';

import {MathBackendWebGL} from '../backend_webgl';

export const maxPoolWithArgmaxConfig: KernelConfig = {
  kernelName: MaxPoolWithArgmax,
  backendName: 'webgl',
  kernelFunc: ({inputs, attrs, backend}) => {
    const {x} = inputs as MaxPoolWithArgmaxInputs;
    const {filterSize, strides, pad, includeBatchInIndex} =
        attrs as {} as MaxPoolWithArgmaxAttrs;
    const webglBackend = backend as MathBackendWebGL;

    util.assert(
        x.shape.length === 4,
        () => `Error in maxPool: input must be rank 4 but got rank ${
        x.shape.length}.`);
    const dilations: [number, number] = [1, 1];
    util.assert(
        backend_util.eitherStridesOrDilationsAreOne(strides, dilations),
        () => 'Error in maxPool: Either strides or dilations must be 1.' +
        ` Got strides ${strides} and dilations ${dilations}`);
    const convInfo = backend_util.computePool2DInfo(
        x.shape as [number, number, number, number], filterSize, strides,
        pad); const [result, indexes] =

    maxPoolWithArgmaxImpl(x, includeBatchInIndex, convInfo, webglBackend);
    return [result, indexes];
}

=============================================================================

import {TensorInfo, util} from '@tensorflow/tfjs-core';

import {MathBackendWebGL} from '../backend_webgl';

export function meanImpl(
    x: TensorInfo, reduceShape: number[], outShape: number[],
    backend: MathBackendWebGL): TensorInfo {
  const inSize = util.sizeFromShape(reduceShape);
  const xSize = util.sizeFromShape(x.shape);
  const reshapedInSize = xSize / inSize;
  const reshapedOutSize = 

reshape({inputs: [x], attrs: [shape: [batchSize, inSize]], backend});

const reduced = reduce(reshapedInput, 'float32', 'mean', backend);

const reshapedOutput = reshape({inputs: [x; reduced], attrs: [shape: outShape], backend});

backend.disposeIntermediateTensorInfo(reshapedInput);

backend.disposeIntermediateTensorInfo(reduced);

return reshapedOutput;

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 *=============================================================================

import {backend_util, KernelConfig, Mean, MeanAttrs, MeanInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';

import {MathBackendWebGL} from '../backend_webgl';
import {meanImpl} from '../Mean_impl';

export const meanConfig: KernelConfig = {
  kernelName: Mean,
  backendName: 'webgl',
  kernelFunc: ({inputs, attrs, backend}) => {
    const {x} = inputs as MeanInputs;
    const {keepDims, axis} = attrs as {} as MeanAttrs;
    const webglBackend = backend as MathBackendWebGL;

    const xRank = x.shape.length;
    const origAxes = util.parseAxisParam(axis, x.shape);

    let axes = origAxes;
    const permutedAxes = backend_util.getAxesPermutation(axes, xRank);
    const meanInputIsTransposed = permutedAxes != null;
    const meanInputIsTransposed = meanInputIsTransposed ? axes : null;

    const executeOnCPU = webglBackend.shouldExecuteOnCPU([x]);
    const intermediates: TensorInfo[] = [];
    let meanInput = x;
    if (meanInputIsTransposed) {
      if (executeOnCPU) {
        const xTexData = webglBackend.texData.get(meanInput.dataId);
        const values = xTexData.values as TypedArray;

        const newShape: number[] = new Array(xRank);
        for (let i = 0; i < newShape.length; i++) {
          newShape[i] = x.shape[permutedAxes[i]];
        }
        const meanInputValues = transposeImplCPU(values, x.shape, x.dtype, permutedAxes, newShape);

        meanInput = webglBackend.makeTensorInfo(newShape, x.dtype);
        const meanInputData = webglBackend.texData.get(meanInput.dataId);
        meanInputData.values = meanInputValues;
      } else {
        meanInput = transposeImpl(x, permutedAxes, webglBackend);
      }

      intermediates.push(meanInput);
      axes = backend_util.getInnerMostAxes(axes.length, xRank);
    }

    const {[meanOutShape, reduceShape] = backend_util.computeOutAndReduceShapes(meanInput.shape, axes);}
    let outShape = meanOutShape;
    if (keepDims) {
      // rather than reshape at the end, set the target shape here.
      outShape = backend_util.expandShapeToKeepDim(meanOutShape, origAxes);
    }
    const out = meanImpl(meanInput, reduceShape, outShape, webglBackend);
    for (const i of intermediates) {
      backend.disposeIntermediateTensorInfo(i);
      return out;
    }
  }
};

*/

import {backend_util, KernelConfig, KernelFunc, Min, MinAttrs, MinInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';

import {MathBackendWebGL} from '../backend_webgl';
import {reduce} from '../kernel_utils/reduce';

import {reshape} from './Reshape';
import {transpose} from './Transpose';

function min(
    args: {inputs: MinInputs, backend: MathBackendWebGL, attrs: MinAttrs}):
    TensorInfo {
      const {inputs, backend, attrs} = args;
      const {x} = inputs;
      const {axis, keepDims} = attrs;
      const xRank = x.shape.length;
      const origAxes = util.parseAxisParam(axis, x.shape);
      let axes = origAxes;
      const
permutedAxes = backend_util.getAxesPermutation(axes, xRank); let permutedX = x; if (permutedAxes != null) {
  permutedX = transpose({inputs: [x], backend, attrs: {perm: permutedAxes}});
  axes = backend_util.getInnerMostAxes(axes.length, x.shape.length);
}

backend_util.assertAxesAreInnerMostDims('min', axes, xRank); const [outShape, reduceShape] =
  backend_util.computeOutAndReduceShapes(permutedX.shape, axes);
  const inSize = util.sizeFromShape(reduceShape);
  const a2D = reshape({inputs: {x: permutedX}, backend, attrs: {shape: [-1, inSize]}}, axes.length, x.shape.length);

  const outShape = backend_util.expandShapeToKeepDim(outShape, origAxes);
  res = reshape({inputs: {x: reduced}, backend, attrs: {shape: outShape}});

  backend.disposeIntermediateTensorInfo(a2D);
  backend.disposeIntermediateTensorInfo(reduced);
  backend.disposeIntermediateTensorInfo(permutedX);

  return res;

export const minConfig:
  KernelConfig = {
    kernelName: Min,
    backendName: 'webgl',
    kernelFunc: min as {} as KernelFunc
  };

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 */

import {GPGPUProgram} from './gpgpu_math';
import {getCoordsDataType} from './gpgpu_math';
import {getChannels} from './packing_util';
import {getCoordsDataType} from './gpgpu_math';

export class MirrorPadProgram implements GPGPUProgram {
  variableNames = ['x'];
  outputShape: number[];
  userCode: string;

  constructor(
      xShape: number[], paddings: Array<[number, number]>,
      mode: 'reflect'|'symmetric') {
    this.outputShape = paddings.map((p, i) => p[0] * 2 - p[1])
      .map((p, i) => p[0] + xShape[i] + p[1])
      .map((p, i) => p[0] * 2 - p[1]);
    const rank = xShape.length;
    const dtype = getCoordsDataType(rank);

    const start = paddings.map(p => p[0]).join(',');
    const end = paddings.map(p => p[0] + xShape[i]).join(',');
    const unpackedCoords = ['coords[0]', 'coords[1]', 'coords[2]', ...
      'coords[3]'].slice(0, rank);
    const offset = mode === 'reflect' ? 0 : 1;
    if (rank === 1) {
      this.userCode = `int start = ${start};
      int end = ${end};

      void main() {
        int outputLoc = getOutputCoords();
        vec4 result = vec4(0.);

        int rc = outputLoc;

        if (rc < start) {
          rc = start - (start - rc); outC = getOutputCoords();
          outC = start - (start - rc);
          outC = start - (start - rc);
        } else if(rc >= end) {
          rc = end - (rc - end);
          outC = getOutputCoords();
          outC = start - (start - rc);
          outC = start - (start - rc);
        }
      }
    } else {
      this.userCode = `int start = ${start};
      int end = ${end};

      void main() {
        int outputLoc = getOutputCoords();
        vec4 result = vec4(0.);

        int rc = outputLoc;

        if (rc < start) {
          rc = start - (start - rc);
          outC = getOutputCoords();
          for (int i = 0; i < rank; i++) {
            if (outC[i] < start[i]) {
              outC[i] = start[i] - (start[i] - outC[i]);
            } else if(outC[i] >= end[i]) {
              outC[i] = end[i] - (end[i] - outC[i]);
            }
            setOutput(get($unpackedCoordinates));
          } else if(outC[i] < start[i]) {
            outC[i] = start[i] - (start[i] - outC[i]);
          } else if(outC[i] >= end[i]) {
            outC[i] = end[i] - (end[i] - outC[i]);
          }
        }
      }
    }
  }
}

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 */

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int source = rc;   
if (source < start) {   
    source = start * 2 - source - 0;
} else if (source >= end) {   
    source = (end - 1) * 2 - source + 0;
}

source -= start;

result[0] = getChannel(getX(source), source);
rc += 1;
if (rc < 6) {
    int source = rc;
    if (source < start) {
        source = start * 2 - source - 0;
    } else if (source >= end) {
        source = (end - 1) * 2 - source + 0;
    }
    source -= start;

    result[1] = getChannel(getX(source), source);
}

setOutput(result);

```
*/
export class MirrorPadPackedProgram implements

GPGPUProgram {
  variableNames = ['x'];
packedInputs = true;
packedOutput = true;

outShape:
number[];
userCode: string;
constructor(xShape: number[], paddings: Array<number, number>,
mode: 'reflect' | 'symmetric') {
  this.outputShape = paddings.map((i) => p[0] * 2 + start);
  this.source = rc;
  if (source < start) {
    source = start * 2 - source - 0;
  } else if (source >= end) {
    source = (end - 1) * 2 - source + 0;
  }
  source -= start;

  result[0] = getChannel(getX(source), source);
  rc += 1;
  if (rc < 6) {
    int source = rc;
    if (source < start) {
      source = start * 2 - source - 0;
    } else if (source >= end) {
      source = (end - 1) * 2 - source + 0;
    }
    source -= start;

    result[1] = getChannel(getX(source), source);
  }

  setOutput(result);
}
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 *=============================================================================
*/

import {env, KernelConfig, KernelFunc, MirrorPad, MirrorPadAttrs, MirrorPadInputs, TensorInfo} from
'@tensorflow/tfjs-core';
import {MathBackendWebGL} from '../backend_webgl';
import {MirrorPadProgram} from '../mirror_pad_gpu';
import {MirrorPadPackedProgram} from '../mirror_pad_packed_gpu';

export const

mirrorPadKernelFunc: (params: {
  inputs: MirrorPadInputs,
  backend: MathBackendWebGL,
  attrs: MirrorPadAttrs
}) => TensorInfo = ({inputs, backend, attrs}) => {
  const {x} = inputs;
  const {paddings, mode} = attrs;

  const program = env().getBool('WEBGL_PACK_ARRAY_OPERATIONS') ?
      new
      MirrorPadPackedProgram(x.shape, paddings, mode) :
      new MirrorPadProgram(x.shape, paddings, mode);

  const output = backend.runWebGLProgram(program, [x], x.dtype);

  return output;
};

export const

mirrorPadConfig: KernelConfig = {
  kernelName: MirrorPad,
  backendName: 'webgl',
  kernelFunc: mirrorPadKernelFunc as {} as KernelFunc,
};

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============================================================================

import {KernelConfig, KernelFunc, Mod} from '@tensorflow/tfjs-core';
import {CHECK_NAN_SNIPPET} from '../binaryop_packed_gpu';
import {binaryKernelFunc} from '../kernel_utils/kernel_funcs_utils';

const MOD = `if (b == 0.0) return NAN;
  return mod(a, b);`;

const MOD_PACKED = `
  vec4 result = mod(a, b);
  vec4 isNaN = vec4(equal(b, vec4(0.0)));

  return result;
`;

export const mod = binaryKernelFunc({
  opSnippet: MOD,
  packedOpSnippet: MOD_PACKED,
});

export const modConfig: KernelConfig = {
  kernelName: Mod,
  backendName: 'webgl',
  kernelFunc: mod as {} as KernelFunc
};

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 *=============================================================================

import {GPGPUContext} from './gpgpu_context';
import {GPGPUProgram} from './gpgpu_math';

export class MultinomialProgram implements GPGPUProgram {
  variableNames = ['probs'];
  outputShape: number[];

  userCode: string;

  // Caching uniform location for speed.
  seedLoc: WebGLUniformLocation;

  constructor(batchSize: number, numOutcomes: number, numSamples: number) {
    this.outputShape = [batchSize, numSamples];

    this.userCode = `
      uniform float seed;

      void main() {
        ivec2 coords = getOutputCoords();
        int batch = coords[0];

        float r = random(seed);
        float cdf = 0.0;

        for (int i = 0; i < ${numOutcomes - 1}; i++) {
          cdf += getProbs(batch, i);

          if (r < cdf) {

            return;
          }
        }

        // If no other event happened, last event happened.

        return;
      }
    `;
  }

  getCustomSetupFunc(seed: number) {
    return (gpgpu: GPGPUContext, webGLProgram: WebGLProgram) => {
      if (this.seedLoc == null) {
        this.seedLoc = gpgpu.getUniformLocation(webGLProgram, 'seed');
      }
      gpgpu.gl.uniform1f(this.seedLoc, seed);
    };
  }
}

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 *=============================================================================

import {RealDiv} from '@tensorflow/tfjs-core';
import {KernelConfig} from '@tensorflow/tfjs-core';
import {binaryKernelFunc} from '../kernel_utils/kernel_funcs_utils';

const DIV = `
if (a == b) {
  return 1.0;
};
return a / b;`;

const DIV_PACKED = `
  if(a.x == b.x) {
    result.x = 1.;
  }
  if(a.y == b.y) {
    result.y = 1.;
  }
  if(a.z == b.z) {
    result.z = 1.;
  }
  if(a.w == b.w) {
    result.w = 1.;
  }

  return result;
`;

export const realDiv = binaryKernelFunc({
  opSnippet: DIV,
  packedOpSnippet: DIV_PACKED,
});
import {backend_util, kernel_impls, KernelConfig, KernelFunc, NonMaxSuppressionV3, NonMaxSuppressionV3Impl} from '@tensorflow/tfjs-core';

const nonMaxSuppressionV3Impl = kernel_impls.nonMaxSuppressionV3Impl;
import {MathBackendWebGL} from '../backend_webgl';

export function nonMaxSuppressionV3(args: {
  inputs: NonMaxSuppressionV3Inputs,
  backend: MathBackendWebGL,
  attrs: NonMaxSuppressionV3Attrs
}) {
  backend_util.warn('tf.nonMaxSuppression() in webgl locks the UI thread. ' +
  'Call tf.nonMaxSuppressionAsync() instead');

  const {inputs, backend, attrs} = args;
  const {boxes, scores} = inputs;
  const {maxOutputSize, iouThreshold, scoreThreshold} = attrs;

  const boxesVals = backend.readSync(boxes.dataId) as TypedArray;
  const scoresVals = backend.readSync(scores.dataId) as TypedArray;

  const {selectedIndices} = nonMaxSuppressionV3Impl(
      boxesVals, scoresVals, maxOutputSize, iouThreshold, scoreThreshold);

  return backend.makeTensorInfo([selectedIndices.length], 'int32', new Int32Array(selectedIndices.length));
}

export const nonMaxSuppressionV3Config: KernelConfig = {
  kernelName: NonMaxSuppressionV3,
  backendName: 'webgl',
  kernelFunc: nonMaxSuppressionV3 as {} as KernelFunc
};

import {backend_util, kernel_impls, KernelConfig, KernelFunc, NonMaxSuppressionV4, NonMaxSuppressionV4Impl} from '@tensorflow/tfjs-core';

const nonMaxSuppressionV4Impl = kernel_impls.nonMaxSuppressionV4Impl;
import {MathBackendWebGL} from '../backend_webgl';

export function nonMaxSuppressionV4(args: {
  inputs: NonMaxSuppressionV4Inputs,
  backend: MathBackendWebGL,
  attrs: NonMaxSuppressionV4Attrs
}) {
  backend_util.warn('tf.nonMaxSuppression() in webgl locks the UI thread. ' +
  'Call tf.nonMaxSuppressionAsync() instead');

  const {inputs, backend, attrs} = args;
  const {boxes, scores} = inputs;
  const {maxOutputSize, iouThreshold, scoreThreshold, padToMaxOutputSize} = attrs;

  const boxesVals = backend.readSync(boxes.dataId) as TypedArray;
  const scoresVals = backend.readSync(scores.dataId) as TypedArray;

  const {selectedIndices, validOutputs} = nonMaxSuppressionV4Impl(
      boxesVals, scoresVals, maxOutputSize, iouThreshold, scoreThreshold, padToMaxOutputSize);

  return backend.makeTensorInfo([selectedIndices.length], 'int32', new Int32Array(selectedIndices.length));
}

export const nonMaxSuppressionV4Config: KernelConfig = {
  kernelName: NonMaxSuppressionV4,
  backendName: 'webgl',
  kernelFunc: nonMaxSuppressionV4 as {} as KernelFunc
};
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============================================================================

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 *
 *============================================================================
 */

import {GPGPUProgram} from './gpgpu_math';

export class OneHotProgram implements GPGPUProgram
{
  variableNames = [ 'indices' ];
  outputShape: number[];
  userCode: string;

  // Caching uniform location for speed.
  seedLoc: WebGLUniformLocation;

  constructor(
    numIndices: number, depth: number, onValue: number, offValue: number) {
    this.outputShape = [numIndices, depth];
    this.userCode = `void main()
{
  ivec2 coords = getOutputCoords();
  int index = round(getIndices(coords.x));
  float val = mix(float(${offValue}), float(${onValue}),
                   float(index == coords.y));
  output(mix(mix(val, float(${offValue}), float(${onValue})), val));
}
`;
    this.seedLoc = util.uniformLocation(this.userCode);
  }
}

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 *============================================================================
 */

import {KernelConfig, KernelFunc, NonMaxSuppressionV5, NonMaxSuppressionV5Attrs, NonMaxSuppressionV5Inputs, TensorInfo, TypedArray} from '@tensorflow/tfjs-core';

const nonMaxSuppressionV5Impl = kernel_impls.nonMaxSuppressionV5Impl;
import {MathBackendWebGL} from '/backend_webgl';

export function nonMaxSuppressionV5(args: {
  inputs: NonMaxSuppressionV5Inputs,
  backend: MathBackendWebGL,
  attrs: NonMaxSuppressionV5Attrs
}) {
  backend_util.warn('tf.nonMaxSuppression() in webgl locks the UI thread. ' +
  'Call tf.nonMaxSuppressionAsync() instead');

  const {inputs, backend, attrs} = args;
  const {boxes, scores} = inputs;
  const {maxOutputSize, iouThreshold, scoreThreshold, softNmsSigma} = attrs;

  const boxesVals = backend.readSync(boxes.dataId) as TypedArray;
  const scoresVals = backend.readSync(scores.dataId) as TypedArray;

  const maxOutputSizeVal = maxOutputSize;
  const iouThresholdVal = iouThreshold;
  const scoreThresholdVal = scoreThreshold;
  const softNmsSigmaVal = softNmsSigma;

  const {selectedIndices, selectedScores} = nonMaxSuppressionV5Impl(
    boxesVals, scoresVals, maxOutputSizeVal,
    iouThresholdVal,
    scoreThresholdVal, softNmsSigmaVal);

  return [
    backend.makeTensorInfo(
      [selectedIndices.length], 'int32', new Int32Array(selectedIndices)),
    backend.makeTensorInfo(
      [selectedScores.length], 'float32', new Float32Array(selectedScores))
  ];
}

export const nonMaxSuppressionV5Config: KernelConfig = {
  kernelName: NonMaxSuppressionV5,
  backendName: 'webgl',
  kernelFunc: nonMaxSuppressionV5 as {} as KernelFunc
};

*/

(function() {
  import {backend_util, KernelConfig, KernelFunc, NonMaxSuppressionV5,
    NonMaxSuppressionV5Attrs, NonMaxSuppressionV5Inputs, TensorInfo, TypedArray} from '@tensorflow/tfjs-core';
  const nonMaxSuppressionV5Impl = kernel_impls.nonMaxSuppressionV5Impl;
  import {MathBackendWebGL} from '/backend_webgl';
  function nonMaxSuppressionV5(args: {
    inputs: NonMaxSuppressionV5Inputs,
    backend: MathBackendWebGL,
    attrs: NonMaxSuppressionV5Attrs
  }) {
    backend_util.warn('tf.nonMaxSuppression() in webgl locks the UI thread. ' +
      'Call tf.nonMaxSuppressionAsync() instead');

    const {inputs, backend, attrs} = args;
    const {boxes, scores} = inputs;
    const {maxOutputSize, iouThreshold, scoreThreshold, softNmsSigma} = attrs;

    const boxesVals = backend.readSync(boxes.dataId) as TypedArray;
    const scoresVals = backend.readSync(scores.dataId) as TypedArray;

    const maxOutputSizeVal = maxOutputSize;
    const iouThresholdVal = iouThreshold;
    const scoreThresholdVal = scoreThreshold;
    const softNmsSigmaVal = softNmsSigma;

    const {selectedIndices, selectedScores} = nonMaxSuppressionV5Impl(
      boxesVals, scoresVals, maxOutputSizeVal,
      iouThresholdVal,
      scoreThresholdVal, softNmsSigmaVal);

    return [
      backend.makeTensorInfo(
        [selectedIndices.length], 'int32', new Int32Array(selectedIndices)),
      backend.makeTensorInfo(
        [selectedScores.length], 'float32', new Float32Array(selectedScores))
    ];
  }
  function nonMaxSuppressionV5Config() {
    return {
      kernelName: NonMaxSuppressionV5,
      backendName: 'webgl',
      kernelFunc: nonMaxSuppressionV5
    };
  }
})(global as any);
reshape({inputs: {x: result}, backend, attrs: {shape: outShape}});

backend.disposeIntermediateTensorInfo(result);

export const oneHotConfig: KernelConfig = {
  kernelName: OneHot,
  backendName: 'webgl',
  kernelFunc: oneHot as {} as KernelFunc
};

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 */

import {KernelConfig, KernelFunc, TensorInfo, ZerosLike, ZerosLikeInputs} from '@tensorflow/tfjs-core';

import {MathBackendWebGL} from '../backend_webgl';

import {complex} from './Complex';
import {fill} from './Fill';
import {imag} from './Imag';
import {real} from './Real';
import {zerosLike} from './ZerosLike';

export function zerosLike(
  args: {inputs: ZerosLikeInputs, backend: MathBackendWebGL}): TensorInfo {
  const {inputs, backend} = args;
  const {x} = inputs;

  if (x.dtype === 'complex64') {
    const realPart = real({inputs: {input: x}, backend});
    const r = zerosLike({inputs: {x: realPart}, backend});
    const imagPart = imag({inputs: {input: x}, backend});
    const i = zerosLike({inputs: {x: imagPart}, backend});

    const result = complex({inputs: {real: r, imag: i}, backend});

    backend.disposeIntermediateTensorInfo(realPart);
    backend.disposeIntermediateTensorInfo(r);
    backend.disposeIntermediateTensorInfo(imagPart);
    backend.disposeIntermediateTensorInfo(i);

    return result;
  } else {
    // TODO(cais, smilkov): Add WebGL shader for onesLike:
    //   https://github.com/tensorflow/tfjs/issues/1293
    return fill({attrs: {shape: x.shape, dtype: x.dtype, value: x.dtype === 'string' ? 0 : 1}, backend});
  }
}

export const onesLikeConfig: KernelConfig = {
  kernelName: OnesLike,
  backendName: 'webgl',
  kernelFunc: onesLike as {} as KernelFunc
};

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 */

import {KernelConfig, KernelFunc, TensorInfo, OnesLike, OnesLikeInputs} from '@tensorflow/tfjs-core';

import {MathBackendWebGL} from '../backend_webgl';

import {complex} from './Complex';
import {fill} from './Fill';
import {imag} from './Imag';
import {real} from './Real';
import {zerosLike} from './ZerosLike';

export function onesLike(
  args: {inputs: OnesLikeInputs, backend: MathBackendWebGL}):

...
import {KernelConfig, KernelFunc, Pack, PackAttrs, PackInputs, TensorInfo, util} from '@tensorflow/tfjs-core';
import {MathBackendWebGL} from '../backend_webgl';
import {concat} from './Concat';
import {expandDims} from './ExpandDims';

export function pack(
    TensorInfo {
  const {inputs, backend, attrs} = args;
  const {axis} = attrs;

  if (inputs.length === 1) {
    return expandDims(
        {inputs: {input: inputs[0]}, backend, attrs: {dim: axis}});
  }

  const shape = inputs[0].shape;
  const dtype = inputs[0].dtype;

  inputs.forEach(t => {
    util.assertShapesMatch(
        shape, t.shape,
        'All tensors passed to stack must have matching shapes');
    util.assert(
        dtype === t.dtype,
        () => 'All tensors passed to stack must have matching dtypes');
  });

  const intermediateTensorInfos: TensorInfo[] = [];
  const expandedTensors = inputs.map(t => {
    const expandedT =
        expandDims({inputs: {input: t}, backend, attrs: {dim: axis}});
    intermediateTensorInfos.push(expandedT);
    return expandedT;
  });

  const result = concat({inputs:
      expandedTensors, backend, attrs: {axis}});

  intermediateTensorInfos.forEach(
      t => backend.disposeIntermediateTensorInfo(t));

  return result;
}

export const packConfig: KernelConfig = {
  kernelName: Pack,
  backendName: 'webgl',
  kernelFunc: pack as {} as KernelFunc
};

import {GPGPUProgram} from './gpgpu_math';
import {getChannels} from './packing_util';

export class PadProgram implements GPGPUProgram {
  variableNames = ['x'];
  outputShape: number[];
  userCode: string;

  constructor(
      xShape: number[], paddings: Array<[number, number]>,
      constantValue: number) {
    this.outputShape = paddings.map(
        (p, i) => p[0] /* beforePad */ + xShape[i] + p[1] /* afterPad */);;
    const rank = xShape.length;
    const type = getChannels(rank);
    const start = paddings.map(p => p[0]).join(',');
    const end = paddings.map((p, i) => p[0] + xShape[i]).join(',');
    const unpackedCoords = ['coords[0]', 'coords[1]', 'coords[2]', 'coords[3]'].slice(0, rank);

    if (rank === 1) {
      this.userCode = `
        int start = ${start};
        int end = ${end};

        void main() {
          int outC = getOutputCoords();
          if (any(lessThan(outC, start)) || any(greaterThanEqual(outC, end))) {
            setOutput(float(${constantValue}));
          } else {
            int coords = outC - start;
            setOutput(getX(${unpackedCoords}));
          }
        }
      `;
    } else {
      this.userCode = `;
        void main() {
          int start = $(start); int end = $(end);

          void main() {
            int outC = getOutputCoords();
            if (any(lessThan(outC, start)) || any(greaterThanEqual(outC, end))) {
              setOutput(float($constantValue));
            } else {
              $coords = outC - start;
              setOutput(getX($unpackedCoords));
            }
          }
        }
      `;
    }
  }
}

import {GPGPUProgram} from './gpgpu_math';

export class PadPackedProgram implements GPGPUProgram {
  variableNames = ['x'];
  outputShape: number[];
  userCode: string;

  constructor(
      xShape: number[], paddings: Array<[number, number]>,
      constantValue: number) {
    this.outputShape = paddings.map(
        (p, i) => p[0] /* beforePad */ + xShape[i] + p[1] /* afterPad */);
    const rank = xShape.length;
    const type = getChannels(rank);
    const start = paddings.map(p => p[0]).join(',');
    const end = paddings.map((p, i) => p[0] + xShape[i]).join(',');;
    const unpackedCoords = ['coords[0]', 'coords[1]', 'coords[2]', 'coords[3]'].slice(0, rank);

    if (rank === 1) {
      this.userCode = `
        int start = ${start};
        int end = ${end};

        void main() {
          int outC = getOutputCoords();
          if (any(lessThan(outC, start)) || any(greaterThanEqual(outC, end))) {
            setOutput(float($constantValue));
          } else {
            int coords = outC - start;
            setOutput(getX($unpackedCoords));
          }
        }
      `;
    } else {
      this.userCode = `;
        void main() {
          int start = $(start); int end = $(end);

          void main() {
            int outC = getOutputCoords();
            if (any(lessThan(outC, start)) || any(greaterThanEqual(outC, end))) {
              setOutput(float($constantValue));
            } else {
              $coords = outC - start;
              setOutput(getX($unpackedCoords));
            }
          }
        }
      `;
    }
  }
}
string;

  constructor(xShape: number[], paddings: Array<[number, number]>, constantValue: number) {
    this.outputShape = paddings.map((p, i) => p[0] * beforePad + xShape[i] + p[1]) * afterPad;

    const x = xShape.length;
    const dtype = getCoordsDataType(rank);
    const start = paddings.map(p => p[0]).join(',')
    const end = paddings.map((p, i) => p[0] + xShape[i]).join('');

    const coords = getChannels('rc', rank);
    const source = getChannels('source', rank);
    const cLimit = `${coords[rank - 1]} < ${this.outputShape[rank - 1]}`;

    const paddingArea = rank === 1 ?
      'rc < start || rc >= end' :
      'any(lessThan(rc, start)) || any(greaterThanEqual(rc, end));

    let mainLoop = '';
    for (let i = 0, j = rank === 1 ? 2 : 4; i < j; i++)
      mainLoop += `
        ${componentSetup[i]}
        if (${paddingArea}) {
          result[i] = float(${constantValue});
        } else {
          ${dtype} source = rc - start;
          result[i] = getChannel(getX(source.join()), innerDims);
        }
      `;
    mainLoop += (rank === 1 ? `}` : `}}`);

    this.userCode = `const ${dtype} start = ${dtype}(${start});
      const ${dtype} end = ${dtype}(${end});

      void main() {
        ${dtype} outputLoc = getOutputCoords();
        vec4 result = vec4(0);
        ${mainLoop}
        setOutput(result);
      }
    `;
  }
}

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 *
 *=============================================================================

import {env, KernelConfig, KernelFunc, PadV2, PadV2Attrs, PadV2Inputs, TensorInfo} from
  '@tensorflow/tfjs-core';
import {MathBackendWebGL} from '../backend_webgl';
import {PadProgram} from '../pad_gpu';
import {PadPackedProgram} from '../pad_packed_gpu';

export const padV2 =
    (args: {inputs: PadV2Inputs, backend: MathBackendWebGL, attrs: PadV2Attrs}):
        TensorInfo => {
          const {inputs, backend, attrs} = args;
          const {x} = inputs;
          const {paddings, constantValue} = attrs;

          const program = env().getBool('WEBGL_PACK_ARRAY_OPERATIONS') ?
              new PadPackedProgram(x.shape, paddings, constantValue) :
              new PadProgram(x.shape, paddings, constantValue);
          return backend.runWebGLProgram(program, [x], x.dtype);
        };

export const padV2Config: KernelConfig = {
  kernelName: PadV2,
  backendName: 'webgl',
  kernelFunc: padV2 as {} as KernelFunc
};

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 *
 *=============================================================================

import {KernelConfig, KernelFunc, Pow} from '@tensorflow/tfjs-core';
import {MathBackendWebGL} from '../backend_webgl';
import {PadProgram} from '../pad_gpu';
import {PadPackedProgram} from '../pad_packed_gpu';

const POW = `
  if(a < 0.0 && floor(b) < b){
    return NAN;
  }
  if (b
  == 0.0) {
    return 1.0;
  }
  return (round(mod(b, 2.0)) != 1) ?
      pow(abs(a), b) : sign(a) * pow(abs(a),
      b);
`;

const POW_PACKED = `
  // isModRound1 has 1 for components with round(mod(b, 2.0)) == 1, 0
  else have 0.
  vec4 isModRound1 = vec4(equal(round(mod(b, 2.0), vec4(1.0)));
  vec4 multiplier = sign(a) *

  // Ensure that a^0 = 1, including 0^0 = 1 as this correspond to TF and JS
  vec4 result = multiplier * pow(abs(a), b);

  // Ensure that a^0 = 1, including 0^0 = 1 as this correspond to TF and JS
  vec4 result = equal(b, vec4(0.0));
`;
isExpZero.r ? 1.0 : result.r;
result.g = isExpZero.g ? 1.0 : result.g;
result.b = isExpZero.b ? 1.0 : result.b;
result.a = isExpZero.a ? 1.0 : result.a;

vec4 isNaN = vec4(lessThan(a, vec4(0.0))) * vec4(lessThan(floor(b), b));

CHECK_NAN_SNIPPET + `\nreturn result;`;

export const pow =

binaryKernelFunc({opSnippet: POW, packedOpSnippet: POW_PACKED});

export const powConfig:

KernelConfig = {
  kernelName: Pow,
  backendName: 'webgl',
  kernelFunc: pow as {} as KernelFunc
};

export const pow =

binaryKernelFunc({opSnippet: POW, packedOpSnippet: POW_PACKED});

export const powConfig:

KernelConfig = {
  kernelName: Pow,
  backendName: 'webgl',
  kernelFunc: pow as {} as KernelFunc
};

import {KernelConfig, KernelFunc, Range, RangeAttrs, TensorInfo} from '@tensorflow/tfjs-core';

import {MathBackendWebGL} from '../backend_webgl';
import {rangeImplCPU} from '../kernel_utils/shared';

export const range =
    (args: {backend: MathBackendWebGL, attrs: RangeAttrs}): TensorInfo => {
      const {backend, attrs} = args;
      const {start, stop, step, dtype} = attrs;
      const values = rangeImplCPU(start, stop, step, dtype);
      return backend.makeTensorInfo([values.length], dtype, values);
    };

export const rangeConfig:

KernelConfig = {
  kernelName: Range,
  backendName: 'webgl',
  kernelFunc: range as {} as KernelFunc
};

import {KernelConfig, Reciprocal} from '@tensorflow/tfjs-core';
import {unaryKernelFunc} from '../kernel_utils/kernel_funcs_utils';

const RECIPROCAL = `return 1.0 / x;`;

export const reciprocal =
    unaryKernelFunc({opSnippet: RECIPROCAL});

export const reciprocalConfig: KernelConfig = {
  kernelName: Reciprocal,
  backendName: 'webgl',
  kernelFunc: reciprocal
};

import {KernelConfig, KernelFunc, Range, RangeAttrs, TensorInfo} from '@tensorflow/tfjs-core';

import {MathBackendWebGL} from '../backend_webgl';
import {rangeImplCPU} from '../kernel_utils/shared';

export const range =
    (args: {backend: MathBackendWebGL, attrs: RangeAttrs}): TensorInfo => {
      const {backend, attrs} = args;
      const {start, stop, step, dtype} = attrs;
      const values = rangeImplCPU(start, stop, step, dtype);
      return backend.makeTensorInfo([values.length], dtype, values);
    };

export const rangeConfig:

KernelConfig = {
  kernelName: Range,
  backendName: 'webgl',
  kernelFunc: range as {} as KernelFunc
};

import {KernelConfig, Reciprocal} from '@tensorflow/tfjs-core';
import {unaryKernelFunc} from '../kernel_utils/kernel_funcs_utils';

const RECIPROCAL = `return 1.0 / x;`;

export const reciprocal =
    unaryKernelFunc({opSnippet: RECIPROCAL});

export const reciprocalConfig: KernelConfig = {
  kernelName: Reciprocal,
  backendName: 'webgl',
  kernelFunc: reciprocal
};

import {KernelConfig, KernelFunc, Range, RangeAttrs, TensorInfo} from '@tensorflow/tfjs-core';

import {MathBackendWebGL} from '../backend_webgl';
import {rangeImplCPU} from '../kernel_utils/shared';

export const range =
    (args: {backend: MathBackendWebGL, attrs: RangeAttrs}): TensorInfo => {
      const {backend, attrs} = args;
      const {start, stop, step, dtype} = attrs;
      const values = rangeImplCPU(start, stop, step, dtype);
      return backend.makeTensorInfo([values.length], dtype, values);
    };

export const rangeConfig:

KernelConfig = {
  kernelName: Range,
  backendName: 'webgl',
  kernelFunc: range as {} as KernelFunc
};

import {KernelConfig, Reciprocal} from '@tensorflow/tfjs-core';
import {unaryKernelFunc} from '../kernel_utils/kernel_funcs_utils';

const RECIPROCAL = `return 1.0 / x;`;

export const reciprocal =
    unaryKernelFunc({opSnippet: RECIPROCAL});

export const reciprocalConfig: KernelConfig = {
  kernelName: Reciprocal,
  backendName: 'webgl',
  kernelFunc: reciprocal
};

import {KernelConfig, KernelFunc, Range, RangeAttrs, TensorInfo} from '@tensorflow/tfjs-core';

import {MathBackendWebGL} from '../backend_webgl';
import {rangeImplCPU} from '../kernel_utils/shared';

export const range =
    (args: {backend: MathBackendWebGL, attrs: RangeAttrs}): TensorInfo => {
      const {backend, attrs} = args;
      const {start, stop, step, dtype} = attrs;
      const values = rangeImplCPU(start, stop, step, dtype);
      return backend.makeTensorInfo([values.length], dtype, values);
    };

export const rangeConfig:

KernelConfig = {
  kernelName: Range,
  backendName: 'webgl',
  kernelFunc: range as {} as KernelFunc
};

import {KernelConfig, Reciprocal} from '@tensorflow/tfjs-core';
import {unaryKernelFunc} from '../kernel_utils/kernel_funcs_utils';

const RECIPROCAL = `return 1.0 / x;`;

export const reciprocal =
    unaryKernelFunc({opSnippet: RECIPROCAL});

export const reciprocalConfig: KernelConfig = {
  kernelName: Reciprocal,
  backendName: 'webgl',
  kernelFunc: reciprocal
};

import {KernelConfig, KernelFunc, Range, RangeAttrs, TensorInfo} from '@tensorflow/tfjs-core';

import {MathBackendWebGL} from '../backend_webgl';
import {rangeImplCPU} from '../kernel_utils/shared';

export const range =
    (args: {backend: MathBackendWebGL, attrs: RangeAttrs}): TensorInfo => {
      const {backend, attrs} = args;
      const {start, stop, step, dtype} = attrs;
      const values = rangeImplCPU(start, stop, step, dtype);
      return backend.makeTensorInfo([values.length], dtype, values);
    };

export const rangeConfig:

KernelConfig = {
  kernelName: Range,
  backendName: 'webgl',
  kernelFunc: range as {} as KernelFunc
};

import {KernelConfig, Reciprocal} from '@tensorflow/tfjs-core';
import {unaryKernelFunc} from '../kernel_utils/kernel_funcs_utils';

const RECIPROCAL = `return 1.0 / x;`;

export const reciprocal =
    unaryKernelFunc({opSnippet: RECIPROCAL});

export const reciprocalConfig: KernelConfig = {
  kernelName: Reciprocal,
  backendName: 'webgl',
  kernelFunc: reciprocal
};

import {KernelConfig, KernelFunc, Range, RangeAttrs, TensorInfo} from '@tensorflow/tfjs-core';

import {MathBackendWebGL} from '../backend_webgl';
import {rangeImplCPU} from '../kernel_utils/shared';

export const range =
    (args: {backend: MathBackendWebGL, attrs: RangeAttrs}): TensorInfo => {
      const {backend, attrs} = args;
      const {start, stop, step, dtype} = attrs;
      const values = rangeImplCPU(start, stop, step, dtype);
      return backend.makeTensorInfo([values.length], dtype, values);
    };

export const rangeConfig:

KernelConfig = {
  kernelName: Range,
  backendName: 'webgl',
  kernelFunc: range as {} as KernelFunc
};

import {KernelConfig, Reciprocal} from '@tensorflow/tfjs-core';
import {unaryKernelFunc} from '../kernel_utils/kernel_funcs_utils';

const RECIPROCAL = `return 1.0 / x;`;

export const reciprocal =
    unaryKernelFunc({opSnippet: RECIPROCAL});

export const reciprocalConfig: KernelConfig = {
  kernelName: Reciprocal,
  backendName: 'webgl',
  kernelFunc: reciprocal
};

import {KernelConfig, KernelFunc, Range, RangeAttrs, TensorInfo} from '@tensorflow/tfjs-core';

import {MathBackendWebGL} from '../backend_webgl';
import {rangeImplCPU} from '../kernel_utils/shared';

export const range =
    (args: {backend: MathBackendWebGL, attrs: RangeAttrs}): TensorInfo => {
      const {backend, attrs} = args;
      const {start, stop, step, dtype} = attrs;
      const values = rangeImplCPU(start, stop, step, dtype);
      return backend.makeTensorInfo([values.length], dtype, values);
    };

export const rangeConfig:

KernelConfig = {
  kernelName: Range,
  backendName: 'webgl',
  kernelFunc: range as {} as KernelFunc
};

import {KernelConfig, Reciprocal} from '@tensorflow/tfjs-core';
import {unaryKernelFunc} from '../kernel_utils/kernel_funcs_utils';

const RECIPROCAL = `return 1.0 / x;`;

export const reciprocal =
    unaryKernelFunc({opSnippet: RECIPROCAL});

export const reciprocalConfig: KernelConfig = {
  kernelName: Reciprocal,
  backendName: 'webgl',
  kernelFunc: reciprocal
};

import {KernelConfig, KernelFunc, Range, RangeAttrs, TensorInfo} from '@tensorflow/tfjs-core';

import {MathBackendWebGL} from '../backend_webgl';
import {rangeImplCPU} from '../kernel_utils/shared';

export const range =
    (args: {backend: MathBackendWebGL, attrs: RangeAttrs}): TensorInfo => {
      const {backend, attrs} = args;
      const {start, stop, step, dtype} = attrs;
      const values = rangeImplCPU(start, stop, step, dtype);
      return backend.makeTensorInfo([values.length], dtype, values);
    };

export const rangeConfig:

KernelConfig = {
  kernelName: Range,
  backendName: 'webgl',
  kernelFunc: range as {} as KernelFunc
};

import {KernelConfig, Reciprocal} from '@tensorflow/tfjs-core';
import {unaryKernelFunc} from '../kernel_utils/kernel_funcs_utils';

const RECIPROCAL = `return 1.0 / x;`;

export const reciprocal =
    unaryKernelFunc({opSnippet: RECIPROCAL});

export const reciprocalConfig: KernelConfig = {
  kernelName: Reciprocal,
  backendName: 'webgl',
  kernelFunc: reciprocal
};

import {KernelConfig, KernelFunc, Range, RangeAttrs, TensorInfo} from '@tensorflow/tfjs-core';

import {MathBackendWebGL} from '../backend_webgl';
import {rangeImplCPU} from '../kernel_utils/shared';

export const range =
    (args: {backend: MathBackendWebGL, attrs: RangeAttrs}): TensorInfo => {
      const {backend, attrs} = args;
      const {start, stop, step, dtype} = attrs;
      const values = rangeImplCPU(start, stop, step, dtype);
      return backend.makeTensorInfo([values.length], dtype, values);
    };

export const rangeConfig:

KernelConfig = {
  kernelName: Range,
  backendName: 'webgl',
  kernelFunc: range as {} as KernelFunc
};
import {KernelConfig, KernelFunc, Relu6} from '@tensorflow/tfjs-core';
import {unaryKernelFunc} from '../kernel_utils/kernel_funcs_utils';
import {CHECK_NAN_SNIPPET} from '../unaryop_gpu';

const RELU6 = CHECK_NAN_SNIPPET + `return (x < 0.0) ? 0.0 : min(6.0, x);`;

const RELU6PACKED = `vec4 result = min(x, vec4(6.0)) * vec4(greaterThanEqual(x, vec4(0.0)));`;

export const relu6 = unaryKernelFunc({opSnippet: RELU6, packedOpSnippet: RELU6PACKED});

export const relu6Config: KernelConfig = {
  kernelName: 'Relu6',
  backendName: 'webgl',
  kernelFunc: relu6 as {} as KernelFunc
};

import {GPGPUProgram} from './gpgpu_math';

export class ResizeBilinearProgram implements GPGPUProgram {
  variableNames = ['A'];
  outputShape: number[] = [];
  userCode: string;
  constructor(outputShape: [number, number, number, number], newHeight: number, newWidth: number, alignCorners: boolean, halfPixelCenters: boolean) {
    const [batch, oldHeight, oldWidth, depth] = outputShape;
    this.outputShape = [batch, newHeight, newWidth, depth];

    const effectiveInputOverOutputRatioRC = vec2(oldHeight / newHeight, oldWidth / newWidth);

    void main() {
      ivec4 coords = getOutputCoords();
      int b = coords[0];
      int d = coords[3];
      vec2 yRC = coords.yz;

      vec4 coords = getOutputCoordinates();
      int b = coords[0];
      int d = coords[3];
      vec2 yRC = coords.yz;

      vec2 sourceFloorRC = floor(yRC);
      vec2 sourceCeilRC = ceil(yRC);

      vec2 sourceFracIndexRC = floor(yRC) - sourceFloorRC;

      vec2 topLeft = getA(b, sourceFloorRC.x, sourceFloorRC.y, d);
      vec2 bottomLeft = getA(b, sourceCeilRC.x, sourceFloorRC.y, d);
      vec2 topRight = getA(b, sourceFloorRC.x, sourceCeilRC.y, d);
      vec2 bottomRight = getA(b, sourceCeilRC.x, sourceCeilRC.y, d);

      vec2 fraction = sourceFracIndexRC;

      vec2 sourceFloorRC = iivec4(0.0) + fraction;
      vec2 sourceCeilRC = iivec4(1.0) + fraction;

      vec2 frac = fraction;

      vec2 interpolatedTopLeft = getA(b, sourceFloorRC.x, sourceFloorRC.y, d);
      vec2 interpolatedBottomLeft = getA(b, sourceFloorRC.x, sourceFloorRC.y, d);
      vec2 interpolatedTopRight = getA(b, sourceFloorRC.x, sourceFloorRC.y, d);
      vec2 interpolatedBottomRight = getA(b, sourceFloorRC.x, sourceFloorRC.y, d);

      vec2 fractionalTopLeft = getA(b, sourceFloorRC.x, sourceFloorRC.y, d);
      vec2 fractionalBottomLeft = getA(b, sourceFloorRC.x, sourceFloorRC.y, d);
      vec2 fractionalTopRight = getA(b, sourceFloorRC.x, sourceFloorRC.y, d);
      vec2 fractionalBottomRight = getA(b, sourceFloorRC.x, sourceFloorRC.y, d);

      vec2 interpolatedValue = interpolatedTopLeft + (1.0 - frac) * interpolatedBottomLeft + frac * interpolatedTopRight + (1.0 - frac) * interpolatedBottomRight;
      vec2 interpolatedValue = iivec4(0.0) + interpolatedValue;

      setOutput(interpolatedValue);
    }
  }
}

// The following is a placeholder for the actual license text.
import {GPGPUProgram} from './gpgpu_math';

export class ResizeBilinearPackedProgram implements GPGPUProgram {
  variableNames = ['A'];
  packedInputs = true;
  packedOutput = true;
  outputShape: number[] = [];
  userCode: string;

  constructor(
      inputShape: number[],
      newHeight: number, newWidth: number, alignCorners: boolean, halfPixelCenters: boolean) {
    const [batch, oldHeight, oldWidth, depth] = inputShape;
    const effectiveInSize = [batch, newHeight, newWidth, depth];
    const effectiveOutSize = [batch, newHeight, newWidth, depth];
    let sourceFracIndexRC: string;
    if (halfPixelCenters) {
      sourceFracIndexRC = `(vec3(yRC) + vec3(0.5)) * ` +
        `effectiveInputOverOutputRatioRC - vec3(0.5)`;
    } else {
      sourceFracIndexRC = `vec3(yRC) * effectiveInputOverOutputRatioRC`;
    }
    this.userCode = `const vec3 effectiveInputOverOutputRatioRC = vec3(0.5);

    let sourceFracIndexRC = vec3(0, 0, 0);
    void void main() {
      ivec4 coords = getOutputCoords();
      int b = coords[0];
      int d = coords[3];
      // Calculate indices.
      ivec3 sourceFloor = ivec3(max(sourceFracIndexRC, vec3(0.0)));
      ivec3 sourceCeil = min(inputShapeRC - 1.0, ceil(sourceFracIndexRC));
      // Should we calculate next column and row elements in 2x2 packed cell.
      bool hasNextCol = d < $(newWidth - 1);
      bool hasNextRow = $(newHeight - 1);
      // In parallel, construct four corners for all four components in 2x2 cell.
      vec4 topLeft = vec4(getAValue(b, sourceFloorRC.x, sourceFloorRC.y, d),
        hasNextCol ? getAValue(b, sourceFloorRC.x, sourceFloorRC.y, d + 1) : 0.0,
        hasNextRow ? getAValue(b, sourceFloorRC.x, sourceFloorRC.y, d),
        hasNextRow && hasNextCol ? getAValue(b, sourceFloorRC.x, sourceFloorRC.y, d + 1) : 0.0);
      vec4 bottomLeft = vec4(getAValue(b, sourceFloorRC.x, sourceFloorRC.y, d),
        hasNextCol ? getAValue(b, sourceFloorRC.x, sourceFloorRC.y, d),
        hasNextRow ? getAValue(b, sourceFloorRC.x, sourceFloorRC.y, d),
        hasNextRow && hasNextCol ? getAValue(b, sourceFloorRC.x, sourceFloorRC.y, d + 1) : 0.0);
      vec4 topRight = vec4(getAValue(b, sourceFloorRC.x, sourceFloorRC.y, d),
        hasNextCol ? getAValue(b, sourceFloorRC.x, sourceFloorRC.y, d),
        hasNextRow ? getAValue(b, sourceFloorRC.x, sourceFloorRC.y, d),
        hasNextRow && hasNextCol ? getAValue(b, sourceFloorRC.x, sourceFloorRC.y, d + 1) : 0.0);
      vec4 bottomRight = vec4(getAValue(b, sourceFloorRC.x, sourceFloorRC.y, d),
        hasNextCol ? getAValue(b, sourceFloorRC.x, sourceFloorRC.y, d),
        hasNextRow ? getAValue(b, sourceFloorRC.x, sourceFloorRC.y, d),
        hasNextRow && hasNextCol ? getAValue(b, sourceFloorRC.x, sourceFloorRC.y, d + 1) : 0.0);
    }
}

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```typescript
import {env, KernelConfig, KernelFunc, ResizeBilinear, ResizeBilinearAttrs, ResizeBilinearInputs, TensorInfo} from '@tensorflow/tfjs-core';
import {MathBackendWebGL} from '../backend_webgl';
import {ResizeBilinearProgram} from '../resize_bilinear_gpu';
import {ResizeBilinearPackedProgram} from '../resize_bilinear_packed_gpu';

export function resizeBilinear(args: {
  inputs: ResizeBilinearInputs,
  backend: MathBackendWebGL,
  attrs: ResizeBilinearAttrs
}): TensorInfo {
  const {inputs, backend, attrs} = args;
  const {images} = inputs;
  const {alignCorners, halfPixelCenters, size} = attrs;

  const [newHeight, newWidth] = size;

  const program = env().getBool('WEBGL_PACK_IMAGE_OPERATIONS') ?
      new ResizeBilinearPackedProgram(
          images.shape as [number, number, number, number], newHeight, newWidth, alignCorners, halfPixelCenters) : 
      new ResizeBilinearProgram(
          images.shape as [number, number, number, number], newHeight, newWidth, alignCorners, halfPixelCenters);
  return backend.runWebGLProgram(program, [images], 'float32');
}

export const resizeBilinearConfig: KernelConfig =
{kernelName: ResizeBilinear, 
backendName: 'webgl', 
kernelFunc: resizeBilinear as {} as KernelFunc}

import {GPGPUProgram} from './gpgpu_math';

export class ResizeBilinearBackpropProgram implements GPGPUProgram {
  variableNames = ['dy'];
  outputShape: number[] = [];
  userCode: string;
  constructor(
    dyShape: [number, number, number, number],
    inputShape: [number, number, number, number],
    alignCorners: boolean) {
    this.outputShape = inputShape;
    const [xHeight, xWidth, yHeight, yWidth] = dyShape;
    // 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
    const effectiveXSize: [number, number] = [
      (alignCorners && yHeight > 1) ? xHeight - 1 : xHeight,
      (alignCorners && yWidth > 1) ? xWidth - 1 : xWidth
    ];
    const effectiveYSize: [number, number] = [
      (alignCorners && yHeight > 1) ? yHeight - 1 : yHeight,
      (alignCorners && yWidth > 1) ? yWidth - 1 : yWidth
    ];
    const heightScale = effectiveXSize[0] / effectiveYSize[0];
    const widthScale = effectiveXSize[1] / effectiveYSize[1];
    const invHeightScale = 1 / heightScale;
    const invWidthScale = 1 / widthScale;
    // 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;
    const winHeight = Math.ceil(invHeightScale) * 2;
    const winWidth = Math.ceil(invWidthScale) * 2;
    this.userCode = `void main() {
        ivec4 coords = getOutputCoords();
        int b = coords[0];
        int d = coords[3];
        int r = coords[1];
        int c = coords[2];
        float accumulator = 0.0;
        const float heightScale = float(${heightScale});
        const float widthScale = float(${widthScale});
        const float invHeightScale = float(${invHeightScale});
        const float invWidthScale = float(${invWidthScale});
        const int winHeight = int(${winHeight});
        const int winWidth = int(${winWidth});
        // Compute bounds for where in dy we will look
        float startDyR = floor(float(r) * invHeightScale);
        float startDyC = floor(float(c) * invWidthScale);
        // Loop over dy
        for (int dyROffset = 0; dyROffset < winHeight; dyROffset++) {
            int dyR = dyROffset + startDyR;
            // Guard against the window exceeding the bounds of dy
            if (dyR >= ${yHeight}) {
                continue;
            }
            int dyC = dyROffset + startDyC;
            // Guard against the window exceeding the bounds of dy
            if (dyC >= ${yWidth}) {
                continue;
            }
            int d = coords[3];
            int r = coords[1];
            int c = coords[2];
            float accumulator = 0.0;
            const float heightScale = float(${heightScale});
            int topDyRIndex = int(floor(float(r)));
            int bottomDyRIndex = int(min(ceil(dxR),
```
float dxRLerp = dxR - float(topDxRIndex);
float inverseDxRLerp = 1.0 - dxRLerp;

float dxCLerp = dxC - float(leftDxCIndex);
float inverseDxCLerp = 1.0 - dxCLerp;

if (r == topDxRIndex && c == leftDxCIndex) {
  accumulator += getDy(b, dyR, dyC, d) * inverseDxRLerp * inverseDxCLerp;
}

if (r == topDxRIndex && c == rightDxCIndex) {
  accumulator += getDy(b, dyR, dyC, d) * inverseDxRLerp * dxCLerp;
}

if (r == bottomDxRIndex && c == leftDxCIndex) {
  accumulator += getDy(b, dyR, dyC, d) * dxRLerp * inverseDxCLerp;
}

if (r == bottomDxRIndex && c == rightDxCIndex) {
  accumulator += getDy(b, dyR, dyC, d) * dxRLerp * dxCLerp;
}

setOutput(accumulator);

}
const vec2 inputShapeRC = vec2(oldHeight, 0);
const vec2 sourceNearestRC = vec2(sourceFracIndexRC);
// Compute the coordinators of nearest neighbor point.
ivec2 sourceNearestRC = ivec2(min(inputShapeRC - 1.0, floor(sourceFracIndexRC + 0.5)));

float newValue = getA(b, sourceNearestRC.x, sourceNearestRC.y, d);

setOutput(newValue);

}  

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 */

import {KernelConfig, KernelFunc, ResizeNearestNeighbor, ResizeNearestNeighborAttrs, ResizeNearestNeighborInputs, TensorInfo} from '@tensorflow/tfjs-core';

import {MathBackendWebGL} from '../backend_webgl';
import {ResizeNearestNeighborProgram} from '../resize_nearest_neighbor_gpu';

export function resizeNearestNeighbor(args: {
  inputs: ResizeNearestNeighborInputs,
  backend: MathBackendWebGL,
  attrs: ResizeNearestNeighborAttrs
}): TensorInfo {
  const {inputs, backend, attrs} = args;
  const {images} = inputs;
  const {alignCorners, halfPixelCenters, size} = attrs;

  const [newHeight, newWidth] = size;

  const program = new ResizeNearestNeighborProgram(images.shape as [number, number, number, number], newHeight, newWidth, alignCorners, halfPixelCenters);
  return backend.runWebGLProgram(program, [images], images.dtype);
}

export const resizeNearestNeighborConfig: KernelConfig = {
  kernelName: ResizeNearestNeighbor,
  backendName: 'webgl',
  kernelFunc: resizeNearestNeighbor as {} as KernelFunc
};

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 */

import {GPGPUProgram} from './gpgpu_math';

export class ResizeNearestNeighborBackpropProgram implements GPGPUProgram {
  variableNames = ['dy'];
  outputShape: number[] = [
    ];
  userCode: string;

  constructor(
      dyShape: [number, number, number, number],
      inputShape: [number, number, number, number], alignCorners: boolean) {
    this.outputShape = inputShape;
    const [xHeight, xWidth, ] = inputShape;
    const [], yHeight, yWidth = dyShape;// In the backwards pass, we want to find the pixels that were generated for num // each pixel in the input image the forward pass and add the corresponding num // coefficient from dy to the gradient (with some interpolation).
    const effectiveXSize: [number, number] = [
      ];
    const effectiveYSize: [number, number] = [
      ];
    const xWidth
    yHeight, yWidth
    yHeight
    yWidth
    ];
    const heightScale = effectiveXSize[0] / effectiveYSize[0];
    const widthScale = effectiveXSize[1] / effectiveYSize[1];
    const invHeightScale = 1 / heightScale;
    const invWidthScale = 1 / widthScale;
    // This defines the size of the window of values around a particular num // index in dy that we want to search for contributions to dx.
    const winHeight = (Math.ceil(invHeightScale) * 2) + 2;
    const winWidth = (Math.ceil(invWidthScale) * 2) + 2;
    this.userCode = 'void main() {
      ivec4 coords = getOutputCoords();
      int b = coords[0];
      int d = coords[3];
      int r = coords[1];
      int c = coords[2];
      float accumulator = 0.0;
      const float heightScale = float(heightScale);
      const float widthScale = float(widthScale);
      ';
    }
invHeightScale = float(${invHeightScale});
const float invWidthScale = float(${invWidthScale});
const int winHeight = int(${winHeight});
const int winWidth = int(${winWidth}); // Compute bounds for where in dy we will look
float startR = floor(float(r) * invHeightScale);
int startC = floor(float(c) * invWidthScale);

// Loop over dy
for (int dyOffset = 0; dyOffset < winHeight; dyOffset++) {
  int dy = dyOffset + startR;

  // Guard against the window exceeding the bounds of dy
  if (dy < 0 || dy >= ${yHeight}) {
    continue;
  }

  for (int dyCOffset = 0; dyCOffset < winWidth; dyCOffset++) {
    int dyC = dyCOffset + startC;

    // Guard against the window exceeding the bounds of dy
    if (dyC < 0 || dyC >= ${yWidth}) {
      continue;
    }

  }
}

setOutput(accumulator);
}
}


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 *
=============================================================================
*/

import {KernelConfig, KernelFunc, ResizeNearestNeighborGrad, ResizeNearestNeighborGradAttrs, ResizeNearestNeighborGradInputs, TensorInfo} from '@tensorflow/tfjs-core';
import {MathBackendWebGL} from '../backend_webgl';
import {ResizeNearestNeighborBackpropProgram} from '../resize_nearest_neighbor_backprop_gpu';

export function resizeNearestNeighborGrad(args: {
  inputs: ResizeNearestNeighborGradInputs,
  backend: MathBackendWebGL,
  attrs: ResizeNearestNeighborGradAttrs
}): TensorInfo {
  const {inputs, backend, attrs} = args;
  const {images, dy} = inputs;
  const {alignCorners} = attrs;

  const program = new ResizeNearestNeighborBackpropProgram(
    dy.shape as [number, number, number, number],
    images.shape as [number, number, number, number],
    alignCorners);
  return backend.runWebGLProgram(program, [dy], dy.dtype);
}

export const resizeNearestNeighborGradConfig: KernelConfig = {
  kernelName: ResizeNearestNeighborGrad,
  backendName: 'webgl',
  kernelFunc: resizeNearestNeighborGrad as {} as KernelFunc
};

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 *
=============================================================================
*/

import {GPGPUProgram} from './gpgpu_math';
import {getCoordsDataType} from './shader_compiler';

export class ReverseProgram implements GPGPUProgram {
  variableNames = ['x'];
  outputShape: number[];
  userCode: string;
  constructor(xShape: number[], axis: number[]) {
    const rank = xShape.length;
    if (rank > 4) {
      throw new Error('WebGL backend: Reverse of rank-$\text{rank}$ tensor is not yet supported');
    }
    this.outputShape = xShape;
    if (rank === 1) {
      this.userCode = `void main() {
        int coord = getOutputCoords();
        setOutput(getX(${xShape[0]} - coord - 1));
      }
    }
  }
  main(code: string) {
    this.userCode = code;
  }
}

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 *
=============================================================================
*/

import {GPUPUProgram} from './gpgpu_math';
import {getCoordsDataType} from './shader_compiler';

export class ReverseProgram implements GPUPUProgram {
  variableNames = ['x'];
  outputShape: number[];
  userCode: string;
  constructor(xShape: number[], axis: number[]) {
    const rank = xShape.length;
    if (rank > 4) {
      throw new Error('WebGL backend: Reverse of rank-$\text{rank}$ tensor is not yet supported');
    }
    this.outputShape = xShape;
    if (rank === 1) {
      this.userCode = `void main() {
        int coord = getOutputCoords();
        setOutput(getX(${xShape[0]} - coord - 1));
      }
    }
  }
  main(code: string) {
    this.userCode = code;
  }
}
```javascript
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```
ReverseAttrs\n\n): TensorInfo \nconst \nconst \n\n\nconst xRank = x.shape.length;\nconst Sdims = util.parseAxisParam(dims, x.shape);\nif (xRank === 0) \nreturn identity({\n  inputs: [x],\n  backend\n});\n\nconst program = \nenv().getBool('WEBGL_PACK_ARRAY_OPERATIONS') ? new ReversePackedProgram(x.shape, Sdims) : new ReverseProgram(x.shape, Sdims);\n\nreturn backend.runWebGLProgram(program, [x], x.dtype);\n\n\n//export const reverseConfig: KernelConfig = \n{\n  kernelName: Reverse,\n  backendName: 'webgl',\n  kernelFunc: reverse as {} as KernelFunc\n};

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=============================================================================

import {backend_util} from '@tensorflow/tfjs-core';
import {GPGPUProgram} from './gpgpu_math';

export class RotateProgram implements GPGPUProgram {
  variableNames = ['Image'];
  outputShape: number[] = [];
  constructor(imageShape: number[], radians: number, fillValue: number|number[], center: number|number[]) {
    const imageHeight = imageShape[1];
    const imageWidth = imageShape[2];
    const sinFactor = Math.sin(radians).toFixed(3);
    const cosFactor = Math.cos(radians).toFixed(3);
    this.outputShape = imageShape;

    const [centerX, centerY] = backend_util.getImageCenter(center, imageHeight, imageWidth);
    const centerXString = centerX.toFixed(3);
    const centerYString = centerY.toFixed(3);

    let fillSnippet = '';
    if (typeof fillValue === 'number') {
      fillSnippet = `float outputValue = ${fillValue.toFixed(2)};`;
    } else {
      fillSnippet = `vec3 fill = vec3(${fillValue.join(',')}); float outputValue = fill[coords[3]];`;
    }

    this.userCode = `void main() {
      ivec4 coords = getOutputCoords();
      int x = coords[2];
      int y = coords[1];
      float coordXFloat = (float(x) - ${centerXString}) * ${cosFactor} - (float(y) - ${centerYString}) * ${sinFactor};
      float coordYFloat = (float(x) - ${centerXString}) * ${sinFactor} + (float(y) - ${centerYString}) * ${cosFactor};
      int coordX = int(round(coordXFloat + ${centerXString}));
      int coordY = int(round(coordYFloat + ${centerYString}));
      ${fillSnippet}
      if(coordX >= 0 && coordX < ${imageWidth} && coordY >= 0 && coordY < ${imageHeight}) {
        outputValue = getImage(coords[0], coordY, coordX, coords[3]);
      }
      setOutput(outputValue);
    }`;
  }
}

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=============================================================================

import {KernelConfig, Tensor4D} from '@tensorflow/tfjs-core';
import {RotateWithOffset, RotateWithOffsetAttrs, RotateWithOffsetInputs} from '@tensorflow/tfjs-core';

import {MathBackendWebGL} from '../backend_webgl';
import {RotateProgram} from '../rotate_gpu';

export const rotateWithOffsetConfig: KernelConfig = {
  kernelName: RotateWithOffset,
  backendName: 'webgl',
  kernelFunc: (inputs, backend) => {
    const [image] = inputs as RotateWithOffsetInputs;
    const [radians, fillValue, center] = attrs as {} as RotateWithOffsetAttrs;
    const webglBackend = backend as MathBackendWebGL;
    const program = new RotateProgram(image as Tensor4D).shape, fillValue, center);
    const output = webglBackend.runWebGLProgram(program, [image], image.dtype);\n    return output;\n  }
};

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*/

import {KernelConfig, Round} from '@tensorflow/tfjs-core';
import {unaryKernelFunc} from './kernel_utils/kernel_funcs_utils';
const ROUND = `// OpenGL ES does not support round function. The algorithm is based on banker's rounding:
  float base = floor(x);
  if ((x - base) < 0.5) {
    return floor(x);
  }
  else if ((x - base) > 0.5) {
    return ceil(x);
  } else {
    if (mod(base, 2.0) == 0.0) {
      return base;
    } else {
      return base + 1.0;
    }
  }
`;

export const round = unaryKernelFunc({opSnippet: ROUND});

export const roundConfig: KernelConfig = {
  kernelName: Round,
  backendName: 'webgl',
  kernelFunc: round,
};

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 */

import {GPGPUProgram} from './gpgpu_math';
import {getCoordsDataType} from './shader_compiler';
export class ScatterProgram implements GPGPUProgram {
  variableNames = ['indices', 'defaultValue'];
  outputShape: number[];
  userCode: string;

  constructor(
      updateSize: number,
      sliceDim: number, indicesRank: number,
      updatesRank: number, strides: number[], shape: number[],
      summingDupeIndex = true) {
    this.outputShape = shape;
    const stridesType = getCoordsDataType(strides.length);
    const dtype = getCoordsDataType(shape.length);
    let indicesString = '';
    if (indicesRank === 1) {
      indicesString = 'i';
    } else if (indicesRank === 2) {
      indicesString = 'i, j';
    }
    const indicesSnippet = `getIndices(${indicesString})`;
    let updatesString = '';
    if (updatesRank === 1) {
      updatesString = 'i';
    } else if (updatesRank === 2) {
      updatesString = 'i, coords[1]';
    }
    const updatesSnippet = `getUpdates(${updatesString})`;
    this.userCode = `
        ${stridesType} strides = ${stridesType}(${strides});

        void main() {
          ${dtype} coords = getOutputCoords();
          float sum = 0.0;
          bool found = false;
          for (int i = 0; i < $updateSize; i++) {
            int flattenedIndex = 0;
            for (int j = 0; j < $sliceDim; j++) {
              int index = round(${indicesSnippet});
              flattenedIndex += index * $strides;}
            if (flattenedIndex == coords[0]) {
              sum += ${updatesSnippet};
              found = true;
            }
          }
          setOutput(mix(getDefaultValue(), sum, float(found)));}
`;
  }
}

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 */

import {backend_util, KernelConfig, KernelFunc, ScatterNd, ScatterNdAttrs, ScatterNdInputs, TensorInfo} from '@tensorflow/tfjs-core';
import {MathBackendWebGL} from '../backend_webgl';
import {ScatterProgram} from '../scatter_gpu';
import {reshape} from './Reshape';

export function scatterNd(args: {
  inputs: ScatterNdInputs,
  backend: MathBackendWebGL,
  attrs: ScatterNdAttrs
}): TensorInfo {
  const {inputs, backend, MathBackendWebGL, attrs: ScatterNdAttrs}:
  TensorInfo {
  const {inputs, backend: MathBackendWebGL, const {inputs, backend, attrs}: args;
  const {inputs, backend, attrs}: args;
  const {indices, updates}: inputs;
  const {shape}: attrs;
  const {sliceRank,
numUpdates, sliceSize, strides, outputSize) =>
    backend_util.calculateShapes(updates, indices, shape);

const flattenShape = [outputSize / sliceSize, sliceSize];

if (outputSize === 0) {
  return backend.makeTensorInfo(shape, indices.dtype);
}

const flattenIndices = reshape({inputs: {x: indices},
    backend, attrs: {shape: [numUpdates, sliceRank]}},
    flattenX.shape.length, flattenX.shape.length, strides, flattenShape);

const res = backend.runWebGLProgram(program, [flattenX, flattenIndices, defaultValue], flattenX.dtype);

const reshaped = reshape({inputs: {x: res}, backend, attrs: {shape}});

backend.disposeIntermediateTensorInfo(flattenIndices);
backend.disposeIntermediateTensorInfo(flattenX);
backend.disposeIntermediateTensorInfo(res);
backend.disposeIntermediateTensorInfo(res);
backend.disposeIntermediateTensorInfo(res);
backend.disposeIntermediateTensorInfo(res);

return reshaped;
}

export const scatterNdConfig: KernelConfig = {
    kernelName: ScatterNd,
    backendName: 'webgl',
    kernelFunc: scatterNd as {} as KernelFunc
};

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 *
 *=============================================================================
 */

import {GPGPUProgram} from './gpgpu_math';
import {getCoordsDataType} from './shader_compiler';

export class SelectProgram implements GPGPUProgram {
    variableNames = ['c', 'a', 'b'];

    outputShape: number[];

    constructor(cRank: number, shape: number[], rank: number) {
        this.outputShape = shape;

        let cCoords;
        let abCoords;
        if (rank > 4) {
            throw Error(`Where for rank ${rank} is not yet supported`);
        }

        if (rank === 1) {
            abCoords = `resRC`;
            cCoords = `resRC`;
        } else {
            const currentCoords = ['resRC.x', 'resRC.y', 'resRC.z', 'resRC.w'];
            const cCoordVars = [];
            const abCoordVars = [];
            for (let i = 0; i < shape.length; i++) {
                abCoordVars.push(`${currentCoords[i]}`);
                if (i < cRank) {
                    cCoordVars.push(`${currentCoords[i]}`);
                }
            }
            cCoords = cCoordVars.join();
            abCoords = abCoordVars.join();
        }

        const dtype = getCoordsDataType(rank);

        this.userCode = `
            void main()
            {`
            + dtype + ` resRC = getOutputCoords();
            float cVal = get($cCoords);
            if (cVal >= 1.0) {
                setOutput(getA($abCoords));
            } else {
                setOutput(getB($abCoords));
            }
        }
    }
}

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 *
 *=============================================================================
 */

import {KernelConfig, KernelFunc, Select, SelectInputs, TensorInfo, upcastType} from '@tensorflow/tfjs-core';

import {MathBackendWebGL} from '../backend_webgl';
import {SelectProgram} from '../../gpu_math';

export function select(args: {inputs: SelectInputs, backend: MathBackendWebGL}):
    TensorInfo {
        const {inputs, backend} = args;

        const [condition, t, e] = inputs;

        const program = new SelectProgram(condition.shape.length, t.shape, e.shape)
            void main()
            {`
            + t.dtype + ` resRC = getOutputCoords();
            float cVal = get($cCoords);
            if (cVal >= 1.0) {
                setOutput(getA($abCoords));
            } else {
                setOutput(getB($abCoords));
            }
        }
    }
}

export const selectConfig: KernelConfig = {
    kernelName: Select,
    backendName: 'webgl',
    kernelFunc: select as {} as KernelFunc
};

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 *
 *=============================================================================
 */

import {this_gpgpu_math} from './gpgpu_math';
import {getCoordsDataType} from './shader_compiler';

export class SelectProgram implements GPGPUProgram {
    variableNames = ['c', 'a', 'b'];

    outputShape: number[];

    constructor(cRank: number, shape: number[], rank: number) {
        this.outputShape = shape;

        let cCoords;
        let abCoords;
        if (rank > 4) {
            throw Error(`Where for rank ${rank} is not yet supported`);
        }

        if (rank === 1) {
            abCoords = `resRC`;
            cCoords = `resRC`;
        } else {
            const currentCoords = ['resRC.x', 'resRC.y', 'resRC.z', 'resRC.w'];
            const cCoordVars = [];
            const abCoordVars = [];
            for (let i = 0; i < shape.length; i++) {
                abCoordVars.push(`${currentCoords[i]}`);
                if (i < cRank) {
                    cCoordVars.push(`${currentCoords[i]}`);
                }
            }
            cCoords = cCoordVars.join();
            abCoords = abCoordVars.join();
        }

        const dtype = getCoordsDataType(rank);

        this.userCode = `
            void main()
            {`
            + dtype + ` resRC = getOutputCoords();
            float cVal = get($cCoords);
            if (cVal >= 1.0) {
                setOutput(getA($abCoords));
            } else {
                setOutput(getB($abCoords));
            }
        }
    }
}

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 *=============================================================================
 */

import {KernelConfig, KernelFunc, Select, SelectInputs, TensorInfo, upcastType} from '@tensorflow/tfjs-core';

import {MathBackendWebGL} from '../backend_webgl';
import {SelectProgram} from '../select_gpu';

export function select(args: {inputs: SelectInputs, backend: MathBackendWebGL}):
    TensorInfo {
        const {inputs, backend} = args;

        const [condition, t, e] = inputs;

        const program = new SelectProgram(condition.shape.length, t.shape, e.shape);

        return backend.runWebGLProgram(program, [condition, t, e], upcastType(t.dtype, e.dtype));
    }

export const selectConfig: KernelConfig = {
    kernelName: Select,
    backendName: 'webgl',
    kernelFunc: select as {} as KernelFunc
};

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=============================================================================

import {backend_util, KernelConfig, Selu} from '@tensorflow/tfjs-core';

import {unaryKernelFunc} from '../kernel_utils/kernel_funcs_utils';

const SELU =`
  // Stable and Attracting Fixed Point (0, 1) for Normalized Weights.
  // see: https://arxiv.org/abs/1706.02515
  float scaleAlpha = $[backend_util.SELU_SCALEALPHA];
  float scale = $[backend_util.SELU_SCALE];
  return (x >= 0.0) ? scale * x : scaleAlpha * (exp(x) - 1.0);
`;

export const selu = unaryKernelFunc({opSnippet: SELU});

export const seluConfig: KernelConfig = {
  kernelName: Selu,
  backendName: 'webgl',
  kernelFunc: selu,
};

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 *
=============================================================================

import {KernelConfig, Sigmoid} from '@tensorflow/tfjs-core';

import {unaryKernelFunc} from '../kernel_utils/kernel_funcs_utils';

const SIGMOID = `return 1.0 / (1.0 + exp(-1.0 * x));`;

export const sigmoid = unaryKernelFunc({opSnippet: SIGMOID});

export const sigmoidConfig: KernelConfig = {
  kernelName: Sigmoid,
  backendName: 'webgl',
  kernelFunc: sigmoid,
};

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=============================================================================

import {KernelConfig, Sign} from '@tensorflow/tfjs-core';

import {unaryKernelFunc} from '../kernel_utils/kernel_funcs_utils';

// Sign does not propagate NANs.
const SIGN =`
  if (isnan(x)) { return 0.0; }
  return sign(x);
`;

export const sign = unaryKernelFunc({opSnippet: SIGN});

export const signConfig: KernelConfig = {
  kernelName: Sign,
  backendName: 'webgl',
  kernelFunc: sign,
};

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 *
=============================================================================

import {KernelConfig, Sin} from '@tensorflow/tfjs-core';

import {CHECK_NAN_SNIPPET_UNARY, unaryKernelFunc} from '../kernel_utils/kernel_funcs_utils';

const SIN = CHECK_NAN_SNIPPET_UNARY +`
  return sin(x);
`;

export const sin = unaryKernelFunc({opSnippet: SIN});

export const sinConfig: KernelConfig = {
  kernelName: Sin,
  backendName: 'webgl',
  kernelFunc: sin,
};

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 *
=============================================================================

import {KernelConfig, Sqrt} from '@tensorflow/tfjs-core';

import {unaryKernelFunc} from '../kernel_utils/kernel_funcs_utils';

const SQRT =`
  return sqrt(x);
`;

export const sqrt = unaryKernelFunc({opSnippet: SQRT});

export const sqrtConfig: KernelConfig = {
  kernelName: Sqrt,
  backendName: 'webgl',
  kernelFunc: sqrt,
};

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=============================================================================

*/

import {KernelConfig, Sinh} from '@tensorflow/tfjs-core';
import {unaryKernelFunc} from './kernel_utils/kernel_funcs_utils';

const SINH = `
  float e2x = exp(x);
  return (e2x - 1.0 / e2x) / 2.0;
`;

export const sinh = unaryKernelFunc({opSnippet: SINH});

export const sinhConfig: KernelConfig = {
  kernelName: Sinh,
  backendName: 'webgl',
  kernelFunc: sinh,
};

/*=============================================================================

*/

import {KernelConfig, Softplus} from '@tensorflow/tfjs-core';
import {unaryKernelFunc} from './kernel_utils/kernel_funcs_utils';

const SOFTPLUS = `
  float epsilon = 1.1920928955078125e-7;
  float
  threshold = log(epsilon) + 2.0;

  bool too_large = x > -threshold;
  bool too_small = x < threshold;

  float
  result;
  float exp_x = exp(x);

  if (too_large){
    result = x;
  }
  else if (too_small){
    result = exp_x;
  }
  else{
    result = log(exp_x + 1.0);
  }
  return result;
`;

export const softplus = unaryKernelFunc({opSnippet: SOFTPLUS});

export const softplusConfig: KernelConfig = {
  kernelName: Softplus,
  backendName: 'webgl',
  kernelFunc: softplus,
};

/*=============================================================================

*/

import {backend_util, KernelConfig, KernelFunc, SpaceToBatchND, SpaceToBatchNDAttrs, SpaceToBatchNDInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {MathBackendWebGL} from '../backend_webgl';
import {padV2} from './PadV2';
import {reshape} from './Reshape';
import {transpose} from './Transpose';

export const spaceToBatchND = (args: {
  inputs: SpaceToBatchNDInputs,
  backend: MathBackendWebGL,
  attrs: SpaceToBatchNDAttrs
}): TensorInfo => {
  const {inputs, backend, attrs} = args;
  const {x} = inputs;
  const {blockShape, paddings} = attrs;

  util.assert(
      x.shape.length <= 4,
      () => 'spaceToBatchND for rank > 4 with a WebGL backend not ' +
          'implemented yet');

  const prod = blockShape.reduce((a, b) => a * b);

  const completePaddings: Array<
[ number, number ]> = [[0, 0]];
  completePaddings.push(...paddings as Array<
[ number, number ]>);
  for (let i = 1 + blockShape.length; i <
      x.shape.length; ++i) {
    completePaddings.push([0, 0]);
  }

  const toDispose = 
[ ];

  const paddedX =
      padV2({
        inputs: {x},
        backend,
        attrs: {paddings: completePaddings, constantValue: 0}
      });

  const
      reshapedPaddedShape =
          backend_util.getReshaped(paddedX.shape, blockShape, prod, false);
      permutedReshapedPaddedPermutation = backend_util.getPermutated(
          reshapedPaddedShape, blockShape, length, blockShape.length, false);

  const flattenShape =
      backend_util.getReshaped(paddedX.shape, blockShape, prod, false);
  const
      permutedReshapedPaddedPermutation = backend_util.getPermutated(
          reshapedPaddedShape, blockShape, length, blockShape.length, false);

  const toDispose.push(...paddings as Array<
[ number, number ]>);
  const completePaddings = Array<
[ number, number ]>);
  const completePaddings.push([0, 0]);
  const toDispose = [];
  const
      const paddedX =
          padV2({
            inputs: {x},
            backend,
            attrs: {paddings: completePaddings, constantValue: 0}
          });

  const
      const flattenShape =
          backend_util.getReshaped(paddedX.shape, blockShape, prod, false);
  const
      permutedReshapedPaddedPermutation = backend_util.getPermutated(
          reshapedPaddedShape, blockShape, length, blockShape.length, false);

  const toDispose.push(...paddings as Array<
[ number, number ]>);
  const completePaddings = Array<
[ number, number ]>);
  const completePaddings.push([0, 0]);
  const toDispose = [];
  const
      const paddedX =
          padV2({
            inputs: {x},
            backend,
            attrs: {paddings: completePaddings, constantValue: 0}
          });

  const
      const flattenShape =
          backend_util.getReshaped(paddedX.shape, blockShape, prod, false);
  const
      permutedReshapedPaddedPermutation = backend_util.getPermutated(
          reshapedPaddedShape, blockShape, length, blockShape.length, false);

  const toDispose.push(...paddings as Array<
[ number, number ]>);
  const completePaddings = Array<
[ number, number ]>);
  const completePaddings.push([0, 0]);
  const toDispose = [];
  const
      const paddedX =
          padV2({
            inputs: {x},
            backend,
            attrs: {paddings: completePaddings, constantValue: 0}
          });

  const
      const flattenShape =
          backend_util.getReshaped(paddedX.shape, blockShape, prod, false);
  const
      permutedReshapedPaddedPermutation = backend_util.getPermutated(
          reshapedPaddedShape, blockShape, length, blockShape.length, false);

  const toDispose.push(...paddings as Array<
[ number, number ]>);
  const completePaddings = Array<
[ number, number ]>);
  const completePaddings.push([0, 0]);
  const toDispose = [];
  const
      const paddedX =
          padV2({
            inputs: {x},
            backend,
            attrs: {paddings: completePaddings, constantValue: 0}
          });

  const
      const flattenShape =
          backend_util.getReshaped(paddedX.shape, blockShape, prod, false);
  const
      permutedReshapedPaddedPermutation = backend_util.getPermutated(
          reshapedPaddedShape, blockShape, length, blockShape.length, false);
backend.disposeIntermediateTensorInfo(0);

export const spaceToBatchNDConfig: KernelConfig = {
  kernelName: 'SpaceToBatchND',
  backendName: 'webgl',
  kernelFunc: spaceToBatchND as {} as KernelFunc
};

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 */

import {backend_util, KernelConfig, KernelFunc, SpaceToDense, SpaceToDenseAttr,
SpaceToDenseInputs, TensorInfo} from '@tensorflow/tfjs-core';

import {MathBackendWebGL} from '../backend_webgl';
import {ReshapeProgram} from '../reshape_gpu';
import {reshape} from './Reshape';

export function spaceToBatchND(args: {
  inputs: SpaceToDenseInputs,
  backend: MathBackendWebGL,
  attrs: SpaceToDenseAttr
}): TensorInfo {
  const {inputs, backend, attrs} = args;
  const {
    sparseIndices,
    sparseValues, defaultVal
  } = inputs;
  const {
    outputShape
  } = attrs;

  const {
    sliceRank, numUpdates, strides, outputSize
  } = backend_util.calculateShapes(sparseValues, sparseIndices, outputShape);

  const {
    sumDupeIndices
  } = false;
  const program = new ReshapeProgram(
    numUpdates, sliceRank,
    sparseIndices.shape.length, sparseValues.shape.length, strides, [outputSize], sumDupeIndices);

  const reshaped =
      reshape({inputs: {x: res}, backend, attrs: {shape: outputShape}});

  backend.disposeIntermediateTensorInfo(res);
  return reshaped;
}

export const spaceToBatchNDConfig: KernelConfig = {
  kernelName: 'SpaceToBatchND',
  backendName: 'webgl',
  kernelFunc: spaceToBatchND as {} as KernelFunc
};

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 */

import {backend_util, KernelConfig, KernelFunc, SplitV, SplitVAttr,
SplitVInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {MathBackendWebGL} from '../backend_webgl';
import {Slice} from './Slice';

export function splitV(
    args:
        {inputs: SplitVInputs, backend: MathBackendWebGL, attrs: SplitVAttr}):
    TensorInfo[] {
  const {inputs, backend, attrs} = args;
  const {
    x
  } = inputs;
  const {
    numOrSizeSplits, axis
  } = attrs;

  const {
    xRank
  } = x.shape;

  const {
    begin, size
  } = backend_util.calculateShapes(numOrSizeSplits, x.shape);

  const {
    xRank
  } = x.shape;

  const {
    sliceSize
  } = size;

  const {
    sliceSize
  } = size;

  const {
    slice
  } = slice;

  const {
    slice
  } = slice;

  const {
    slice
  } = slice;

  const {
    slice
  } = slice;

  return splitSlices;
}

export const splitVConfig: KernelConfig = {
  kernelName: 'SplitV',
  backendName: 'webgl',
  kernelFunc: splitV as {} as KernelFunc
};

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 */

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import {KernelConfig, KernelFunc, Sqrt} from '@tensorflow/tfjs-core';
import {UnaryKernelFunc} from '../kernel_utils/kernel_funcs_utils';

const SQRT = `return sqrt(x);`;

export const sqrt = unaryKernelFunc({opSnippet: SQRT});

export const sqrtConfig: KernelConfig = {
  kernelName: Sqrt,
  backendName: 'webgl',
  kernelFunc: sqrt as {} as KernelFunc
};

import {KernelConfig, Square} from '@tensorflow/tfjs-core';

import {UnaryKernelFunc} from '../kernel_utils/kernel_funcs_utils';

const SQUARE = `return x * x;`;

export const square = unaryKernelFunc({opSnippet: SQUARE});

export const squareConfig: KernelConfig = {
  kernelName: Square,
  backendName: 'webgl',
  kernelFunc: square,
};

import {KernelConfig, Step, StepAttrs, TensorInfo, UnaryInputs} from '@tensorflow/tfjs-core';

import {MathBackendWebGL} from '../backend_webgl';
import {CHECK_NAN_SNIPPET, UnaryOpProgram} from '../unaryop_gpu';

export function step(
  {inputs, attrs, backend}:
  {inputs: UnaryInputs, attrs: StepAttrs, backend: MathBackendWebGL}):
  TensorInfo {
    const {x} = inputs;
    const opSnippet = CHECK_NAN_SNIPPET + `
      return x > 0.0 ? 1.0 : float(${attrs.alpha});
    `;
    
    const program = new UnaryOpProgram(x.shape, opSnippet);
    
    return backend.runWebGLProgram(program, [x], x.dtype);
  }

export const stepConfig: KernelConfig = {
  kernelName: Step,
  backendName: 'webgl',
  kernelFunc: step as {} as KernelFunc,
};

import {GPGPUProgram} from './gpgpu_math';
import {getCoordsDataType} from './shader_compiler';

export class StridedSliceProgram implements GPGPUProgram {
  variableNames = ['x'];
  outputShape: number[];
  userCode: string;

  constructor(begin: number[], strides: number[], size: number[]) {
    this.outputShape = size;
    const rank = size.length;
    const inputDtype = getCoordsDataType(rank);
    const dtype = getCoordsDataType(size.length);

    let newCoords = '';
    if (rank === 1) {
      newCoords = `coords * strides[0] + begin[0]`;
    } else {
      let outputAxis = 0;
      newCoords = size.map((_, i) => {
        outputAxis++;
        return dtype + `[` + outputAxis + `]`;
      }).join(',');
    }

    this.userCode = `
      ${inputDtype} begin = ${inputDtype}(begin);
      ${inputDtype} strides = ${inputDtype}(strides);

      void main() {
        ${dtype} coords = getOutputCoords();
        outputAxis += 1 ? 0 : 1;
        `coords = getOutputCoordinates(size.length);
        let newCoords = '';
        if (rank === 1) {
          newCoords += `coordinates * strides + begin`;
        } else {
          outputAxis = 0;
          newCoords = size.map((_, i) => {
            outputAxis++;
            return size.length === 1 ? 'coordinates[0] * strides + begin' : `coordinates[outputAxis - 1] * strides[$(i)] + begin[$(i)];`;
          }).join(');
        }

        this.userCode = `$[inputDtype] begin = $(inputDtype)($(begin));
        $[inputDtype] strides = $(inputDtype)($(strides));
        void main() {
          $[dtype] coordinates = getOutputCoordinates();
          setOutput(getX(\newCoords));
        }
      }
    `;
  }

export const stridedSliceConfig: KernelConfig = {
  kernelName: 'strided_slice',
  backendName: 'webgl',
  kernelFunc: stridedSlice as {} as KernelFunc,
};
import {buffer, KernelConfig, KernelFunc, Rank, slice_util, StridedSlice, StridedSliceAttr, StridedSliceInputs, TensorBuffer, TensorInfo, TypedArray} from '@tensorflow/tfjs-core';

import {MathBackendWebGL} from '../backend_webgl';
import {stridedSliceImplCPU} from '../kernel_utils/kernel_funcs_utils';
import {StridedSliceProgram} from '../strided_slice_gpu';

import {reshape} from './Reshape';
import {slice} from './Slice';

export function stridedSlice(args: {
  inputs: StridedSliceInputs,
  backend: MathBackendWebGL,
  attrs: StridedSliceAttr
}): TensorInfo {
  const {inputs, backend, attrs} = args;
  const {x} = inputs;
  const {
    begin,
    end,
    strides,
    beginMask,
    endMask,
    ellipsisMask,
    newAxisMask,
    shrinkAxisMask
  } = attrs;

  const {nonStrided, $begin, $strides, size, 
      newShape, outShape} =
      slice_util.sliceInfo(
          x.shape, begin, end, strides, beginMask, endMask,
          ellipsisMask,
          newAxisMask,
          shrinkAxisMask);;

  const $x = reshape({inputs: {x}, backend, attrs: {shape: newShape}});

  let result;
  if (nonStrided) {
    const sliced =
        slice({inputs: {x: $x}, backend, attrs: {begin: $begin, size}});
    result = reshape({inputs: {x: sliced}, backend, attrs: {shape: outShape}});

    backend.disposeIntermediateTensorInfo(sliced);
  } else if (outShape.some(axis => axis === 0)) {
    result = backend.makeTensorInfo(outShape, x.dtype, []);
  } else {
    const shouldExecuteOnCPU = backend.shouldExecuteOnCPU($x);
    if (shouldExecuteOnCPU) {
      const xTexData = backend.texData.get($x.dataId);
      const values = xTexData.values as TypedArray;
      const xBuf = buffer($x.shape, $x.dtype, values) as TensorBuffer<Rank>;
      resultValues =
      stridedSliceImplCPU(outShape, xBuf, $strides, $begin);
      result = backend.makeTensorInfo(outShape, $x.dtype, resultValues);
    } else {
      const program = new StridedSliceProgram($begin, $strides, outShape);
      result = backend.runWebGLProgram(program, $x);
    }

    const resultReshaped =
      reshape({inputs: {x: result}, backend, attrs: {shape: outShape}});

    backend.disposeIntermediateTensorInfo($x);
    backend.disposeIntermediateTensorInfo(result);

    return resultReshaped;
  }

  return result;
}

export const stridedSliceConfig: KernelConfig = {
  kernelName: StridedSlice,
  backendName: 'webgl',
  kernelFunc: stridedSlice as {} as KernelFunc
};

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 */

import {buffer, KernelConfig, Tan} from '@tensorflow/tfjs-core';

export const tan = unaryKernelFunc({
  name: 'Tan',
  opSnippet: 'return tan(x);'
});

export const tanConfig: KernelConfig = {
  kernelName: Tan,
  backendName: 'webgl',
  kernelFunc: tan as {} as KernelFunc
};

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 */
import {KernelConfig, Tanh} from '@tensorflow/tfjs-core';
import {unaryKernelFunc} from '../kernel_utils/kernel_funcs_utils';

const TANH = `float e2x = exp(-2.0 * abs(x));
return sign(x) * (1.0 - e2x) / (1.0 + e2x);
`;

export const tanh = unaryKernelFunc({opSnippet: TANH});

export const tanhConfig: KernelConfig = {
  kernelName: Tanh,
  backendName: 'webgl',
  kernelFunc: tanh,
};;/*. *

---

import {GPGPUProgram} from './gpgpu_math';
import {getCoordsDataType} from './shader_compiler';

export class TileProgram implements GPGPUProgram {
  variableNames = ['A'];
  outputShape: number[];
  userCode: string;
  rank: number;

  constructor(aShape: number[], reps: number[]) {
    const outputShape: number[] = new Array(aShape.length);
    for (let i = 0; i < outputShape.length; i++) {
      outputShape[i] = aShape[i] * reps[i];
    }
    this.outputShape = outputShape;
    this.rank = outputShape.length;
    const dtype = getCoordsDataType(this.rank);
    const sourceCoords = getSourceCoords(aShape);

    this.userCode = `void main() {
      ${dtype} resRC = getOutputCoords();
      setOutput(getA(${sourceCoords}));
    }`
  }
}

function getSourceCoords(aShape: number[]): string {
  const rank = aShape.length;
  if (rank > 5) { throw Error('Tile for rank $rank is not yet supported'); }
  if (rank === 1) { return `imod(resRC, ${aShape[0]})`;
  }
  const currentCoords = ['resRC.x', 'resRC.y', 'resRC.z', 'resRC.w', 'resRC.u'];
  const sourceCoords = [];
  for (let i = 0; i < aShape.length; i++) {
    sourceCoords.push(`imod(${currentCoords[i]}, ${aShape[i]})`);
  }
  return sourceCoords.join();
}

---

import {buffer, KernelConfig, KernelFunc, TensorInfo, Tile, TileAttrs, TileInputs, util} from '@tensorflow/tfjs-core';
import {MathBackendWebGL} from '../backend_webgl';
import {tileImplCPU} from '../kernel_utils/shared';
import {TileProgram} from '../tile_gpu';

export function tile(
    params: {inputs: TileInputs, backend: MathBackendWebGL, attrs: TileAttrs}):
    TensorInfo {
  const {inputs, backend, attrs} = params;
  const {x} = inputs;
  const {reps} = attrs;

  if (x.dtype === 'string') { const data = backend.readSync(x.dataId) as Uint8Array;
    const decodedData = data.map(d => util.decodeString(d));
    const buf = buffer(x.shape, x.dtype, decodedData);
    const outBuf = tileImplCPU(buf, reps);
    return backend.makeTensorInfo(outBuf.shape, outBuf.dtype, outBuf.values);
  }

  const program = new TileProgram(x.shape, reps);
  const output = backend.runWebGLProgram(program, [x], x.dtype);
  return output;
}

export const tileConfig: KernelConfig = {
  kernelName: Tile,
  backendName: 'webgl',
  kernelFunc: tileImplCPU as {} as KernelFunc,
};

---

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---

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export function topK(args: {inputs: TopKInputs, backend: MathBackendWebGL, attrs: TopKAttrs}): TensorInfo[] {
    const {inputs, backend, attrs} = args;
    const {x} = inputs;
    const {k, sorted} = attrs;

    const xVals = backend.readSync(x.dataId) as TypedArray;
    const [allTopKVals, allTopKIndices] =
        topKImplCPU(xVals, x.shape, x.dtype as NumericDataType, k, sorted);

    return [backend.makeTensorInfo(allTopKVals.shape, allTopKVals.dtype, allTopKVals.values),
        backend.makeTensorInfo([allTopKIndices.shape, allTopKIndices.dtype, allTopKIndices.values])];
}

export const topKConfig: KernelConfig = {
    kernelName: TopK,
    backendName: 'webgl',
    kernelFunc: topK as {} as KernelFunc
};

export function unique(args: {inputs: UniqueInputs, attrs: UniqueAttrs, backend: MathBackendWebGL}): TensorInfo[] {
    const {inputs, attrs, backend} = args;
    const {axis} = attrs;
    const {x} = inputs;
    assertNotComplex(x, 'unique');

    // For now, always forward calculation to the CPU backend.
    console.warn('WARNING: ', 'UI might be locked temporarily as data is being downloaded');
    const values = backend.readSync(x.dataId);
    const {outputValues, outputShape, indices} =
        uniqueImplCPU(values, axis, x.shape, x.dtype);
    return [backend.makeTensorInfo(outputShape, x.dtype, outputValues),
        backend.makeTensorInfo([indices.length], 'int32', indices)];
}

export const uniqueConfig: KernelConfig = {
    kernelName: Unique,
    backendName: 'webgl',
    kernelFunc: unique as {} as KernelFunc,
};

export function unpack(args: {inputs: UnpackInputs, backend: MathBackendWebGL, attrs: UnpackAttrs}): TensorInfo[] {
    const {inputs, backend, attrs} = args;
    const {value} = inputs;
    let {axis} = attrs;

    if (axis < 0) {
        axis += value.shape.length;
    }

    const x = value;
    const xRank = x.shape.length;

    const num = value.shape[axis];
    const outShape: number[] = new Array(xRank - 1);
    let outIndex = 0;
    for (let i = 0; i < xRank; i++) {
        if (i !== axis) {
            outShape[outIndex++] = x.shape[i];
        }
    }

    const toDispose = [ ];

    const begin = new Array(xRank).fill(0);
    const size = x.shape.slice();
    size[axis] = 1;
    const res: TensorInfo[] = new Array(num);
    for (let i = 0; i < res.length; i++) {
        begin[axis] = i;
        const sliced = slice({inputs: {x}, backend, attrs: {begin, size}});
        const reshaped =
            reshape({inputs: {x: sliced}, backend, attrs: {shape: xRank - 1}});
        res[i] = backend.makeTensorInfo(reshaped.shape, reshaped.dtype, reshaped.values);
    }

    return res;
}

export const unpackConfig: KernelConfig = {
    kernelName: Unpack,
    backendName: 'webgl',
    kernelFunc: unpack as {} as KernelFunc
};
```javascript
outShape}});
res[i] = reshaped;

const dispose = (sliced) => {
  toDispose.push(sliced);
  return res;
};

toDispose.forEach(t =>
  backend.disposeIntermediateTensorInfo(t);
); return res;


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export const unpackConfig: KernelConfig = {
  kernelName: Unpack,
  backendName: 'webgl',
  kernelFunc: unpack as {} as KernelFunc
};

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 */

import {backend_util} from '@tensorflow/tfjs-core';
import {GPGPUProgram} from './gpgpu_math';

export class SegmentOpProgram implements GPGPUProgram {
  variableNames = ['x', 'segmentIds'];
  outputShape: number[];
  userCode: string;
  constructor(segOpInfo: backend_util.segment_util.SegOpInfo, segOpType: 'unsortedSegmentSum') {
    const windowSize = segOpInfo.windowSize;
    const batchSize = segOpInfo.batchSize;
    const inSize = segOpInfo.inSize;
    const numSegments = segOpInfo.numSegments;
    const outSize = numSegments * Math.ceil(inSize / windowSize);
    this.outputShape = [batchSize, outSize];
    const initializationValue = '0.0';
    const returnValue = `$\text{sumValue}`;
    const windowSizeNearestVec4 = Math.floor(windowSize / 4) * 4;
    const windowSizeVec4Remainder = windowSize % 4;
    const updateSnippet = `sumValue += dot(values, segFilter);

    let checkValueOutOfBounds = 
      if (inIdx < 0 || inIdx >= $\text{inSize}) {
        return initializationValue;
      }`;

    let checkSegmentIdOutOfBounds = 
      if (inIdx < 0 || inIdx >= $\text{inSize}) {
        return -1.0;
      }`;

    this.userCode = `const float initializationValue = ${initializationValue};

    float getValue(int batch, int inIdx) {
      ${checkValueOutOfBounds}
      return getX(batch, inIdx);
    }

    float getSegmentIdAtIndex(int inIdx) {
      ${checkSegmentIdOutOfBounds}
      return getSegmentIds(inIdx);
    }

    void main() {
      ivec2 coords = getOutputCoords();
      int batch = coords[0];
      int outIdx = coords[1];
      int inOffset = int(floor(float(outIdx) / float($\text{numSegments}))) * float($\text{windowSize}));

      float vec4 values = vec4(0, 0, 0, 0);
      for (int i = 0; i < $\text{windowSizeNearestVec4}; i += 4) {
        vec4 values = vec4(getValue(batch, inIdx), getValue(batch, inIdx + 1), getValue(batch, inIdx + 2), getValue(batch, inIdx + 3));
        vec4 segFilter = vec4($\text{windowSizeVec4Remainder == 1}) ? 1 : 0, $\text{windowSizeVec4Remainder == 2}) ? 1 : 0, $\text{windowSizeVec4Remainder == 3}) ? 1 : 0, 0);
      }

      int currentSeg = int(mod(float(outIdx), float($\text{numSegments})));
      float sumValue = 0.0;
      for (int i = 0; i < $\text{windowSizeNearestVec4}; i += 4) {
        vec4 values = vec4($\text{getRow}(batch, inIdx), getValue(batch, inIdx + 1), getValue(batch, inIdx + 2), getValue(batch, inIdx + 3));
        vec4 segFilter = vec4($\text{getRow}(batch, inIdx), getValue(batch, inIdx + 1), getValue(batch, inIdx + 2), getValue(batch, inIdx + 3));
      }
    }
```
```typescript
import {backend_util, DataType, KernelConfig, KernelFunc, sumOutType, TensorInfo, UnsortedSegmentSum, UnsortedSegmentSumAttrs, UnsortedSegmentSumInputs, util} from '@tensorflow/tfjs-core';
import {MathBackendWebGL} from './backend_webgl';
import {range, reshape, tile, transpose} from './util';

export function unsortedSegmentSum(args: {
  inputs: UnsortedSegmentSumInputs,
  backend: MathBackendWebGL,
  attrs: UnsortedSegmentSumAttrs
}): TensorInfo {
  const {inputs, backend, attrs} = args;
  const {x, segmentIds} = inputs;
  const {numSegments} = attrs;

  const xRank = x.shape.length;

  const toDispose = [];

  let axis = 0;
  const permutation = backend_util.getAxesPermutation([axis], xRank);
  let permutedX = x;
  if (permutation != null) {
    permutedX = transpose({inputs: {x}, backend, attrs: {perm: permutation}});
    toDispose.push(permutedX);
    axis = backend_util.getInnerMostAxes(1, xRank)[0];
  }

  const outShape = backend_util.segment_util.computeOutShape(permutedX.shape, axis, numSegments);
  const inSize = util.sizeFromShape([permutedX.shape[axis]]);
  const a2D = reshape({inputs: {x: permutedX}, backend, attrs: {shape: [-1, inSize]}});
  toDispose.push(a2D);

  const outputDType = sumOutType(x.dtype);

  const segOpCompute = (x: TensorInfo, segOpType: 'unsortedSegmentSum', segmentIds: TensorInfo, dtype: DataType, numSegments: number): TensorInfo => {
    const batchSize = x.shape[0];
    const inSize = x.shape[1];
    const windowSize = backend_util.segment_util.segOpComputeOptimalWindowSize(x, numSegments);
    const tileInfo = tile({inputs: {x}, backend, attrs: {reps: [inSize / windowSize]}});
    const rangeInfo = range({backend, attrs: {start: 0, stop: numSegments, step: 1, dtype: 'float32'}});
    const segOpResult = segOpCompute(outputDType = sumOutType(x.dtype), numSegments);
    return segOpResult;
  };

  const segOpResult = segOpCompute(a2D, numSegments);
  return segOpResult;
}
```

```typescript
import {KernelConfig, registerKernel} from '@tensorflow/tfjs-core';

export const unsortedSegmentSumConfig: KernelConfig = {
  kernelName: UnsortedSegmentSum,
  backendName: 'webgl',
  kernelFunc: unsortedSegmentSum
};
```

```typescript
import {backend_util, DataType, KernelConfig, KernelFunc, sumOutType, TensorInfo} from '@tensorflow/tfjs-core';
import {MathBackendWebGL} from './backend_webgl';
import {range, reshape, tile, transpose} from './util';

export function unsortedSegmentSum(args: {
  inputs: UnsortedSegmentSumInputs,
  backend: MathBackendWebGL,
  attrs: UnsortedSegmentSumAttrs
}): TensorInfo {
  const {inputs, backend, attrs} = args;
  const {x, segmentIds} = inputs;
  const {numSegments} = attrs;

  const xRank = x.shape.length;

  const toDispose = [];

  let axis = 0;
  const permutation = backend_util.getAxesPermutation([axis], xRank);
  let permutedX = x;
  if (permutation != null) {
    permutedX = transpose({inputs: {x}, backend, attrs: {perm: permutation}});
    toDispose.push(permutedX);
    axis = backend_util.getInnerMostAxes(1, xRank)[0];
  }

  const outShape = backend_util.segment_util.computeOutShape(permutedX.shape, axis, numSegments);
  const inSize = util.sizeFromShape([permutedX.shape[axis]]);
  const a2D = reshape({inputs: {x: permutedX}, backend, attrs: {shape: [-1, inSize]}});
  toDispose.push(a2D);

  const outputDType = sumOutType(x.dtype);

  const segOpCompute = (x: TensorInfo, segOpType: 'unsortedSegmentSum', segmentIds: TensorInfo, dtype: DataType, numSegments: number): TensorInfo => {
    const batchSize = x.shape[0];
    const inSize = x.shape[1];
    const windowSize = backend_util.segment_util.segOpComputeOptimalWindowSize(x, numSegments);
    const tileInfo = tile({inputs: {x}, backend, attrs: {reps: [inSize / windowSize]}});
    const rangeInfo = range({backend, attrs: {start: 0, stop: numSegments, step: 1, dtype: 'float32'}});
    const segOpResult = segOpCompute(a2D, numSegments);
    return segOpResult;
  };

  const segOpResult = segOpCompute(a2D, numSegments);
  return segOpResult;
}
```

```typescript
export const unsortedSegmentSumConfig: KernelConfig = {
  kernelName: UnsortedSegmentSum,
  backendName: 'webgl',
  kernelFunc: unsortedSegmentSum
};
```

```typescript
import {KernelConfig, registerKernel} from '@tensorflow/tfjs-core';

export const unsortedSegmentSumConfig: KernelConfig = {
  kernelName: UnsortedSegmentSum,
  backendName: 'webgl',
  kernelFunc: unsortedSegmentSum
};
```

```typescript
import {KernelConfig, registerKernel} from '@tensorflow/tfjs-core';

export const unsortedSegmentSumConfig: KernelConfig = {
  kernelName: UnsortedSegmentSum,
  backendName: 'webgl',
  kernelFunc: unsortedSegmentSum
};
```
from './kernels/_FusedMatMul';
import {absConfig} from './kernels/Abs';
import {acosConfig} from './kernels/Acos';
import {acoshConfig} from './kernels/Acosh';
import {addConfig} from './kernels/Add';
import {addNConfig} from './kernels/AddN';
import {allConfig} from './kernels/All';
import {anyConfig} from './kernels/Any';
import {argMaxConfig} from './kernels/ArgMax';
import {argMinConfig} from './kernels/ArgMin';
import {asinConfig} from './kernels/Asin';
import {asinhConfig} from './kernels/Asinh';
import {atanConfig} from './kernels/Atan';
import {atan2Config} from './kernels/Atan2';
import {atanhConfig} from './kernels/Atanh';
import {avgPoolConfig} from './kernels/AvgPool';
import { avgPool3DConfig } from './kernels/AvgPool3D';
import { avgPoolGrad3DConfig } from './kernels/AvgPoolGrad3D';
import {batchMatMulConfig} from './kernels/BatchMatMul';
import {batchNormConfig} from './kernels/BatchNorm';
import {batchToSpaceNDConfig} from './kernels/BatchToSpaceND';
import {bcastConfig} from './kernels/Bcast';
import {bincountConfig} from './kernels/Bincount';
import {castConfig} from './kernels/Cast';
import {ceilConfig} from './kernels/Ceil';
import {clipByValueConfig} from './kernels/ClipByValue';
import {complexAbsConfig} from './kernels/ComplexAbs';
import {concatConfig} from './kernels/Concat';
import {conv2DConfig} from './kernels/Conv2D';
import {conv2DBackpropFilterConfig} from './kernels/Conv2DBackpropFilter';
import {conv2DBackpropInputConfig} from './kernels/Conv2DBackpropInput';
import {conv3DConfig} from './kernels/Conv3D';
import {conv3DBackpropFilterV2Config} from './kernels/Conv3DBackpropFilterV2';
import {conv3DBackpropInputV2Config} from './kernels/Conv3DBackpropInputV2';
import {coshConfig} from './kernels/Cosh';
import {cropAndResizeConfig} from './kernels/CropAndResize';
import {cumsumConfig} from './kernels/Cumsum';
import {denseBcounstConfig} from './kernels/DenseBcounst';
import {depthToSpaceConfig} from './kernels/DepthToSpace';
import {depthwiseConv2dNativeConfig} from './kernels/DepthwiseConv2dNative';
import {depthwiseConv2dNativeBackpropFilterConfig} from './kernels/DepthwiseConv2dNativeBackpropFilter';
import {depthwiseConv2dNativeBackpropInputConfig} from './kernels/DepthwiseConv2dNativeBackpropInput';
import {diagConfig} from './kernels/Diag';
import {dilation2DConfig} from './kernels/Dilation2D';
import {eluConfig} from './kernels/Elu';
import {expConfig} from './kernels/Exp';
import {expandDimsConfig} from './kernels/ExpandDims';
import {expm1Config} from './kernels/Expm1';
import {fftConfig} from './kernels/FFT';
import {fillConfig} from './kernels/Fill';
import {flipLeftRightConfig} from './kernels/FlipLeftRight';
import {floorConfig} from './kernels/Floor';
import {floorDivConfig} from './kernels/FloorDiv';
import {fromPixelsConfig} from './kernels/FromPixels';
import {fusedConv2DConfig} from './kernels/FusedConv2D';
import { fusedDepthwiseConv2DConfig } from './kernels/FusedDepthwiseConv2D';
import { gatherNdConfig } from './kernels/GatherNd';
import {gatherV2Config} from './kernels/GatherV2';
import { greaterConfig } from './kernels/Greater';
import {greaterEqualConfig} from './kernels/GreaterEqual';
import {identityConfig} from './kernels/Identity';
import { ifftConfig } from './kernels/IFFT';
import { imagConfig } from './kernels/Imag';
import { isFiniteConfig } from './kernels/IsFinite';
import { isInfConfig } from './kernels/IsInf';
import { isnaNConfig } from './kernels/IsNaN';
import { leakyReluConfig } from './kernels/LeakyRelu';
import { lessEqualConfig } from './kernels/LessEqual';
import { linSpaceConfig } from './kernels/LinSpace';
import { logConfig } from './kernels/Log';
import { log1pConfig } from './kernels/Log1p';
import { logicalAndConfig } from './kernels/LogicalAnd';
import { logicalNotConfig } from './kernels/LogicalNot';
import { logicalOrConfig } from './kernels/LogicalOr';
import { LRNConfig } from './kernels/LRN';
import { LRNGradConfig } from './kernels/LRNGrad';
import { maxConfig } from './kernels/Max';
import { maximumConfig } from './kernels/Maximum';
import { maxPoolConfig } from './kernels/MaxPool';
import { maxPool3DConfig } from './kernels/MaxPool3D';
import { maxPoolGrad3DConfig } from './kernels/MaxPoolGrad3D';
import { maxPoolWithArgmaxConfig } from './kernels/MaxPoolWithArgmax';
leakyReluConfig, lessConfig, lessEqualConfig, linSpaceConfig, log1pConfig, logConfig, logicalAndConfig, logicalNotConfig, logicalOrConfig, maxConfig, maxPool1DConfig, maxPool2DConfig, maxPool3DConfig, maxPoolGrad3DConfig, maxPoolGradConfig, maxPoolWithArgmaxConfig, maximumConfig, meanConfig, minConfig, minimumConfig, mirrorPadConfig, modConfig, multinomialConfig, multiplyConfig, negConfig, nonMaxSuppression3VConfig, nonMaxSuppressionV4Config, nonMaxSuppressionV5Config, notEqualConfig, oneHotConfig, onesLikeConfig, packConfig, padV2Config, powConfig, prodConfig, rangeConfig, realConfig, realDivConfig, reciprocalConfig, relu6Config, reluConfig, reshapeConfig, resizeBilinearConfig, resizeBilinearGradConfig, resizeGrad3DConfig, resizeGradConfig, resizeWithArgmaxConfig, roundConfig, rsqrtConfig, scatterNdConfig, selectConfig, seluConfig, sigmoidConfig, signConfig, sinhConfig, sliceConfig, softmaxConfig, softplusConfig, spaceToBatchNDConfig, sparseToDenseConfig, splitVConfig, sqrtConfig, squareConfig, squaredDifferenceConfig, stepConfig, stridedSliceConfig, subConfig, sumConfig, tanConfig, tanhConfig, tileConfig, topKConfig, transposeConfig, uniqueConfig, unpackConfig, unsortedSegmentSumConfig, zerosLikeConfig

for (const kernelConfig
  of kernelConfigs) {
  registerKernel(kernelConfig);
}

/**
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 * software
 * distributed under the License is distributed on an "AS IS" BASIS,
 * WITHOUT WARRANTIES
 * OR CONDITIONS OF ANY KIND, either express or implied.
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 * governing permissions and
 * limitations under the License.
 */

/* tslint:disable */

/** Properties of an Any. */
export declare interface IAny {
  /** Any typeUrl */
  typeUrl?: (string|null);

  /** Any value */
  value?: (Uint8Array|null);
}

/** DataType enum. */
export enum DataType {
  'DT_INVALID' = 0,
  'DT_FLOAT' = 1,
  'DT_DOUBLE' = 2,
  'DT_INT32' = 3,
  'DT_UINT8' = 4,
  'DT_INT16' = 5,
  'DT_INT8' = 6,
  'DT_STRING' = 7,
  'DT_COMPLEX64' = 8,
  'DT_ENUM' = 9,
  'DT_BOOL' = 10,
  'DT_QINT8' = 11,
  'DT_QUINT8' = 12,
  'DT_QINT32' = 13,
  'DT_BFLOAT16' = 14,
  'DT_FLOAT_REF' = 101,
  'DT_DOUBLE_REF' = 102,
  'DT_INT32_REF' = 103,
  'DT_UINT8_REF' = 104,
  'DT_INT16_REF' = 105,
  'DT_INT8_REF' = 106,
  'DT_STRING_REF' = 107,
  'DT_COMPLEX64_REF' = 108,
  'DT_ENUM_REF' = 109,
  'DT_BOOL_REF' = 110,
  'DT_QINT8_REF' = 111,
  'DT_QUINT8_REF' = 112,
  'DT_BFLOAT16_REF' = 113
}

/** Properties of a TensorShape. */
export declare interface ITensorShape {
  /** TensorShape dim */
  dim?: (IAny.IDim|null);

  /** TensorShape unknownRank */
  unknownRank?: (boolean|null);
}

/** Properties of a Dim. */
export declare interface IDim {
  /** Dim name */
  name?: (string|null);
}

/** Properties of a Tensor. */
export declare interface ITensor {
  /** Tensor dtype */
  dtype?: (DataType|null);

  /** Tensor tensorShape */
  tensorShape?: (ITensorShape|null);

  /** Tensor versionNumber */
  versionNumber?: (number|null);

  /** Tensor floatVal */
  floatVal?: (number|null);

  /** Tensor doubleVal */
  doubleVal?: (number|null);

  /** Tensor intVal */
  intVal?: (number|null);

  /** Tensor stringVal */
  stringVal?: (string|null);

  /** Tensor scomplexVal */
  scomplexVal?: (number|null);

  /** Tensor int64Val */
  int64Val?: (number|string|null);

  /** Tensor boolVal */
  boolVal?: (boolean|null);

  /** Tensor uintVal */
  uintVal?: (number|string|null);

  /** Tensor uint32Val */
  uint32Val?: (number|null);

  /** Tensor uint64Val */
  uint64Val?: (number|string|null);

  /** Properties of an AttrValue. */
  AttrValue {
    /** AttrValue value */
    value?: (ITensorShape|null);

    /** AttrValue type */
    type?: (DataType|null);

    /** AttrValue shape */
    shape?: (ITensorShape|null);
  }

  /** AttrValue tensor */
  tensor?: (ITensor|null);
}

/** Properties of a Tensor. */
export declare interface ITensor {
  /** Tensor dtype */
  dtype?: (DataType|null);

  /** Tensor tensorShape */
  tensorShape?: (ITensorShape|null);

  /** Tensor versionNumber */
  versionNumber?: (number|null);

  /** Tensor floatVal */
  floatVal?: (number|null);

  /** Tensor doubleVal */
  doubleVal?: (number|null);

  /** Tensor intVal */
  intVal?: (number|null);

  /** Tensor stringVal */
  stringVal?: (string|null);

  /** Tensor scomplexVal */
  scomplexVal?: (number|null);

  /** Tensor int64Val */
  int64Val?: (number|string|null);

  /** Tensor boolVal */
  boolVal?: (boolean|null);

  /** Tensor uintVal */
  uintVal?: (number|string|null);

  /** Tensor uint32Val */
  uint32Val?: (number|null);

  /** Tensor uint64Val */
  uint64Val?: (number|string|null);

  /** Properties of an AttrValue. */
  AttrValue {
    /** AttrValue value */
    value?: (ITensorShape|null);

    /** AttrValue type */
    type?: (DataType|null);

    /** AttrValue shape */
    shape?: (ITensorShape|null);
  }

  /** AttrValue tensor */
  tensor?: (ITensor|null);
}
OpDef attr *\ROUTE\AttrDef{[]}\ROUTE{null}\ROUTE{null}\ROUTE{\ROUTE{**\ROUTE{OpDef\ROUTE{deprecation}}\ROUTE{}}\ROUTE{name\ROUTE{}}}\ROUTE{description\ROUTE{}}\ROUTE{summar\ROUTE{y\ROUTE{}}}\ROUTE{comment\ROUTE{}}\ROUTE{reference\ROUTE{}}\ROUTE{De\ROUTE{scription\ROUTE{}}}\ROUTE{Attr\ROUTE{Def\ROUTE{}}}\ROUTE{is\ROUTE{Commutative\ROUTE{}}}\ROUTE{is\ROUTE{Aggregat\ROUTE{e\ROUTE{}}}\ROUTE{}}\ROUTE{is\ROUTE{Stateful\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{Unin\ROUTE{itialized\ROUTE{Input\ROUTE{}}}\ROUTE{allows\ROUTE{Unin\ROUTE{itialized\ROUTE{Input\ROUTE{}}}}\ROUTE{}}\ROUTE{AttrDef\ROUTE{name\ROUTE{}}}\ROUTE{AttrDef\ROUTE{type\ROUTE{}}}\ROUTE{AttrDef\ROUTE{number\ROUTE{}}}\ROUTE{AttrDef\ROUTE{AttrDef\ROUTE{Number\ROUTE{}}}\ROUTE{AttrDef\ROUTE{list\ROUTE{}}}\ROUTE{AttrDef\ROUTE{is\ROUTE{Ref\ROUTE{}}}\ROUTE{AttrDef\ROUTE{default\ROUTE{Value\ROUTE{}}}\ROUTE{default\ROUTE{Value\ROUTE{}}\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{firstName\ROUTE{}}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{firstName\ROUTE{}}}\ROUTE{OpDef\ROUTE{}}\ROUTE{first
import {clone, Tensor, util} from '@tensorflow/tfjs-core';
import {NamedTensorsMap} from '../../data/types';
import {ExecutionContext} from '../../executor/execution_context';
import {ResourceManager} from '../../executor/resource_manager';
import {Node, ValueType} from '../types';

export function getParamValue(
    paramName: string, node: Node, tensorMap: NamedTensorsMap,
    context: ExecutionContext, resourceManager?: ResourceManager): ValueType {
  const inputParam = node.inputParams[paramName];
  if (inputParam && inputParam.inputIndexStart !== undefined) {
    const start = inputParam.inputIndexStart;
    const end = inputParam.inputIndexEnd === 0 ?
        undefined :
        (inputParam.inputIndexEnd === undefined ? start + 1 :
        inputParam.inputIndexEnd);
    if (inputParam.type === 'tensor') {
      return getTensor(
          node.inputNames[inputParam.inputIndexStart], tensorMap, context,
          resourceManager);
    }
    if (inputParam.type === 'tensors') {
      const inputs = node.inputNames.slice(start, end);
      return inputs.map(
          name => getTensor(name, tensorMap, context, resourceManager));
    }
    const tensor = getTensor(
        node.inputNames.slice(start)[0], tensorMap, context, resourceManager);
    const data = tensor.dataSync();
    return inputParam.type === 'number' ?
        data[0] :
        util.toNestedArray(tensor.shape, data);
  }
  const attrParam = node.attrParams[paramName];
  return attrParam && attrParam.value;
}

/**
 * Retrieve the tensor from tensorsMap based on input name.
 * @param name Node input name
 * @param tensorsMap Tensors map keyed by the node
 */
export function getTensor(
    name: string, tensorsMap: NamedTensorsMap, context: ExecutionContext,
    resourceManager?: ResourceManager): Tensor {
  const [nodeName, index] = parseNodeName(name);

  if (resourceManager != null) {
    const tensor = resourceManager.getHashTableHandleByName(nodeName);
    if (tensor != null) {
      return tensor;
    }
  }

  const contextId = context.currentContextIds.find(contextId => {
    return tensorsMap[getNodeNameWithContextId(nodeName, contextId)];
  });
  return contextId !== undefined ?
      tensorsMap[getNodeNameWithContextId(nodeName, contextId)][index] :
      undefined;
}

/**
 * Retrieve the tensors based on input name for current context.
 * @param name string, tensorsMap: NamedTensorsMap, context: ExecutionContext
 */
export function getTensorsForCurrentContext(
    name: string, tensorsMap: NamedTensorsMap, context: ExecutionContext): Tensor[] {
  return tensorsMap[getNodeNameWithContextId(name, context)] || [];
}

/**
 * @param tensorsMap Tensors map keyed by the node.
 * @param context contains tensors and information for running the current node.
 * @param resourceManager Optional. Contains global resources of the model.
 */
export function getTensorsForGraphModelExecutor(
    tensorsMap: NamedTensorsMap, context: ExecutionContext): Tensor[] {
  return tensorsMap[getNodeNameWithContextId(name, context)] || [];
}
export const json: OpMapper[] = [
  {
    'tfOpName': 'Abs',
    'category': 'basic_math',
    'inputs': [
      {'start': 0, 'name': 'x', 'type': 'tensor'},
    ],
    'attrs': [
      {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}
    ]
  },
  {
    'tfOpName': 'FloorMod',
    'category': 'arithmetic',
    'inputs': [
      {'start': 0, 'name': 'a', 'type': 'tensor'},
      {'start': 1, 'name': 'b', 'type': 'tensor'},
    ],
    'attrs': [null,
      {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}
    ]
  },
  {
    'tfOpName': 'SquaredDifference',
    'category': 'arithmetic',
    'inputs': [
      {'start': 0, 'name': 'a', 'type': 'tensor'},
      {'start': 1, 'name': 'b', 'type': 'tensor'},
    ],
    'attrs': [null,
      {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}
    ]
  },
  {
    'tfOpName': 'Pow',
    'category': 'arithmetic',
    'inputs': [
      {'start': 0, 'name': 'x', 'type': 'tensor'},
      {'start': 1, 'name': 'y', 'type': 'tensor'},
    ],
    'attrs': [null,
      {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}
    ]
  },
  {
    'tfOpName': 'Minimum',
    'category': 'arithmetic',
    'inputs': [
      {'start': 0, 'name': 'a', 'type': 'tensor'},
      {'start': 1, 'name': 'b', 'type': 'tensor'},
    ],
    'attrs': [null,
      {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}
    ]
  },
  {
    'tfOpName': 'Maximum',
    'category': 'arithmetic',
    'inputs': [
      {'start': 0, 'name': 'a', 'type': 'tensor'},
      {'start': 1, 'name': 'b', 'type': 'tensor'},
    ],
    'attrs': [null,
      {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}
    ]
  },
  {
    'tfOpName': 'Mul',
    'category': 'arithmetic',
    'inputs': [
      {'start': 0, 'name': 'a', 'type': 'tensor'},
      {'start': 1, 'name': 'b', 'type': 'tensor'},
    ],
    'attrs': [null,
      {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}
    ]
  },
  {
    'tfOpName': 'Complex',
    'category': 'complex',
    'inputs': [
      {'start': 0, 'name': 'real', 'type': 'tensor'},
      {'start': 1, 'name': 'imag', 'type': 'tensor'},
    ],
    'attrs': [null,
      {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}
    ]
  },
  {
    'tfOpName': 'ComplexAbs',
    'category': 'complex',
    'inputs': [
      {'start': 0, 'name': 'x', 'type': 'tensor'},
    ],
    'attrs': [null,
      {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}
    ]
  },
  {
    'tfOpName': 'Cos',
    'category': 'basic_math',
    'inputs': [
      {'start': 0, 'name': 'x', 'type': 'tensor'},
    ],
    'attrs': [null,
      {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}
    ]
  },
  {
    'tfOpName': 'Cosh',
    'category': 'basic_math',
    'inputs': [
      {'start': 0, 'name': 'x', 'type': 'tensor'},
    ],
    'attrs': [null,
      {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}
    ]
  },
  {
    'tfOpName': 'Sin',
    'category': 'basic_math',
    'inputs': [
      {'start': 0, 'name': 'x', 'type': 'tensor'},
    ],
    'attrs': [null,
      {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}
    ]
  },
  {
    'tfOpName': 'Sinh',
    'category': 'basic_math',
    'inputs': [
      {'start': 0, 'name': 'x', 'type': 'tensor'},
    ],
    'attrs': [null,
      {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}
    ]
  },
  {
    'tfOpName': 'Atan',
    'category': 'basic_math',
    'inputs': [
      {'start': 0, 'name': 'x', 'type': 'tensor'},
    ],
    'attrs': [null,
      {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}
    ]
  },
  {
    'tfOpName': 'Atan2',
    'category': 'basic_math',
    'inputs': [
      {'start': 0, 'name': 'x', 'type': 'tensor'},
      {'start': 1, 'name': 'y', 'type': 'tensor'},
    ],
    'attrs': [null,
      {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}
    ]
  },
  {
    'tfOpName': 'Asin',
    'category': 'basic_math',
    'inputs': [
      {'start': 0, 'name': 'x', 'type': 'tensor'},
    ],
    'attrs': [null,
      {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}
    ]
  },
  {
    'tfOpName': 'Acos',
    'category': 'basic_math',
    'inputs': [
      {'start': 0, 'name': 'x', 'type': 'tensor'},
    ],
    'attrs': [null,
      {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}
    ]
  },
  {
    'tfOpName': 'Asinh',
    'category': 'basic_math',
    'inputs': [
      {'start': 0, 'name': 'x', 'type': 'tensor'},
    ],
    'attrs': [null,
      {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}
    ]
  },
  {
    'tfOpName': 'Acsinh',
    'category': 'basic_math',
    'inputs': [
      {'start': 0, 'name': 'x', 'type': 'tensor'},
    ],
    'attrs': [null,
      {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}
    ]
  }];
import {OpMapper} from '../types';

export const json: OpMapper[] = [
  {
    'tfOpName': 'Asinh',
    'category': 'basic_math',
    'inputs': [{
      'start': 0,
      'name': 'x',
      'type': 'tensor'
    },
    {
      'tfName': 'T',
      'name': 'dtype',
      'type': 'dtype',
      'notSupported': true
    }]
  },
  {
    'tfOpName': 'Acosh',
    'category': 'basic_math',
    'inputs': [{
      'start': 0,
      'name': 'x',
      'type': 'tensor'
    },
    {
      'tfName': 'T',
      'name': 'dtype',
      'type': 'dtype',
      'notSupported': true
    }]
  },
  {
    'tfOpName': 'Atanh',
    'category': 'basic_math',
    'inputs': [{
      'start': 0,
      'name': 'x',
      'type': 'tensor'
    },
    {
      'tfName': 'T',
      'name': 'dtype',
      'type': 'dtype',
      'notSupported': true
    }]
  },
  {
    'tfOpName': 'Erf',
    'category': 'basic_math',
    'inputs': [{
      'start': 0,
      'name': 'x',
      'type': 'tensor'
    },
    {
      'tfName': 'T',
      'name': 'dtype',
      'type': 'dtype',
      'notSupported': true
    }]
  },
  {
    'tfOpName': 'LeakyRelu',
    'category': 'basic_math',
    'inputs': [{
      'start': 0,
      'name': 'x',
      'type': 'tensor'
    },
    {
      'tfName': 'alpha',
      'name': 'alpha',
      'type': 'number',
      'defaultValue': 0.2
    }]
  },
  {
    'tfOpName': 'TensorArrayV3',
    'category': 'control',
    'inputs': [{
      'start': 0,
      'name': 'size',
      'type': 'number'
    }]
  },
  {
    'tfOpName': 'TensorArrayReadV3',
    'category': 'control',
    'inputs': [{
      'start': 0,
      'name': 'tensorArrayId',
      'type': 'tensor'
    },
    {
      'tfName': 'T',
      'name': 'dtype',
      'type': 'dtype',
      'notSupported': true
    }]
  },
  {
    'tfOpName': 'TensorArrayWriteV3',
    'category': 'control',
    'inputs': [{
      'start': 0,
      'name': 'tensorArrayId',
      'type': 'tensor'
    },
    {
      'tfName': 'T',
      'name': 'dtype',
      'type': 'dtype',
      'notSupported': true
    }]
  },
  {
    'tfOpName': 'NextIteration',
    'category': 'control',
    'inputs': [{
      'start': 0,
      'name': 'tensor',
      'type': 'tensor'
    }]
  },
  {
    'tfOpName': 'Exit',
    'category': 'control',
    'inputs': [{
      'start': 0,
      'name': 'tensor',
      'type': 'tensor'
    }]
  },
  {
    'tfOpName': 'Enter',
    'category': 'control',
    'inputs': [{
      'start': 0,
      'name': 'tensor',
      'type': 'tensor'
    }]
  },
  {
    'tfOpName': 'Merge',
    'category': 'control',
    'inputs': [{
      'start': 0,
      'end': 0,
      'name': 'tensors',
      'type': 'tensors'
    }]
  },
  {
    'tfOpName': 'Switch',
    'category': 'control',
    'inputs': [{
      'start': 0,
      'name': 'data',
      'type': 'tensor'
    },
    {
      'start': 1,
      'name': 'pred',
      'type': 'bool'
    }]
  },
  {
    'tfOpName': 'SwitchV2',
    'category': 'control',
    'inputs': [{
      'start': 0,
      'name': 'pred',
      'type': 'bool'
    },
    {
      'start': 1,
      'name': 'data',
      'type': 'tensor'
    }]
  },
  {
    'tfOpName': 'LoopCond',
    'category': 'control',
    'inputs': [{
      'start': 0,
      'end': 0,
      'name': 'maxNumElements',
      'type': 'number'
    }]
  },
  {
    'tfOpName': 'EmptyTensorList',
    'category': 'control',
    'inputs': [{
      'start': 0,
      'name': 'elementShape',
      'type': 'shape'
    }]
  },
  {
    'tfOpName': 'SwitchCase',
    'category': 'control',
    'inputs': [{
      'start': 0,
      'name': 'caseValue',
      'type': 'tensor'
    },
    {
      'start': 1,
      'name': 'data',
      'type': 'tensor'
    }]
  },
  {
    'tfOpName': 'tfOpName',
    'category': 'control',
    'inputs': [{
      'start': 0,
      'name': 'tensor',
      'type': 'tensor'
    }]
  },
  {
    'tfOpName': 'tfOpName',
    'category': 'control',
    'inputs': [{
      'start': 0,
      'name': 'tensor',
      'type': 'tensor'
    }]
  },
  {
    'tfOpName': 'tfOpName',
    'category': 'control',
    'inputs': [{
      'start': 0,
      'name': 'tensor',
      'type': 'tensor'
    }]
  },
  {
    'tfOpName': 'tfOpName',
    'category': 'control',
    'inputs': [{
      'start': 0,
      'name': 'tensor',
      'type': 'tensor'
    }]
  },
  {
    'tfOpName': 'tfOpName',
    'category': 'control',
    'inputs': [{
      'start': 0,
      'name': 'tensor',
      'type': 'tensor'
    }]
  }];

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import {OpMapper} from '../types';

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 */

export const json: OpMapper[] = [
  {
    'tfOpName': 'Fill',
    'category': 'creation',
    'inputs': [
      {
        'tfName': 'T',
        'name': 'value',
        'type': 'number',
      },
      {
        'tfName': 'T',
        'name': 'dtype',
        'type': 'number',
      },
    ],
    'attrs': [
      {
        'tfName': 'Tidx',
        'name': 'dtype',
        'type': 'number',
      },
      {
        'tfName': 'seed',
        'name': 'seed',
        'type': 'number',
      },
      {
        'tfName': 'seed2',
        'name': 'seed2',
        'type': 'number',
      },
    ],
  },
  {
    'tfOpName': 'Ones',
    'category': 'creation',
    'inputs': [
      {
        'tfName': 'shape',
        'name': 'shape',
        'type': 'number',
      },
    ],
    'attrs': [
      {
        'tfName': 'num',
        'name': 'num',
        'type': 'number',
      },
      {
        'tfName': 'dtype',
        'name': 'dtype',
        'type': 'number',
      },
    ],
  },
  {
    'tfOpName': 'OnesLike',
    'category': 'creation',
    'inputs': [
      {
        'tfName': 'shape',
        'name': 'shape',
        'type': 'number',
      },
    ],
    'attrs': [
      {
        'tfName': 'num',
        'name': 'num',
        'type': 'number',
      },
      {
        'tfName': 'dtype',
        'name': 'dtype',
        'type': 'number',
      },
    ],
  },
  {
    'tfOpName': 'RandomUniform',
    'category': 'creation',
    'inputs': [
      {
        'tfName': 'shape',
        'name': 'shape',
        'type': 'number',
      },
    ],
    'attrs': [
      {
        'tfName': 'num',
        'name': 'num',
        'type': 'number',
      },
      {
        'tfName': 'dtype',
        'name': 'dtype',
        'type': 'number',
      },
    ],
  },
  {
    'tfOpName': 'TruncatedNormal',
    'category': 'creation',
    'inputs': [
      {
        'tfName': 'shape',
        'name': 'shape',
        'type': 'number',
      },
    ],
    'attrs': [
      {
        'tfName': 'num',
        'name': 'num',
        'type': 'number',
      },
      {
        'tfName': 'dtype',
        'name': 'dtype',
        'type': 'number',
      },
    ],
  },
  {
    'tfOpName': 'Multinomial',
    'category': 'creation',
    'inputs': [
      {
        'tfName': 'shape',
        'name': 'shape',
        'type': 'number',
      },
    ],
    'attrs': [
      {
        'tfName': 'num',
        'name': 'num',
        'type': 'number',
      },
      {
        'tfName': 'dtype',
        'name': 'dtype',
        'type': 'number',
      },
    ],
  },
];

============================================================================

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*
export const json: OpMapper[] = [
  {
    'tfOpName': 'GreaterEqual',
    'category': 'logical',
    'inputs': [
      {'start': 0, 'name': 'a', 'type': 'tensor'},
      {'start': 1, 'name': 'b', 'type': 'tensor'},
    ],
    'attrs': [
      {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}
    ]
  },
  {
    'tfOpName': 'Less',
    'category': 'logical',
    'inputs': [
      {'start': 0, 'name': 'a', 'type': 'tensor'},
      {'start': 1, 'name': 'b', 'type': 'tensor'},
    ],
    'attrs': [
      {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}
    ]
  },
  {
    'tfOpName': 'Equal',
    'category': 'logical',
    'inputs': [
      {'start': 0, 'name': 'a', 'type': 'tensor'},
      {'start': 1, 'name': 'b', 'type': 'tensor'},
    ],
    'attrs': [
      {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}
    ]
  },
  {
    'tfOpName': 'LogicalAnd',
    'category': 'logical',
    'inputs': [
      {'start': 0, 'name': 'a', 'type': 'tensor'},
      {'start': 1, 'name': 'b', 'type': 'tensor'},
    ],
    'attrs': [
      {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}
    ]
  },
  {
    'tfOpName': 'LogicalOr',
    'category': 'logical',
    'inputs': [
      {'start': 0, 'name': 'a', 'type': 'tensor'},
      {'start': 1, 'name': 'b', 'type': 'tensor'},
    ],
    'attrs': [
      {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}
    ]
  },
  {
    'tfOpName': 'LogicalXor',
    'category': 'logical',
    'inputs': [
      {'start': 0, 'name': 'a', 'type': 'tensor'},
      {'start': 1, 'name': 'b', 'type': 'tensor'},
    ],
    'attrs': [
      {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}
    ]
  },
  {
    'tfOpName': 'Not',
    'category': 'logical',
    'inputs': [
      {'start': 0, 'name': 'a', 'type': 'tensor'},
    ],
    'attrs': [
      {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}
    ]
  },
  {
    'tfOpName': 'Neg',
    'category': 'logical',
    'inputs': [
      {'start': 0, 'name': 'a', 'type': 'tensor'},
    ],
    'attrs': [
      {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}
    ]
  },
  {
    'tfOpName': 'NotEqual',
    'category': 'logical',
    'inputs': [
      {'start': 0, 'name': 'a', 'type': 'tensor'},
      {'start': 1, 'name': 'b', 'type': 'tensor'},
    ],
    'attrs': [
      {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}
    ]
  },
  {
    'tfOpName': 'Positive',
    'category': 'logical',
    'inputs': [
      {'start': 0, 'name': 'a', 'type': 'tensor'},
    ],
    'attrs': [
      {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}
    ]
  }
];
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Open Source Used In Cisco Meeting Server (formerly Acano Server) 3.4
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] =
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,

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```javascript

// Import TensorFlow modules

private mapArgToTensorInfo(arg: tensorflow.OpDef.IArgDef, nameMap?: {[key: string]: string}) {  
  let name = arg.name;  
  if (nameMap !== null) {  
    name = nameMap[name];  
  }  
  return {name, dtype: arg.type};
}

export function decodeBase64(text: string): string {  
  const global = env().global;  
  if (typeof global.atob !== 'undefined') {  
    return global.atob(text);  
  } else if (typeof Buffer !== 'undefined') {  
    return new Buffer(text, 'base64').toString();  
  } else {  
    throw new Error('Unable to decode base64 in this environment.');  
  }
}

export function parseStringParam(s: string, keepCase: boolean): string {  
  const value = Array.isArray(s) ? String.fromCharCode.apply(null, s) : decodeBase64(s);  
  return keepCase ? value : value.toLowerCase();
}

export function getTensorShapeParam(attrs: {[key: string]: tensorflow.IAttrValue}, name: string, def?: number[]): number[] | undefined {  
  const param = attrs[name];  
  if (param) {  
    return parseTensorShapeParam(param.shape);
  } else {  
    return def;
  }
}
```

import {DataType, Tensor} from '@tensorflow/tfjs-core';
import {NamedTensorsMap} from '../../data/types';
import {ExecutionContext} from '../../executor/execution_context';
import {getTensor} from '../executors/utils';
import {getBoolArrayParam, getBoolParam, getDtypeArrayParam, getDtypeParam,
getNumberParam, getNumericArrayParam, getStringArrayParam, getStringParam, getTensorShapeArrayParam,
getTensorShapeParam} from '../operation_mapper';
import {GraphNode, Node, ValueType} from '../types';

/**
 * Helper class for lookup inputs and params for nodes in the model graph.
 */
export class NodeValueImpl implements GraphNode {
  public readonly inputs: Tensor[] = [];
  public readonly attrs: {[key: string]: ValueType} = {};
  constructor(
      private node: Node, private tensorMap: NamedTensorsMap,
      private context: ExecutionContext) {
    this.inputs = node.inputNames.map(name => this.getInput(name));
    if (node.rawAttrs != null) {
      this.attrs = Object.keys(node.rawAttrs)
                       .reduce((attrs: {[key: string]: ValueType}, key) => {
                         attrs[key] = this.getAttr(key);
                         return attrs;
}, {});

    return attr[key] = this.getAttribute(key);
  }

  /**
   * Return the value of the attribute or input param.
   * @param name String: name of attribute or input param.
   */
  private getInput(name: string): Tensor {
    return getTensor(name, this.tensorMap, this.context);
  }

  /**
   * Return the value of the attribute or input param.
   * @param name String: name of attribute or input param.
   */
  private getAttr(name: string, defaultValue?: ValueType): ValueType {
    const value = this.node.rawAttrs[name];
    if (value.tensor != null) {
      return getTensor(name, this.tensorMap, this.context);
    }
    if (value.i != null || value.f != null) {
      return getNumberParam(this.node.rawAttrs, name, defaultValue as number);
    }
    if (value.s != null) {
      return getStringParam(this.node.rawAttrs, name, defaultValue as string);
    }
    if (value.b != null) {
      return getBoolParam(this.node.rawAttrs, name, defaultValue as boolean);
    }
    if (value.shape != null) {
      return getTensorShapeParam(this.node.rawAttrs, name, defaultValue as number);
    }
    if (value.list != null) {
      if (value.list.i != null || value.list.f != null) {
        return getNumericArrayParam(this.node.rawAttrs, name, defaultValue as number);
      }
      if (value.list.s != null) {
        return getStringArrayParam(this.node.rawAttrs, name, defaultValue as string);
      }
      if (value.list.shape != null) {
        return getTensorShapeArrayParam(this.node.rawAttrs, name, defaultValue as number);
      }
    }
    return defaultValue;
  }
}
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=============================================================================

*/

import {Tensor} from '@tensorflow/tfjs-core';
// tslint:disable-next-line: no-imports-from-dist
import * as tfOps from '@tensorflow/tfjs-core/dist/ops/ops_for_converter';

import {NamedTensorsMap} from '../../data/types';
import {ExecutionContext} from '../../executor/execution_context';
import {InternalOpExecutor, Node} from './executor/executor_context';

import {getParamValue} from './utils';

export const executeOp: InternalOpExecutor =

    (node: Node, tensorMap: NamedTensorsMap,
     context: ExecutionContext): Tensor[] => {
      switch (node.op) {
        case 'BiasAdd':
        case 'AddV2':
        case 'Add': {
          return [tfOps.add(
              getParamValue('a', node, tensorMap, context) as Tensor,
              getParamValue('b', node, tensorMap, context) as Tensor)];
        }
        case 'AddN': {
          return [tfOps.addN((
              getParamValue('tensors', node, tensorMap, context) as Tensor[]) as Tensor)];
        }
        case 'FloorMod':
        case 'Mod':
          return [tfOps.mod(
              getParamValue('a', node, tensorMap, context) as Tensor,
              getParamValue('b', node, tensorMap, context) as Tensor)];
        case 'Mul':
          return [tfOps.mul(
              getParamValue('a', node, tensorMap, context) as Tensor,
              getParamValue('b', node, tensorMap, context) as Tensor)];
        case 'RealDiv':
        case 'Div': {
          return [tfOps.div(
              getParamValue('a', node, tensorMap, context) as Tensor,
              getParamValue('b', node, tensorMap, context) as Tensor)];
        }
        case 'DivNoNan': {
          return [tfOps.divNoNan(
              getParamValue('a', node, tensorMap, context) as Tensor,
              getParamValue('b', node, tensorMap, context) as Tensor)];
        }
        case 'FloorDiv': {
          return [tfOps.floorDiv(
              getParamValue('a', node, tensorMap, context) as Tensor,
              getParamValue('b', node, tensorMap, context) as Tensor)];
        }
        case 'Sub': {
          return [tfOps.sub(
              getParamValue('a', node, tensorMap, context) as Tensor,
              getParamValue('b', node, tensorMap, context) as Tensor)];
        }
        case 'Minimum': {
          return [tfOps.minimum(
              getParamValue('a', node, tensorMap, context) as Tensor,
              getParamValue('b', node, tensorMap, context) as Tensor)];
        }
        case 'Maximum': {
          return [tfOps.maximum(
              getParamValue('a', node, tensorMap, context) as Tensor,
              getParamValue('b', node, tensorMap, context) as Tensor)];
        }
        case 'Pow': {
          return [tfOps.pow(
              getParamValue('a', node, tensorMap, context) as Tensor,
              getParamValue('b', node, tensorMap, context) as Tensor)];
        }
        case 'SquaredDifference': {
          return [tfOps.squaredDifference(
              getParamValue('a', node, tensorMap, context) as Tensor,
              getParamValue('b', node, tensorMap, context) as Tensor)];
        }
        default:
          throw TypeError(`Node type ${node.op} is not implemented`);
      }
    }

export const CATEGORY = 'arithmetic';

/**
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 * limitations under the License.
 */

import {Tensor} from '@tensorflow/tfjs-core';
// tslint:disable-next-line: no-imports-from-dist
import * as tfOps from '@tensorflow/tfjs-core/dist/ops/ops_for_converter';

import {NamedTensorsMap} from '../../data/types';
import {ExecutionContext} from '../../executor/execution_context';
import {InternalOpExecutor, Node} from '../types';

import {getParamValue, getTensor} from './utils';

export const executeOp: InternalOpExecutor =
    (node: Node, tensorMap: NamedTensorsMap,
     context: ExecutionContext): Tensor[] => {
      switch (node.op) {
        case 'Abs':
        case 'ComplexAbs':
          return [tfOps.abs(
              getParamValue('x', node, tensorMap, context) as Tensor)];
        case 'Acos':
          return [tfOps.acos(
              getParamValue('x', node, tensorMap, context) as Tensor)];
        case 'Acosh':
          return [tfOps.acosh(
              getParamValue('x', node, tensorMap, context) as Tensor)];
        case 'Asin':
          return [tfOps.asin(
              getParamValue('x', node, tensorMap, context) as Tensor)];
        case 'Asinh':
          return [tfOps.asinh(
              getParamValue('x', node, tensorMap, context) as Tensor)];
        case 'Atan':
          return [tfOps.atan(
              getParamValue('x', node, tensorMap, context) as Tensor)];
        case 'Atan2':
          return [tfOps.atan2(
              getParamValue('x', node, tensorMap, context) as Tensor,
              getParamValue('y', node, tensorMap, context) as Tensor)];
        case 'Atanh':
          return [tfOps.atanh(
              getParamValue('x', node, tensorMap, context) as Tensor)];
        case 'Ceil':
          return [tfOps.ceil(
              getParamValue('x', node, tensorMap, context) as Tensor)];
        case 'Cosh':
          return [tfOps.cosh(
              getParamValue('x', node, tensorMap, context) as Tensor)];
        case 'Floor':
          return [tfOps.floor(
              getParamValue('x', node, tensorMap, context) as Tensor)];
        case 'FloorMod':
        case 'Fmod':
          return [tfOps.fmod(
              getParamValue('x', node, tensorMap, context) as Tensor,
              getParamValue('y', node, tensorMap, context) as Tensor)];
        case 'Log':
          return [tfOps.log(
              getParamValue('x', node, tensorMap, context) as Tensor)];
        case 'Log1p':
          return [tfOps.log1p(
              getParamValue('x', node, tensorMap, context) as Tensor)];
        case 'LogSoftmax':
          return [tfOps.logSoftmax(
              getParamValue('x', node, tensorMap, context) as Tensor)];
        case 'Rint':
          return [tfOps.rint(
              getParamValue('x', node, tensorMap, context) as Tensor)];
        case 'Sinh':
          return [tfOps.sinh(
              getParamValue('x', node, tensorMap, context) as Tensor)];
        case 'Sign':
          return [tfOps.sign(
              getParamValue('x', node, tensorMap, context) as Tensor)];
        case 'Sin':
          return [tfOps.sin(
              getParamValue('x', node, tensorMap, context) as Tensor)];
        case 'Sqrt':
          return [tfOps.sqrt(
              getParamValue('x', node, tensorMap, context) as Tensor)];
        case 'Tan':
          return [tfOps.tan(
              getParamValue('x', node, tensorMap, context) as Tensor)];
        case 'Tanh':
          return [tfOps.tanh(
              getParamValue('x', node, tensorMap, context) as Tensor)];
        default:
          throw TypeError(`Node type ${node.op} is not implemented`);
      }
    }
This differs from `util.assertShapesMatch` in that it allows values of one negative one, an undefined size of a dimension, in a shape to match another anything. This `unimport { Tensor, util } from '@tensorflow/tfjs-core';` `unimport { Tensor, util } from '@tensorflow/tfjs-core';` `unimport { Tensor, util } from '@tensorflow/tfjs-core';`

Used by TensorList and TensorArray to verify if elementShape matches, support

```
import {Tensor, util} from '@tensorflow/tfjs-core';

/**
 * Used by TensorList and TensorArray to verify if elementShape matches, support
 * undefined as the dim shape.
 * @param shapeA
 * @param shapeB
 * @param errorMessagePrefix
 */
export function assertShapesMatchAllowUndefinedSize(shapeA: number|number[], shapeB: number|number[], errorMessagePrefix = ''): void {
  // constant shape means unknown rank
  if (typeof shapeA === 'number' || typeof shapeB === 'number') {
    return;
  }
  util.assert(
      shapeA.length === shapeB.length,
      () => errorMessagePrefix + ` Shapes ${shapeA} and ${shapeB} must match`);
  for (let i = 0; i < shapeA.length; i++) {
    const dim0 = shapeA[i];
    const dim1 = shapeB[i];
    util.assert(
        dim0 < 0 || dim1 < 0 || dim0 === dim1,
        () => errorMessagePrefix + ` Shapes ${shapeA} and ${shapeB} must match`);
  }
}

export function fullDefinedShape(elementShape: number|number[]): boolean {
  if (typeof elementShape === 'number' || elementShape.some(dim => dim < 0)) {
    return false;
  }
  return true;
}

/**
 * Generate the output element shape from the list elementShape, list tensors
 * and input param.
 * @param listElementShape
 * @param tensors
 * @param elementShape
 */
export function inferElementShape(listElementShape: number|number[], tensors: Tensor[], elementShape: number|number[]): number[] {
  let partialShape = mergeElementShape(listElementShape, elementShape);
  const notfullDefinedShape = !fullDefinedShape(partialShape);
  if (notfullDefinedShape && tensors.length === 0) {
    throw new Error('Tried to calculate elements of an empty list ' +'
      with non-fully-defined elementShape: $partialShape$');
  }
  if (notfullDefinedShape) {
    tensors.forEach(tensor => {
      partialShape = mergeElementShape(tensor.shape, partialShape);
    });
  }
  if (!fullDefinedShape(partialShape)) {
    throw new Error(`Non-fully-defined elementShape: ${partialShape}`);
  }
  return partialShape as number[];
}

export function mergeElementShape(elementShapeA: number|number[], elementShapeB: number|number[]): number|number[] {
  if (typeof elementShapeA === 'number') {
    return elementShapeB;
  }
  if (typeof elementShapeB === 'number') {
    return elementShapeA;
  }

  if (elementShapeA.length !== elementShapeB.length) {
    throw new Error('Incompatible ranks during merge: $elementShapeA$ vs. $elementShapeB$');
  }

  const result: number[] = 

  for (let i = 0; i < elementShapeA.length; i++) {
    const dim0 = elementShapeA[i];
    const dim1 = elementShapeB[i];
    if (dim0 >= 0 && dim1 >= 0 && dim0 !== dim1) {
      throw new Error('Incompatible shape during merge: $elementShapeA$ vs. $elementShapeB$');
    }
    result[i] = dim0 >= 0 ? dim0 : dim1;
  }
  return result;
}

import {concat, DataType, keep, reshape, scalar, slice, stack, Tensor, tensor, tidy, unstack} from '@tensorflow/tfjs-core';

import {assertShapesMatchAllowUndefinedSize} from './tensor_utils';

export interface TensorWithState {
  tensor?: Tensor;
  written?: boolean;
  read?: boolean;
  cleared?: boolean;
}

export class TensorArray {
  private tensors: TensorWithState[] = [

  const notfullDefinedShape = !fullDefinedShape(partialShape);
  if (notfullDefinedShape && tensors.length === 0) {
    throw new Error('Tried to calculate elements of an empty list ' +'
      with non-fully-defined elementShape: $partialShape$');
  }
  if (notfullDefinedShape) {
    tensors.forEach(tensor => {
      partialShape = mergeElementShape(tensor.shape, partialShape);
    });
  }
  if (!fullDefinedShape(partialShape)) {
    throw new Error(`Non-fully-defined elementShape: ${partialShape}`);
  }
  return partialShape as number[];
}

export function mergeElementShape(elementShapeA: number|number[], elementShapeB: number|number[]): number|number[] {
  if (typeof elementShapeA === 'number') {
    return elementShapeB;
  }
  if (typeof elementShapeB === 'number') {
    return elementShapeA;
  }

  if (elementShapeA.length !== elementShapeB.length) {
    throw new Error('Incompatible ranks during merge: $elementShapeA$ vs. $elementShapeB$');
  }

  const result: number[] = 

  for (let i = 0; i < elementShapeA.length; i++) {
    const dim0 = elementShapeA[i];
    const dim1 = elementShapeB[i];
    if (dim0 >= 0 && dim1 >= 0 && dim0 !== dim1) {
      throw new Error('Incompatible shape during merge: $elementShapeA$ vs. $elementShapeB$');
    }
    result[i] = dim0 >= 0 ? dim0 : dim1;
  }
  return result;
}

import {concat, DataType, keep, reshape, scalar, slice, stack, Tensor, tensor, tidy, unstack} from '@tensorflow/tfjs-core';

import {assertShapesMatchAllowUndefinedSize} from './tensor_utils';

export interface TensorWithState {
  tensor?: Tensor;
  written?: boolean;
  read?: boolean;
  cleared?: boolean;
}

export class TensorArray {
  private tensors: TensorWithState[] = [

  const notfullDefinedShape = !fullDefinedShape(partialShape);
  if (notfullDefinedShape && tensors.length === 0) {
    throw new Error('Tried to calculate elements of an empty list ' +'
      with non-fully-defined elementShape: $partialShape$');
  }
  if (notfullDefinedShape) {
    tensors.forEach(tensor => {
      partialShape = mergeElementShape(tensor.shape, partialShape);
    });
  }
  if (!fullDefinedShape(partialShape)) {
    throw new Error(`Non-fully-defined elementShape: ${partialShape}`);
  }
  return partialShape as number[];
}

export function mergeElementShape(elementShapeA: number|number[], elementShapeB: number|number[]): number|number[] {
  if (typeof elementShapeA === 'number') {
    return elementShapeB;
  }
  if (typeof elementShapeB === 'number') {
    return elementShapeA;
  }

  if (elementShapeA.length !== elementShapeB.length) {
    throw new Error('Incompatible ranks during merge: $elementShapeA$ vs. $elementShapeB$');
  }

  const result: number[] = 

  for (let i = 0; i < elementShapeA.length; i++) {
    const dim0 = elementShapeA[i];
    const dim1 = elementShapeB[i];
    if (dim0 >= 0 && dim1 >= 0 && dim0 !== dim1) {
      throw new Error('Incompatible shape during merge: $elementShapeA$ vs. $elementShapeB$');
    }
    result[i] = dim0 >= 0 ? dim0 : dim1;
  }
  return result;
}
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```
write(index: number, tensor: Tensor) {
    if (this.closed_)
        throw new Error(`TensorArray ${this.name} has already been closed.`);
    }

    if (index < 0 || index >= this.size())
        throw new Error(`Tried to read from index ${index}, but array size is: ${this.size()}`);
    const tensorWithState = this.tensors[index];
    if (tensorWithState.cleared)
        throw new Error(`TensorArray ${this.name}: Could not read index ${index} twice because it was cleared after a previous read` +
            ` (perhaps try setting clear_after_read = false?).`);

    if (this.clearAfterRead)
        (tensorWithState.tensor as any).clear();

    if (tensor.dtype !== this.dtype)
        throw new Error(`TensorArray ${this.name}: Could not write to TensorArray index ${index}, because the value dtype is ${this.dtype}.`);

    this.tensors[index] = tensor;
}

/**
 * Helper method to write multiple tensors to the specified indices.
 */
writeMany(indices: number[], tensors: Tensor[]) {
    if (indices.length !== tensors.length)
        throw new Error(`TensorArray ${this.name}: Could not write multiple tensors, ` +
            `because the index size: ${indices.length} is not the same as tensors size: ${tensors.length}.`);

    indices.forEach((i, index) =>
        this.write(i, tensors[index]));
}

/**
 * Return selected values in the TensorArray as a packed Tensor. All of
 * selected values must have been written and their shapes must all match.
 * @param [indices] number[] Optional. Taking values in [0, max_value). If the
 * TensorArray is not dynamic, max_value=size(). If not specified returns *
 * all tensors in the original order. @param [dtype] dtypename *An
 * gather(indices?: number[], tensors: Tensor[]) {
    if (indices.length !== tensors.length)
        throw new Error(`TensorArray ${this.name}: Could not write multiple tensors, ` +
            `because the index size: ${indices.length} is not the same as tensors size: ${tensors.length}.`);

    const tensorWithState = this.tensors[index];
    if (tensorWithState.cleared)
        throw new Error(`TensorArray ${this.name}: Could not read index ${index} twice because it was cleared after a previous read` +
            ` (perhaps try setting clear_after_read = false?).`);

    if (this.clearAfterRead)
        (tensorWithState.tensor as any).clear();

    if (tensor.dtype !== this.dtype)
        throw new Error(`TensorArray ${this.name}: Could not write to TensorArray index ${index}, because the value dtype is ${this.dtype}.`);

    this.tensors[index] = tensor;
}

/**
 * Helper method to write multiple tensors to the specified indices.
 */
writeMany(indices: number[], tensors: Tensor[]) {
    if (indices.length !== tensors.length)
        throw new Error(`TensorArray ${this.name}: Could not write multiple tensors, ` +
            `because the index size: ${indices.length} is not the same as tensors size: ${tensors.length}.`);

    indices.forEach((i, index) =>
        this.write(i, tensors[index]));
}

/**
 * Return selected values in the TensorArray as a packed Tensor. All of
 * selected values must have been written and their shapes must all match.
 * @param [indices] number[] Optional. Taking values in [0, max_value). If the
 * TensorArray is not dynamic, max_value=size(). If not specified returns *
 * all tensors in the original order. @param [dtype] dtypename *An
 * gather(indices?: number[], tensors: Tensor[]) {
    if (indices.length !== tensors.length)
        throw new Error(`TensorArray ${this.name}: Could not write multiple tensors, ` +
            `because the index size: ${indices.length} is not the same as tensors size: ${tensors.length}.`);

    const tensorWithState = this.tensors[index];
    if (tensorWithState.cleared)
        throw new Error(`TensorArray ${this.name}: Could not read index ${index} twice because it was cleared after a previous read` +
            ` (perhaps try setting clear_after_read = false?).`);

    if (this.clearAfterRead)
        (tensorWithState.tensor as any).clear();

    if (tensor.dtype !== this.dtype)
        throw new Error(`TensorArray ${this.name}: Could not write to TensorArray index ${index}, because the value dtype is ${this.dtype}.`);

    this.tensors[index] = tensor;
}

/**
 * Helper method to write multiple tensors to the specified indices.
 */
writeMany(indices: number[], tensors: Tensor[]) {
    if (indices.length !== tensors.length)
        throw new Error(`TensorArray ${this.name}: Could not write multiple tensors, ` +
            `because the index size: ${indices.length} is not the same as tensors size: ${tensors.length}.`);

    indices.forEach((i, index) =>
        this.write(i, tensors[index]));
}

/**
 * Return selected values in the TensorArray as a packed Tensor. All of
 * selected values must have been written and their shapes must all match.
 * @param [indices] number[] Optional. Taking values in [0, max_value). If the
 * TensorArray is not dynamic, max_value=size(). If not specified returns *
 * all tensors in the original order. @param [dtype] dtypename *An
 * gather(indices?: number[], tensors: Tensor[]) {
    if (indices.length !== tensors.length)
        throw new Error(`TensorArray ${this.name}: Could not write multiple tensors, ` +
            `because the index size: ${indices.length} is not the same as tensors size: ${tensors.length}.`);

    const tensorWithState = this.tensors[index];
    if (tensorWithState.cleared)
        throw new Error(`TensorArray ${this.name}: Could not read index ${index} twice because it was cleared after a previous read` +
            ` (perhaps try setting clear_after_read = false?).`);

    if (this.clearAfterRead)
        (tensorWithState.tensor as any).clear();

    if (tensor.dtype !== this.dtype)
        throw new Error(`TensorArray ${this.name}: Could not write to TensorArray index ${index}, because the value dtype is ${this.dtype}.`);

    this.tensors[index] = tensor;
}

/**
 * Helper method to write multiple tensors to the specified indices.
 */
writeMany(indices: number[], tensors: Tensor[]) {
    if (indices.length !== tensors.length)
        throw new Error(`TensorArray ${this.name}: Could not write multiple tensors, ` +
            `because the index size: ${indices.length} is not the same as tensors size: ${tensors.length}.`);

    indices.forEach((i, index) =>
        this.write(i, tensors[index]));
}

/**
 * Return selected values in the TensorArray as a packed Tensor. All of
 * selected values must have been written and their shapes must all match.
 * @param [indices] number[] Optional. Taking values in [0, max_value). If the
 * TensorArray is not dynamic, max_value=size(). If not specified returns *
 * all tensors in the original order. @param [dtype] dtypename *An
 * gather(indices?: number[], tensors: Tensor[]) {
    if (indices.length !== tensors.length)
        throw new Error(`TensorArray ${this.name}: Could not write multiple tensors, ` +
            `because the index size: ${indices.length} is not the same as tensors size: ${tensors.length}.`);

    const tensorWithState = this.tensors[index];
    if (tensorWithState.cleared)
        throw new Error(`TensorArray ${this.name}: Could not read index ${index} twice because it was cleared after a previous read` +
            ` (perhaps try setting clear_after_read = false?).`);

    if (this.clearAfterRead)
        (tensorWithState.tensor as any).clear();

    if (tensor.dtype !== this.dtype)
        throw new Error(`TensorArray ${this.name}: Could not write to TensorArray index ${index}, because the value dtype is ${this.dtype}.`);

    this.tensors[index] = tensor;
}

/**
 * Helper method to write multiple tensors to the specified indices.
 */
writeMany(indices: number[], tensors: Tensor[]) {
    if (indices.length !== tensors.length)
        throw new Error(`TensorArray ${this.name}: Could not write multiple tensors, ` +
            `because the index size: ${indices.length} is not the same as tensors size: ${tensors.length}.`);

    indices.forEach((i, index) =>
        this.write(i, tensors[index]));
}

/**
 * Return selected values in the TensorArray as a packed Tensor. All of
 * selected values must have been written and their shapes must all match.
 * @param [indices] number[] Optional. Taking values in [0, max_value). If the
 * TensorArray is not dynamic, max_value=size(). If not specified returns *
 * all tensors in the original order. @param [dtype] dtypename *An
 * gather(indices?: number[], tensors: Tensor[]) {
    if (indices.length !== tensors.length)
        throw new Error(`TensorArray ${this.name}: Could not write multiple tensors, ` +
            `because the index size: ${indices.length} is not the same as tensors size: ${tensors.length}.`);

    const tensorWithState = this.tensors[index];
    if (tensorWithState.cleared)
        throw new Error(`TensorArray ${this.name}: Could not read index ${index} twice because it was cleared after a previous read` +
            ` (perhaps try setting clear_after_read = false?).`);

    if (this.clearAfterRead)
        (tensorWithState.tensor as any).clear();

    if (tensor.dtype !== this.dtype)
        throw new Error(`TensorArray ${this.name}: Could not write to TensorArray index ${index}, because the value dtype is ${this.dtype}.`);

    this.tensors[index] = tensor;
}

/**
 * Helper method to write multiple tensors to the specified indices.
 */
writeMany(indices: number[], tensors: Tensor[]) {
    if (indices.length !== tensors.length)
        throw new Error(`TensorArray ${this.name}: Could not write multiple tensors, ` +
            `because the index size: ${indices.length} is not the same as tensors size: ${tensors.length}.`);

    indices.forEach((i, index) =>
        this.write(i, tensors[index]));
}
```
```javascript
const assertShapesMatchAllowUndefinedSize = (elementShape, tensors[0].shape, 
  'TensorArray shape mismatch: tensor array shape (\$tensors[0].shape) vs first tensor shape 
  \$tensors[0].shape)') => {
  return concat(tensors, 0);};

export class TensorList {
  readonly idTensor: Tensor;
  maxNumElements: number;
  constructor(tensors: Tensor[], elementShape: number|number[], elementDtype: DataType, 
    maxNumElements = -1) {
    if (tensors != null) {
      tensors.forEach(tensor => {
        tensor = reshape(tensor, [1, totalLength, elementPerRow]);
        for (let i = 0; i < length.length; ++i) {
          const previousLength = (i === 0) ? 0 : cumulativeLengths[i - 1];
          const sizes = [1, length[i], elementPerRow];
          tensors[i] = reshape(slice(tensor, indices, sizes), 
            this.elementShape);}
        return tensors;}
      return tensors;};
    const indices = [i];
    this.writeMany(indices, tensors);};
  }
}

```
if (elementDtype !== tensor.dtype) {
    throw new Error('Invalid data types; op elements ${{\text{elementDtype}}}$, but list elements ${{\text{tensor.dtype}}}$');
  }
  assertShapesMatchAllowUndefinedSize(elementShape, tensor.shape, 'TensorList shape mismatch: ');
  keep(tensor);
}

// this.idTensor = scalar(0);
this.maxNumElements = maxNumElements;
keep(this.idTensor);
*/
*  
* Get a new TensorList containing a copy of the underlying tensor container.
*  
* Dispose the tensors and idTensor and clear the tensor list.
*  
* The size of the tensors in the tensor list.
*  
* Return a tensor that stacks a list of rank-R tf.Tensors into one rank-(R+1) tf.Tensor.
*  
* @param elementShape shape of each tensor
*  
* @param elementDtype data type of each tensor
*  
* number[]

else if (keepIds == null || !keepIds.has(tensor.id)) {
    tensor.dispose();
  }
}

this.tensors.length = 0;
this.idTensor.dispose();
*/
* 
* The size of the tensors in the tensor list.
*  
* Return a tensor that stacks a list of rank-R tf.Tensors into one rank-(R+1) tf.Tensor.
*  
* @param elementShape shape of each tensor
*  
* @param elementDtype data type of each tensor
*  
* number[]

elementShape: DataShape, numElements = -1); Tensor

if (numElements !== -1 && this.tensors.length !== numElements) {
    throw new Error('Operation expected a list with ${\text{numElements}}$ elements but got a list with ${\text{this.tensors.length}}$ elements.');
  }

assertShapesMatchAllowUndefinedSize(elementShape, this.elementShape, 'TensorList shape mismatch: ');  

const outputElementShape =

inferElementShape(this.elementShape, this.tensors, elementShape);

return tidy(() => {
    const reshapedTensors =
        this.tensors.map(tensor => reshape(tensor, outputElementShape));

    return 

stack(reshapedTensors, 0);
});

*/
* 
* Push a tensor to the end of the list.
*  
* @param tensor Tensor to be pushed.
*  
* @param elementShape type of the tensor
*  
* @param elementDtype: DataShape
*  
* number

pushBack(tensor: Tensor) {
    if (tensor.dtype !== this.elementDtype) {
        throw new Error('Invalid data types; op elements ${{\text{elementDtype}}}$, but list elements ${{\text{tensor.dtype}}}$');
    }
    if (this.maxNumElements !== this.tensors.length) {
        throw new Error(`Trying to push element into a full list.`);
    }
    keep(tensor);
    this.tensors.push(tensor);
}

*/
* 
* Update the size of the list.
*  
* @param size the new size of the list.
*  
* @param elementShape shape of the tensor.
*  
* @param elementDtype: DataShape
*  
* number

resize(size: number) {
    if (size < 0) {
        throw new Error('TensorListResize expects size to be non-negative. Got: ${\text{size}}$');
    }

    if (this.maxNumElements !== this.tensors.length) {
        throw new Error('Trying to push element into a full list.');
    }

    keep(tensor);
    this.tensors.push(tensor);
    assertShapesMatchAllowUndefinedSize(this.elementShape, this.elementShape, 'TensorList shape mismatch: ');  

    return reshape(tensor, outputElementShape);
};

*/
* 
* Push a tensor to the end of the list.
*  
* @param tensor Tensor to be pushed.
*  
* @param elementShape type of the tensor
*  
* @param elementDtype: DataShape
*  
* number

pushBack(tensor: Tensor) {
    if (tensor.dtype !== this.elementDtype) {
        throw new Error('Invalid data types; op elements ${{\text{elementDtype}}}$, but list elements ${{\text{tensor.dtype}}}$');
    }
    if (this.maxNumElements !== this.tensors.length) {
        throw new Error('Trying to push element into a full list.');
    }

    keep(tensor);
    this.tensors.push(tensor);
    assertShapesMatchAllowUndefinedSize(this.elementShape, this.elementShape, 'TensorList shape mismatch: ');  

    return reshape(tensor, outputElementShape);
};

*/
* 
* Update the size of the list.
*  
* @param size the new size of the list.
*  
* @param elementShape shape of the tensor.
*  
* @param elementDtype: DataShape
*  
* number

resize(size: number) {
    if (size < 0) {
        throw new Error('TensorListResize expects size to be non-negative. Got: ${\text{size}}$');
    }

    if (this.maxNumElements !== this.tensors.length) {
        throw new Error('Trying to push element into a full list.');
    }

    keep(tensor);
    this.tensors.push(tensor);
    assertShapesMatchAllowUndefinedSize(this.elementShape, this.elementShape, 'TensorList shape mismatch: ');  

    return reshape(tensor, outputElementShape);
};

*/
* 
* Update the size of the list.
*  
* @param size the new size of the list.
*  
* @param elementShape shape of the tensor.
*  
* @param elementDtype: DataShape
*  
* number

resize(size: number) {
    if (size < 0) {
        throw new Error('TensorListResize expects size to be non-negative. Got: ${\text{size}}$');
    }

    if (this.maxNumElements !== this.tensors.length) {
        throw new Error('Trying to push element into a full list.');
    }

    keep(tensor);
    this.tensors.push(tensor);
    assertShapesMatchAllowUndefinedSize(this.elementShape, this.elementShape, 'TensorList shape mismatch: ');  

    return reshape(tensor, outputElementShape);
};

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    this.tensors.push(tensor);
    assertShapesMatchAllowUndefinedSize(this.elementShape, this.elementShape, 'TensorList shape mismatch: ');  

    return reshape(tensor, outputElementShape);
};

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    }

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        throw new Error('Trying to push element into a full list.');
    }

    keep(tensor);
    this.tensors.push(tensor);
    assertShapesMatchAllowUndefinedSize(this.elementShape, this.elementShape, 'TensorList shape mismatch: ');  

    return reshape(tensor, outputElementShape);
};

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        throw new Error('Trying to push element into a full list.');
    }

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    this.tensors.push(tensor);
    assertShapesMatchAllowUndefinedSize(this.elementShape, this.elementShape, 'TensorList shape mismatch: ');  

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*/
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* Update the size of the list.
*  
* @param size the new size of the list.
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* @param elementShape shape of the tensor.
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    if (size < 0) {
        throw new Error('TensorListResize expects size to be non-negative. Got: ${\text{size}}$');
    }

    if (this.maxNumElements !== this.tensors.length) {
        throw new Error('Trying to push element into a full list.');
    }

    keep(tensor);
    this.tensors.push(tensor);
    assertShapesMatchAllowUndefinedSize(this.elementShape, this.elementShape, 'TensorList shape mismatch: ');  

    return reshape(tensor, outputElementShape);
};

*/
* 
* Update the size of the list.
*  
* @param size the new size of the list.
*  
* @param elementShape shape of the tensor.
*  
* @param elementDtype: DataShape
*  
* number
tensor at the index

@param elementIndex index of the tensor

@throws Error('Invalid data types; op elements $\{\text{elementDtype}\}$ but list elements $\{\text{this.elementDtype}\}$)

@throws Error('Trying to set element $\{\text{elementIndex}\}$ in a list with max $\{\text{this.maxNumElements}\}$ elements.')

assertShapesMatchAllowUndefinedSize($\{\text{this.elementShape}\}$, $\{\text{elementShape}\}$)

// Index is greater than the size of the list, indices

// size of the list are ignored.\n
indices = indices.slice(0, this.size());\n
out = inferElementShape($\{\text{this.elementShape}\}$, $\{\text{this.tensors}\}$, $\{\text{elementShape}\}$)

if (indices.length == 0) {

return tensor([], [0].concat(outputElementShape));
}

return tidy(() => {

tensors = indices.map(i => reshape($\{\text{this.tensors}\}$[i], outputElementShape));

return stack(tensors, 0);
});

}

/**
 * Return the values in the TensorList as a concatenated Tensor.
 * @param elementDtype output tensor dtype
 * @param elementShape output tensor element shape
 */
export function fromTensor(

tensor: Tensor,

// tensor must be at least a vector, but saw shape: $\{\text{tensor.shape}\}$

if (tensor.dtype !== elementDtype) {

throw new Error(`Invalid data types; op elements $\{\text{tensor.dtype}\}$, but list elements $\{\text{elementDtype}\}$)

assertShapesMatchAllowUndefinedSize($\{\text{this.elementShape}\}$, $\{\text{elementShape}\}$)

// Tensor must be at least a vector, but saw shape: $\{\text{elementShape}\}$)

if (this.size() === 0) {

return tensor([], [0].concat(outputElementShape));
}

return tidy(() => {

tensors = this.tensors.map(t => reshape(t, outputElementShape));

return concat(tensors, 0);
});

}

/**
 * Split the
values of a Tensor into a TensorList.

```javascript
values of a Tensor into a TensorList.
```

```javascript
//export function split(tensor: Tensor, length: number[], elementShape: number[]) {
const cumulativeLengths = length.map(len => { return totalLength += len; }) || totalLength
if (totalLength !== tensor.shape[0]) { throw new Error(`Expected sum of lengths to be equal to tensor.shape[0], but sum of lengths is: ${totalLength}, and tensor's shape is: ${tensor.shape}`); }
const outputElementShape = new ElementShape(shapeWithoutFirstDim, elementShape);
const elementPerRow = totalLength === 0 ? 0 : tensor.size / totalLength;
const outputElementShape = mergeElementShape(shapeWithoutFirstDim, elementShape);
const list = new TensorList(elementShape, tensor.dtype, length.length);
for (let i = 0; i < length.length; i++) {
  const previousLength = (i === 0) ? 0 : cumulativeLengths[i - 1];
  const indices = [0, previousLength, 0];
  const sizes = [1, length[i], elementPerRow];
  list.setItem(i, split(tensor, indices, sizes, outputElementShape as number[]));
}
return list;
}
```

```javascript
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 * distributed under the License is distributed on an "AS IS"
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 */
```

```javascript
import {DataType, scalar, Tensor} from '@tensorflow/tfjs-core';
import {NamedTensorsMap} from '../../../../data/types';
import {ExecutionContext} from '../../../../executor/execution_context';
import {TensorArray} from '../../../../executor/tensor_array';
import {fromTensor, reserve, scatter, split} from '../../../../executor/tensor_list';
import {InternalOpAsyncExecutor, Node} from '../types';

import {cloneTensor, getParamValue, getTensor} from './utils';

  switch (node.op) {
    case 'If':
      case 'StatelessIf': {
        const cond = getParamValue('cond', node, tensorMap, context) as Tensor;
        const args = getParamValue('args', node, tensorMap, context) as Tensor[];
        const condValue = await cond.data();
        if (condValue[0]) {
          return context.functionMap[thenFunc].executeFunctionAsync(args, context.tensorArrayMap, context.tensorListMap);
        } else {
          return context.functionMap[elseFunc].executeFunctionAsync(args, context.tensorArrayMap, context.tensorListMap);
        }
      }
    case 'While':
    case 'StatelessWhile': {
      const bodyFunc = getParamValue('body', node, tensorMap, context) as string;
      const condFunc = getParamValue('cond', node, tensorMap, context) as Tensor;
      const args = getParamValue('args', node, tensorMap, context) as Tensor[];
      const condValue = await cond.data();
      if (condValue[0]) {
        return context.functionMap[bodyFunc].executeFunctionAsync(args, context.tensorArrayMap, context.tensorListMap);
      } else {
        return context.functionMap[condFunc].executeFunctionAsync(args, context.tensorArrayMap, context.tensorListMap);
      }
    }
    default: {
      return context.functionMap[node.op].executeFunctionAsync(args, context.tensorArrayMap, context.tensorListMap);
    }
  }
}
```
condition of the loop using the latest results.

```javascript
const condResult =
    (await context.functionMap[condFunc].executeFunctionAsync(
        result, context.tensorArrayMap,
        context.tensorListMap));

const condValue = await condResult[0].data();

// Dispose the intermediate tensors
if (result) {
    const resultIds = result[0].indexOf();
    for (let i = 0; i < resultIds.length; i++) {
        const tensor = resultIds[i];
        if (tensor.disposed() && argIds.indexOf(tensor.id) === -1) {
            tensor.dispose();
        }
    }
}

return result;
```

**Case 'LoopCond':**

```javascript
const pred = getParamValue('pred', node, tensorMap, context) as Tensor;
```

**Case 'Switch':**

```javascript
const pred = getParamValue('pred', node, tensorMap, context) as Tensor;
let data = getParamValue('data', node, tensorMap, context) as Tensor;
```

**Case 'If':**

```javascript
if (!data.data()) {
    // Outputs nodes: false
    return (await pred.data())[0] ? [undefined, data] : [data, undefined];
}
```

**Case 'Merge':**

```javascript
const pred = getParamValue('pred', node, tensorMap, context) as Tensor;
let data = getParamValue('data', node, tensorMap, context) as Tensor;
```

**Case 'Exit':**

```javascript
const frameId = getParamValue('frameName', node, tensorMap, context) as string;
context.exitFrame();
```

**Case 'NextIteration':**

```javascript
context.nextIteration();
```

**Case 'TensorArrayV3':**

```javascript
const size = getParamValue('size', node, tensorMap, context) as number;
const dtype = getParamValue('dtype', node, tensorMap, context) as DataType;
const elementShape = getParamValue('elementShape', node, tensorMap, context) as number;
const dynamicSize = getParamValue('dynamicSize', node, tensorMap, context) as boolean;
const clearAfterRead = getParamValue('clearAfterRead', node, tensorMap, context) as boolean;
const identicalElementShapes = getParamValue('identicalElementShapes', node, tensorMap, context) as boolean;
const name = getParamValue('name', node, tensorMap, context) as string;
const tensorArray = new TensorArray(name, dtype, size, elementShape, identicalElementShapes, dynamicSize, clearAfterRead);
context.addTensorArray(tensorArray);
```

**Case 'TensorArrayWriteV3':**

```javascript
const id = getParamValue('tensorArrayId', node, tensorMap, context) as Tensor;
const index = getParamValue('index', node, tensorMap, context) as number;
const writeTensor = getParamValue('tensor', node, tensorMap, context) as Tensor;
```

**Case 'TensorArrayGatherV3':**

```javascript
const gatherId = getParamValue('tensorArrayId', node, tensorMap, context) as Tensor;
const gatherIndices = getParamValue('indices', node, tensorMap, context) as number[];
```

**Case 'TensorArrayScatterV3':**

```javascript
const scatterId = getParamValue('tensorArrayId', node, tensorMap, context) as Tensor;
const scatterIndices = getParamValue('indices', node, tensorMap, context) as number[];
```

**Case 'TensorArrayConcatV3':**

```javascript
const concatId = getParamValue('tensorArrayId', node, tensorMap, context) as Tensor;
```

**Case 'TensorArraySplitV3':**

```javascript
const splitId = getParamValue('tensorArrayId', node, tensorMap, context) as Tensor;
const splitIndices = getParamValue('indices', node, tensorMap, context) as number[];
```
const splitId = getParamValue('tensorArrayId', node, tensorMap, context) as Tensor;
const splitTensor = getParamValue('tensor', node, tensorMap, context) as Tensor;
const lengths = getParamValue('lengths', node, tensorMap, context) as number[];
const splitTensorArray = context.getTensorArray(splitId.id);

splitTensorArray.split(lengths, splitTensor);

return [splitTensorArray.idTensor];

case 'TensorArraySizeV3':

const sizesId = getParamValue('tensorArrayId', node, tensorMap, context) as Tensor;
const sizeTensorArray = context.getTensorArray(sizesId.id);
return [scalar(sizeTensorArray.size(), 'int32')];

break;

case 'TensorArrayCloseV3':

const closeId = getParamValue('tensorArrayId', node, tensorMap, context) as Tensor;
const closeTensorArray = context.getTensorArray(closeId.id);

closeTensorArray.clearAndClose();
return [closeTensorArray.idTensor];

break;

case 'TensorListSetItem':

const idTensor = getParamValue('tensorListId', node, tensorMap, context) as Tensor;
const index = getParamValue('index', node, tensorMap, context) as number;
const writeTensor = getParamValue('tensor', node, tensorMap, context) as Tensor;

const tensorList = context.getTensorList(idTensor.id);
tensorList.setItem(index, writeTensor);
return [tensorList.idTensor];

break;

case 'TensorListGetItem':

const idTensor = getParamValue('tensorListId', node, tensorMap, context) as Tensor;
const readIndex = getParamValue('index', node, tensorMap, context) as number;
const elementShape = getParamValue('elementShape', node, tensorMap, context) as number[];
const elementDType = getParamValue('elementDType', node, tensorMap, context) as DataType;

const tensorList = context.getTensorList(idTensor.id);
return [tensorList.getItem(readIndex, elementShape, elementDType)];

break;

case 'TensorListScatterV2':

const scatterIndices = getParamValue('indices', node, tensorMap, context) as number[];
const scatterTensor = getParamValue('tensor', node, tensorMap, context) as Tensor;

const elementShape = getParamValue('elementShape', node, tensorMap, context) as number[];
const numElements = getParamValue('numElements', node, tensorMap, context) as number;
const tensorList = scatter(scatterTensor, scatterIndices, elementShape, numElements);
context.addTensorList(tensorList);
return [tensorList.idTensor];

break;

case 'TensorListReserve':

if (node.op === 'TensorListReserve') {
  const numElementsParam = 'numElements';
} else {
  const numElementsParam = 'maxNumElements';
}
const numElements = getParamValue(numElementsParam, node, tensorMap, context) as number;
const tensorList = reserve(elementShape, elementDtype, numElements);
context.addTensorList(tensorList);
return [tensorList.idTensor];

break;

case 'TensorListGather':

const gatherId = getParamValue('tensorListId', node, tensorMap, context) as Tensor;
const gatherIndices = getParamValue('indices', node, tensorMap, context) as number[];
const elementShape = getParamValue('elementShape', node, tensorMap, context) as number[];
const elementDType = getParamValue('elementDType', node, tensorMap, context) as DataType;

const tensorList = context.getTensorList(gatherId.id);
return [tensorList.gather(gatherIndices, elementDType, elementShape)];

break;

case 'TensorListStack':

const idTensor = getParamValue('tensorListId', node, tensorMap, context) as Tensor;
const elementShape = getParamValue('elementShape', node, tensorMap, context) as number[];
const elementDType = getParamValue('elementDType', node, tensorMap, context) as DataType;
const numElements = getParamValue('numElements', node, tensorMap, context) as number;
const tensorList = fromTensor(tensorList, elementShape, elementDType);
context.addTensorList(tensorList);
return [tensorList.idTensor];

break;

case 'TensorListFromTensor':

const tensor = getParamValue('tensor', node, tensorMap, context) as Tensor;
const elementShape = getParamValue('elementShape', node, tensorMap, context) as number[];
const elementDType = getParamValue('elementDType', node, tensorMap, context) as DataType;
const numElements = getParamValue('numElements', node, tensorMap, context) as number;
const tensorList = context.getTensorList(idTensor.id);
return [tensorList.idTensor];

break;

case 'TensorListFromTensor':

const tensor = getParamValue('tensor', node, tensorMap, context) as Tensor;
const elementShape = getParamValue('elementShape', node, tensorMap, context) as number[];
const elementDType = getParamValue('elementDType', node, tensorMap, context) as DataType;
const tensorList = fromTensor(tensor, elementShape, elementDType);
context.addTensorList(tensorList);
return [tensorList.idTensor];

break;
```javascript
    case 'TensorListConcat': {
      const concatId =
          getParamValue('tensorListId', node, tensorMap, context) as Tensor;
      const tensorList =
          context.getTensorList(concatId.id);
      const concatDtype =
          getParamValue('dtype', node, tensorMap, context) as DataType;
      const elementShape =
          getParamValue('elementShape', node, tensorMap, context) as number;
      return [tensorList.concat(concatDtype, elementShape)];
    }
    case 'TensorListPushBack': {
      const idTensor =
          getParamValue('tensorListId', node, tensorMap, context) as Tensor;
      const writeTensor =
          getParamValue('tensor', node, tensorMap, context) as Tensor;
      const tensorList =
          context.getTensorList(idTensor.id);
      tensorList.pushBack(writeTensor);
      return [tensorList.idTensor];
    }
    case 'TensorListPopBack': {
      const idTensor =
          getParamValue('tensorListId', node, tensorMap, context) as Tensor;
      const elementShape =
          getParamValue('elementShape', node, tensorMap, context) as number;
      const elementDType =
          getParamValue('elementDType', node, tensorMap, context) as DataType;
      const tensorList = context.getTensorList(idTensor.id);
      return [tensorList.popBack(elementShape, elementDType)];
    }
    case 'TensorListSplit': {
      const splitTensor =
          getParamValue('tensor', node, tensorMap, context) as Tensor;
      const elementShape =
          getParamValue('elementShape', node, tensorMap, context) as number;
      const lengths =
          getParamValue('lengths', node, tensorMap, context) as number;
      const tensorList = split(splitTensor, lengths, elementShape);
      context.addTensorList(tensorList);
      return [tensorList.idTensor];
    }
    default:
      throw TypeError(`Node type ${node.op} is not implemented`);
  };

export const CATEGORY =
    'control';

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 */

import {Rank, Tensor, Tensor3D, Tensor4D, Tensor5D} from '@tensorflow/tfjs-core';
import * as tfOps from '@tensorflow/tfjs-core/dist/ops/ops_for_converter';
import {NamedTensorsMap} from '../../data/types';
import {ExecutionContext} from '../../executor/execution_context';
import {InternalOpExecutor, Node} from '../types';
import {getPadding, getParamValue} from './utils';

function fusedConvAndDepthWiseParams(
    node: Node, tensorMap: NamedTensorsMap, context: ExecutionContext) {
  const 
[.tensorList.idTensor];

  case 'TensorListConcat': {
    const concatId =
        getParamValue('tensorListId', node, tensorMap, context) as Tensor;
    const concatDtype =
        getParamValue('dtype', node, tensorMap, context) as number;
    return [tensorList.concat(concatDtype, elementShape)];
  }
  case 'TensorListPushBack': {
    const idTensor =
        getParamValue('tensorListId', node, tensorMap, context) as Tensor;
    const writeTensor =
        getParamValue('tensor', node, tensorMap, context) as Tensor;
    const tensorList =
        context.getTensorList(idTensor.id);
    tensorList.pushBack(writeTensor);
    return [tensorList.idTensor];
  }
  case 'TensorListPopBack': {
    const idTensor =
        getParamValue('tensorListId', node, tensorMap, context) as Tensor;
    const elementShape =
        getParamValue('elementShape', node, tensorMap, context) as number;
    const elementDType =
        getParamValue('elementDType', node, tensorMap, context) as DataType;
    const tensorList = context.getTensorList(idTensor.id);
    return [tensorList.popBack(elementShape, elementDType)];
  }
  case 'TensorListSplit': {
    const splitTensor =
        getParamValue('tensor', node, tensorMap, context) as Tensor;
    const elementShape =
        getParamValue('elementShape', node, tensorMap, context) as number;
    const lengths =
        getParamValue('lengths', node, tensorMap, context) as number;
    const tensorList = split(splitTensor, lengths, elementShape);
    context.addTensorList(tensorList);
    return [tensorList.idTensor];
  }
  default:
    throw TypeError(`Node type ${node.op} is not implemented`);
}
dataFormat as 'NDHWC' | 'NCDHW',
    [dilations[1], dilations[2], dilations[3]]
  ]
  case 'AvgPool':
    const stride = getParamValue('strides', node, tensorMap, context) as number[];
    const pad = getParamValue('pad', node, tensorMap, context);
    const kernelSize = getParamValue('kernelSize', node, tensorMap, context) as number[];
    return tfOps.avgPool(
        getParamValue('x', node, tensorMap, context) as Tensor3D | Tensor4D,
        [kernelSize[1], kernelSize[2]], [stride[1], stride[2]],
        pad as 'valid' | 'same');
  
  case 'MaxPool':
    const stride = getParamValue('strides', node, tensorMap, context) as number[];
    const kernelSize = getParamValue('kernelSize', node, tensorMap, context) as number[];
    return tfOps.maxPool(
        getParamValue('x', node, tensorMap, context) as Tensor3D | Tensor4D,
        [kernelSize[1], kernelSize[2]], [stride[1], stride[2]],
        pad as 'valid' | 'same');
  
  case 'MaxPoolWithArgmax':
    const stride = getParamValue('strides', node, tensorMap, context) as number[];
    const pad = getParamValue('pad', node, tensorMap, context);
    const kernelSize = getParamValue('kernelSize', node, tensorMap, context) as number[];
    const {result, indexes} = tfOps.maxPoolWithArgmax(
        getParamValue('x', node, tensorMap, context) as Tensor4D,
        [kernelSize[1], kernelSize[2]], [stride[1], stride[2]],
        pad as 'valid' | 'same', includeBatchInIndex);
    return [result, indexes];
  
  case 'AvgPool3D':
    const stride = getParamValue('strides', node, tensorMap, context) as number[];
    const pad = getParamValue('pad', node, tensorMap, context);
    const kernelSize = getParamValue('kernelSize', node, tensorMap, context) as number[];
    return tfOps.avgPool3d(
        getParamValue('x', node, tensorMap, context) as Tensor5D,
        [kernelSize[1], kernelSize[2], kernelSize[3]],
        [stride[1], stride[2], stride[3]],
        pad as 'valid' | 'same');
  
  case 'MaxPool3D':
    const stride = getParamValue('strides', node, tensorMap, context) as number[];
    const pad = getParamValue('pad', node, tensorMap, context);
    const kernelSize = getParamValue('kernelSize', node, tensorMap, context) as number[];
    return tfOps.maxPool3d(
        getParamValue('x', node, tensorMap, context) as Tensor5D,
        [kernelSize[1], kernelSize[2], kernelSize[3]],
        [stride[1], stride[2], stride[3]],
        pad as 'valid' | 'same');
  
  case 'Dilation2D':
    const strides = getParamValue('strides', node, tensorMap, context) as number[];
    const pad = getParamValue('pad', node, tensorMap, context);
    const dilations = getParamValue('dilations', node, tensorMap, context) as number[];
    const strideHeight = strides[1];
    const strideWidth = strides[2];
    const dilationHeight = dilations[1];
    const dilationWidth = dilations[2];
    return tfOps.dilation2d(
        getParamValue('x', node, tensorMap, context) as Tensor3D | Tensor4D,
        [strideHeight, strideWidth], [dilationHeight, dilationWidth], 'NHWC' /* dataFormat */);

export const CATEGORY = 'convolution';

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 */
from '@utils';

export const executeOp: InternalOpExecutor =
    (node: Node, tensorMap: NamedTensorsMap,
     context: ExecutionContext): Tensor[] => {
      switch (node.op) {
        case 'Fill': {
          const shape =
            getParamValue('shape', node, tensorMap, context) as number[];
          const dtype =
            getParamValue('dtype', node, tensorMap, context) as DataType;
          const value =
            getParamValue('value', node, tensorMap, context) as number;
          return [tfOps.fill(shape, value, dtype)];
        }
        case 'LinSpace': {
          const start =
            getParamValue('start', node, tensorMap, context) as number;
          const stop =
            getParamValue('stop', node, tensorMap, context) as number;
          const num = getParamValue('num', node, tensorMap, context) as number;
          return [tfOps.linspace(start, stop, num)];
        }
        case 'Multinomial': {
          const logits =
            getParamValue('logits', node, tensorMap, context) as Tensor;
          const numSamples =
            getParamValue('numSamples', node, tensorMap, context) as number;
          const seed =
            getParamValue('seed', node, tensorMap, context) as number;
          return [tfOps.multinomial(logits, numSamples, seed)];
        }
        case 'OneHot': {
          const indices =
            getParamValue('indices', node, tensorMap, context) as Tensor;
          const depth =
            getParamValue('depth', node, tensorMap, context) as number;
          const onValue =
            getParamValue('onValue', node, tensorMap, context) as number;
          const offValue =
            getParamValue('offValue', node, tensorMap, context) as number;
          return [tfOps.oneHot(indices, depth, onValue, offValue)];
        }
        case 'Ones': {
          return [tfOps.ones(
              getParamValue('shape', node, tensorMap, context) as number[],
              getParamValue('dtype', node, tensorMap, context) as DataType)];
        }
        case 'OnesLike': {
          return [tfOps.onesLike(
              getParamValue('x', node, tensorMap, context) as Tensor)];
        }
        case 'RandomUniform': {
          return [tfOps.randomUniform(
              // tslint:disable-next-line:no-any
              getParamValue('shape', node, tensorMap, context) as any,
              getParamValue('minval', node, tensorMap, context) as number,
              getParamValue('maxval', node, tensorMap, context) as number,
              getParamValue('dtype', node, tensorMap, context) as DataType)];
        }
        case 'Range': {
          const start =
            getParamValue('start', node, tensorMap, context) as number;
          const stop =
            getParamValue('stop', node, tensorMap, context) as number;
          const step =
            getParamValue('step', node, tensorMap, context) as number;
          return [tfOps.range(
              start, stop,
              step,
              getParamValue('dtype', node, tensorMap, context) as 'float32' |
                  'int32')];
        }
        case 'TruncatedNormal': {
          const shape =
            getParamValue('shape', node, tensorMap, context) as number[];
          const mean =
            getParamValue('mean', node, tensorMap, context) as number;
          const stdDev =
            getParamValue('stdDev', node, tensorMap, context) as number;
          const seed =
            getParamValue('seed', node, tensorMap, context) as number;
          return [tfOps.truncatedNormal(
              shape, mean, stdDev,
              getParamValue('dtype', node, tensorMap, context) as 'float32' |
                  'int32',
              seed)];
        }
        case 'Zeros': {
          return [tfOps.zeros(
              getParamValue('shape', node, tensorMap, context) as number[],
              getParamValue('dtype', node, tensorMap, context) as DataType)];
        }
        case 'ZerosLike': {
          return [tfOps.zerosLike(
              getParamValue('x', node, tensorMap, context) as Tensor)];
        }
        default:
          throw TypeError(`Node type ${node.op} is not implemented`);
      }
    };

export const CATEGORY = 'creation';

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 */

import {Tensor, Tensor1D, Tensor2D} from '@tensorflow/tfjs-core';
// tslint:disable-next-line: no-imports-from-dist
import * as tfOps from '@tensorflow/tfjs-core/dist/ops/ops_for_converter';

import {NamedTensorsMap} from '../../data/types';
import {ExecutionContext} from '../../executor/execution_context';
import {InternalOpAsyncExecutor, Node} from '../types';
function nmsParams(node, tensorMap, context) {
  const boxes = getParamValue('boxes', node, tensorMap, context) as Tensor;
  const scores = getParamValue('scores', node, tensorMap, context) as Tensor;
  const maxOutputSize = getParamValue('maxOutputSize', node, tensorMap, context) as number;
  const iouThreshold = getParamValue('iouThreshold', node, tensorMap, context) as number;
  const scoreThreshold = getParamValue('scoreThreshold', node, tensorMap, context) as number;
  const softNmsSigma = getParamValue('softNmsSigma', node, tensorMap, context) as number;

  return {
    boxes,
    scores,
    maxOutputSize,
    iouThreshold,
    scoreThreshold,
    softNmsSigma
  };
}

export const executeOp: InternalOpAsyncExecutor = async(node, tensorMap, context) => {
  switch (node.op) {
    case 'NonMaxSuppressionV5': {
      const {boxes, scores, maxOutputSize, iouThreshold, scoreThreshold, softNmsSigma} = nmsParams(node, tensorMap, context);
      const result = await tfOps.image.nonMaxSuppressionWithScoreAsync(boxes as Tensor2D, scores as Tensor1D, maxOutputSize, iouThreshold, scoreThreshold, softNmsSigma);
      return [result.selectedIndices, result.selectedScores];
    }
    case 'NonMaxSuppressionV4': {
      const {boxes, scores, maxOutputSize, iouThreshold, scoreThreshold, softNmsSigma} = nmsParams(node, tensorMap, context);
      const padToMaxOutputSize = getParamValue('padToMaxOutputSize', node, tensorMap, context) as boolean;
      const result = await tfOps.image.nonMaxSuppressionPaddedAsync(boxes as Tensor2D, scores as Tensor1D, maxOutputSize, iouThreshold, scoreThreshold, padToMaxOutputSize);
      return [result.selectedIndices, result.validOutputs];
    }
    case 'NonMaxSuppressionV3': case 'NonMaxSuppressionV2': {
      const {boxes, scores, maxOutputSize, iouThreshold, scoreThreshold} = nmsParams(node, tensorMap, context);
      return [await tfOps.image.nonMaxSuppressionAsync(boxes as Tensor2D, scores as Tensor1D, maxOutputSize, iouThreshold, scoreThreshold)];
    }
    case 'TopKV2': {
      const x = getParamValue('x', node, tensorMap, context) as Tensor;
      const k = getParamValue('k', node, tensorMap, context) as number;
      const sorted = getParamValue('sorted', node, tensorMap, context) as boolean;
      const result = tfOps.topk(x, k, sorted);
      return [result.values, result.indices];
    }
    case 'Unique': {
      const x = getParamValue('x', node, tensorMap, context) as Tensor;
      const result = tfOps.unique(x);
      return [result.values, result.indices];
    }
    default:
      throw TypeError(`Node type ${node.op} is not implemented`);
  }
};
```javascript
export const executeOp: InternalOpExecutor =
    (node: Node, tensorMap: NamedTensorsMap,
     context: ExecutionContext): Tensor[] => {
      switch (node.op) {
        case 'Const': {
          return tensorMap[node.name];
        }
        case 'PlaceholderWithDefault':
          const def =
              getParamValue('default', node, tensorMap, context) as Tensor;
          return [getTensor(node.name, tensorMap, context) || def];
        case 'Placeholder':
          return [getTensor(node.name, tensorMap, context)];
        case 'Identity':
        case 'StopGradient':
        case 'FakeQuantWithMinMaxVars': {  // This op is currently ignored.
          const data = getParamValue('x', node,
              tensorMap, context) as Tensor;
          return [cloneTensor(data)];
        }
        case 'IdentityN':
          return (getParamValue('x', node, tensorMap, context) as Tensor[])
              .map((t: Tensor) => cloneTensor(t));
        case 'Snapshot':
          const snapshot =
              (getParamValue('x', node, tensorMap, context) as Tensor);
          return [cloneTensor(snapshot)];
        case 'Shape':
          return [tfOps.tensor1d(
              (getParamValue('x', node, tensorMap, context) as Tensor).shape,
              'int32')];
        case 'ShapeN':
          return (getParamValue('x', node, tensorMap, context) as Tensor[])
              .map((t: Tensor) =>
              tfOps.tensor1d(t.shape));
        case 'Size':
          return [tfOps.scalar(
              (getParamValue('x', node, tensorMap, context) as Tensor).size,
              'int32')];
        case 'Rank':
          return [tfOps.scalar(
              (getParamValue('x', node, tensorMap, context) as Tensor).rank,
              'int32')];
        case 'NoOp':
          return [tfOps.scalar(1) as Tensor];
        case 'Print':
          const input = getParamValue('value', node, tensorMap, context) as Tensor;
          const data =
              getParamValue('data', node, tensorMap, context) as Tensor[];
          const message =
              getParamValue('message', node, tensorMap, context) as string;
          const summarize =
              getParamValue('summarize', node, tensorMap, context) as number;
          console.warn(
              'The graph has a tf.print() operation,
              usually used for debugging, which slows down performance.');
          console.log(message);
          for (let i = 0; i < data.length; i++) {
            console.log(Array.prototype.slice.call(data[i].dataSync());
                .slice(0, summarize));
          }
          return [input];
        default:
          throw TypeError(`Node type ${node.op} is not implemented`);
      }
    }

export const CATEGORY = 'evaluation';

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 */

import * as tfOps from '@tensorflow/tfjs-core/dist/ops/ops_for_converter';

import {NamedTensorsMap} from 'tensorflow-data';
import {ExecutionContext} from 'tensorflow-internal';
import {InternalOpExecutor,
    Node} from 'tensorflow-data';

import {cloneTensor, getParamValue, getTensor} from './utils';

export const executeOp: InternalOpExecutor =
    (node: Node, tensorMap: NamedTensorsMap,
     context: ExecutionContext): Tensor[] => {
      switch (node.op) {
        case 'Const': {
          return tensorMap[node.name];
        }
        case 'PlaceholderWithDefault':
          const def =
              getParamValue('default', node, tensorMap, context) as Tensor;
          return [getTensor(node.name, tensorMap, context) || def];
        case 'Placeholder':
          return [getTensor(node.name, tensorMap, context)];
        case 'Identity':
        case 'StopGradient':
        case 'FakeQuantWithMinMaxVars': {  // This op is currently ignored.
          const data = getParamValue('x', node,
              tensorMap, context) as Tensor;
          return [cloneTensor(data)];
        }
        case 'IdentityN':
          return (getParamValue('x', node, tensorMap, context) as Tensor[])
              .map((t: Tensor) => cloneTensor(t));
        case 'Snapshot':
          const snapshot =
              (getParamValue('x', node, tensorMap, context) as Tensor);
          return [cloneTensor(snapshot)];
        case 'Shape':
          return [tfOps.tensor1d(
              (getParamValue('x', node, tensorMap, context) as Tensor).shape,
              'int32')];
        case 'ShapeN':
          return (getParamValue('x', node, tensorMap, context) as Tensor[])
              .map((t: Tensor) =>
              tfOps.tensor1d(t.shape));
        case 'Size':
          return [tfOps.scalar(
              (getParamValue('x', node, tensorMap, context) as Tensor).size,
              'int32')];
        case 'Rank':
          return [tfOps.scalar(
              (getParamValue('x', node, tensorMap, context) as Tensor).rank,
              'int32')];
        case 'NoOp':
          return [tfOps.scalar(1) as Tensor];
        case 'Print':
          const input = getParamValue('value', node, tensorMap, context) as Tensor;
          const data =
              getParamValue('data', node, tensorMap, context) as Tensor[];
          const message =
              getParamValue('message', node, tensorMap, context) as string;
          const summarize =
              getParamValue('summarize', node, tensorMap, context) as number;
          console.warn(
              'The graph has a tf.print() operation,
              usually used for debugging, which slows down performance.');
          console.log(message);
          for (let i = 0; i < data.length; i++) {
            console.log(Array.prototype.slice.call(data[i].dataSync());
                .slice(0, summarize));
          }
          return [input];
        default:
          throw TypeError(`Node type ${node.op} is not implemented`);
      }
    }

export const CATEGORY = 'evaluation';

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 */
```
keyDType `dtype` of the table keys.

```
* @param valueDType `dtype` of the table values.
* @/n
constructor(readonly keyDType: DataType, readonly valueDType: DataType) {
    this.handle = scalar(0);
    this.tensorMap = new Map<any, Tensor>();
}
```

```
/**
   * The number of items in the hash table.
   */
  size(): number {
    return this.tensorMap.size;
  }

  /**
   * Replaces the contents of the table with the specified keys and values.
   * @param keys Keys to store in the hashtable.
   * @param values Values to store in the hashtable.
   */
  async import(keys: Tensor, values: Tensor): Promise<Tensor> {
    this.checkKeyAndValueTensor(keys, values);

    // We only store the primitive values of the keys, this allows lookup
    // to be O(1).
    const $keys = await keys.data();
    const $values = unstack(values);

    util.assert(
        $keys.length === $values.length,
        () => `The number of elements doesn't match, keys has "+$keys.length elements, the values has $values.length elements.
    ` +
        `elements.`);
    for (let i = 0; i < $keys.length; i++) {
      const key = $keys[i];
      const value = this.findWithDefault(key, defaultValue);
      result.push(value);
    }
    return stack(result);
  }

  // tslint:disable-next-line: no-any
  private findWithDefault(key: any, defaultValue: Tensor): Tensor {
    const result = this.tensorMap.get(key);
    return result != null ? result : defaultValue;
  }

  // tslint:disable-next-line: no-any
  private checkKeyAndValueTensor(key: Tensor, value: Tensor) {
    if (key.dtype !== this.keyDType) {
      throw new Error(
          `Expect key dtype ${this.keyDType}, but got ` +
          `${key.dtype}`);
    }
    if (value.dtype !== this.valueDType) {
      throw new Error(
          `Expect value dtype ${this.valueDType}, but got ` +
          `${value.dtype}`);
    }
  }
```

'LookupTableImport':
    case 'LookupTableImportV2': {
      const handle = getParamValue('tableHandle', node, tensorMap, context, resourceManager) as Tensor;
      const keys = getParamValue('keys', node, tensorMap, context) as Tensor;
      const values = getParamValue('values', node, tensorMap, context) as Tensor;
      const hashTable = resourceManager.getHashTableById(handle.id);
      return [await hashTable.import(keys, values)];
    }
    case 'LookupTableFind':
    case 'LookupTableFindV2': {
      const handle = getParamValue('tableHandle', node, tensorMap, context, resourceManager) as Tensor;
      const keys = getParamValue('keys', node, tensorMap, context) as Tensor;
      const defaultValue = getParamValue('defaultValue', node, tensorMap, context) as Tensor;
      const hashTable = resourceManager.getHashTableById(handle.id);
      return [await hashTable.find(keys, defaultValue)];
    }
    default:
      throw TypeError(`Node type ${node.op} is not implemented`);
  }
}

export const CATEGORY = 'hash_table';

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 *
 *=============================================================================
 *
 * @import {Tensor, Tensor1D, Tensor2D, Tensor3D, Tensor4D} from '@tensorflow/tfjs-core';
 * @import {ExecutionContext} from '@tensorflow/core/dist/ops_converter';
 * @import {NamedTensorsMap} from '../../data/types';
 * @import {ExecutionContext} from '../../executor/executor';
 * @import {getParamValue} from './utils';
 *
 * export const executeOp: InternalOpExecutor = (node, tensorMap, context) => {
 *   switch (node.op) {
 *     case 'ResizeBilinear': {
 *       const images = getParamValue('images', node, tensorMap, context) as Tensor;
 *       const size = getParamValue('size', node, tensorMap, context) as number[];
 *       const alignCorners = getParamValue('alignCorners', node, tensorMap, context) as boolean;
 *       const halfPixelCenters = getParamValue('halfPixelCenters', node, tensorMap, context) as boolean;
 *       return [tfOps.image.resizeBilinear(images as Tensor3D | Tensor4D, size as [number, number], alignCorners as boolean, halfPixelCenters as boolean) as tf.Tensor];
 *     }
 *     case 'ResizeNearestNeighbor': {
 *       const images = getParamValue('images', node, tensorMap, context) as Tensor;
 *       const size = getParamValue('size', node, tensorMap, context) as number[];
 *       const alignCorners = getParamValue('alignCorners', node, tensorMap, context) as boolean;
 *       const halfPixelCenters = getParamValue('halfPixelCenters', node, tensorMap, context) as boolean;
 *       return [tfOps.image.resizeNearestNeighbor(images as Tensor3D | Tensor4D, size as [number, number], alignCorners as boolean, halfPixelCenters as boolean) as tf.Tensor];
 *     }
 *     case 'CropAndResize': {
 *       const image = getParamValue('image', node, tensorMap, context) as Tensor;
 *       const boxes = getParamValue('boxes', node, tensorMap, context) as Tensor;
 *       const boxInd = getParamValue('boxInd', node, tensorMap, context) as Tensor;
 *       const cropSize = getParamValue('cropSize', node, tensorMap, context) as number[];
 *       const method = getParamValue('method', node, tensorMap, context) as string;
 *       const extrapolationValue = getParamValue('extrapolationValue', node, tensorMap, context) as number;
 *       return [tfOps.image.cropAndResize(image as Tensor4D, boxes as Tensor2D, boxInd as Tensor1D, cropSize as [number, number], method as 'bilinear' | 'nearest', extrapolationValue) as tf.Tensor];
 *     }
 *     default: throw TypeError(`Node type ${node.op} is not implemented`);
 *   }
 * };

export const CATEGORY = 'image';

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=============================================================================

```typescript
import {Tensor} from '@tensorflow/tfjs-core';
// tslint:disable-next-line: no-imports-from-dist
import * as tfOps from '@tensorflow/tfjs-core/dist/ops/ops_for_converter';

import {NamedTensorsMap} from 'data/types';
import {ExecutionContext} from 'executor/execution_context';
import {InternalOpExecutor, Node} from 'types';

import {getParamValue} from './utils';

export const executeOp: InternalOpExecutor =
  (node: Node, tensorMap: NamedTensorsMap,
   context: ExecutionContext): Tensor[] => {
    switch (node.op) {
      case 'Equal': {
        return [tfOps.equal(
          getParamValue('a', node, tensorMap, context) as Tensor,
          getParamValue('b', node, tensorMap, context) as Tensor)];
      }
      case 'NotEqual': {
        return [tfOps.notEqual(
          getParamValue('a', node, tensorMap, context) as Tensor,
          getParamValue('b', node, tensorMap, context) as Tensor)];
      }
      case 'Greater': {
        return [tfOps.greater(
          getParamValue('a', node, tensorMap, context) as Tensor,
          getParamValue('b', node, tensorMap, context) as Tensor)];
      }
      case 'GreaterEqual': {
        return [tfOps.greaterEqual(
          getParamValue('a', node, tensorMap, context) as Tensor,
          getParamValue('b', node, tensorMap, context) as Tensor)];
      }
      case 'Less': {
        return [tfOps.less(
          getParamValue('a', node, tensorMap, context) as Tensor,
          getParamValue('b', node, tensorMap, context) as Tensor)];
      }
      case 'LessEqual': {
        return [tfOps.lessEqual(
          getParamValue('a', node, tensorMap, context) as Tensor,
          getParamValue('b', node, tensorMap, context) as Tensor)];
      }
      case 'LogicalAnd': {
        return [tfOps.logicalAnd(
          getParamValue('a', node, tensorMap, context) as Tensor,
          getParamValue('b', node, tensorMap, context) as Tensor)];
      }
      case 'LogicalNot': {
        return [tfOps.logicalNot(
          getParamValue('a', node, tensorMap, context) as Tensor)];
      }
      case 'LogicalOr': {
        return [tfOps.logicalOr(
          getParamValue('a', node, tensorMap, context) as Tensor,
          getParamValue('b', node, tensorMap, context) as Tensor)];
      }
      case 'Select': {
        return [tfOps.where(
          getParamValue('condition', node, tensorMap, context) as Tensor,
          getParamValue('a', node, tensorMap, context) as Tensor,
          getParamValue('b', node, tensorMap, context) as Tensor)];
      }
      case 'SelectV2': {
        return [tfOps.where(
          getParamValue('condition', node, tensorMap, context) as Tensor,
          getParamValue('a', node, tensorMap, context) as Tensor,
          getParamValue('b', node, tensorMap, context) as Tensor)];
      }
      default:
        throw TypeError(`Node type ${node.op} is not implemented`);
    }
  }

export const CATEGORY = 'logical';
```
const isBiasAdd = extraOp === 'biasadd';
const isPrelu = activationFunc === 'prelu';
const numArgs = numArgs;
const leakyreluAlpha = leakyreluAlpha;
const numArgs = numArgs;
if (isBiasAdd) if (isPrelu & numArgs !== 2) throw new Error('Fused MatMul with BiasAdd and Prelu must have two extra arguments: bias and alpha.');
if (isBiasAdd) if (isPrelu & numArgs !== 1) throw new Error('Fused MatMul with BiasAdd must have one extra argument: bias.');
const biasArg, preluArg = getParamValue('args', node, tensorMap, context) as Tensor[];
return [tfOps.fused.matMul({ a: getParamValue('a', node, tensorMap, context) as Tensor2D,
b: getParamValue('b', node, tensorMap, context) as Tensor2D,
transposeA: getParamValue('transposeA', node, tensorMap, context) as boolean,
transposeB: getParamValue('transposeB', node, tensorMap, context) as boolean,
bias: biasArg, activation: activationFunc as tfOps.fused.Activation,
preluActivationWeights: preluArg, leakyreluAlpha })];

return [tfOps.fused.batchNorm(
getParamValue('x', node, tensorMap, context) as Tensor,
getParamValue('mean', node, tensorMap, context) as Tensor,
getParamValue('variance', node, tensorMap, context) as Tensor,
getParamValue('offset', node, tensorMap, context) as Tensor,
getParamValue('scale', node, tensorMap, context) as Tensor,
getParamValue('epsilon', node, tensorMap, context) as number) ];

return [tfOps.fused.batchNorm(
getParamValue('x', node, tensorMap, context) as Tensor,
getParamValue('mean', node, tensorMap, context) as Tensor,
getParamValue('variance', node, tensorMap, context) as Tensor,
getParamValue('offset', node, tensorMap, context) as Tensor,
getParamValue('scale', node, tensorMap, context) as Tensor,
getParamValue('eps', node, tensorMap, context) as number) ];

return [tfOps.fused.logSoftmax(
getParamValue('x', node, tensorMap, context) as Tensor,
getParamValue('beta', node, tensorMap, context) as number) ];

return [tfOps.fused.sparseToDense(
getParamValue('sparseIndices', node, tensorMap, context) as Tensor,
getParamValue('outputShape', node, tensorMap, context) as number[],
getParamValue('defaultValue', node, tensorMap, context) as number) ];

return [tfOps.fused.softmax(
getParamValue('x', node, tensorMap, context) as Tensor);]

return [tfOps.fused.logSoftmax(
getParamValue('x', node, tensorMap, context) as Tensor);]

return [tfOps.fused.sparseToDense(
getParamValue('sparseIndices', node, tensorMap, context) as number[]);]

return [tfOps.fused.softmax(
getParamValue('x', node, tensorMap, context) as Tensor);]

return [tfOps.fused.logSoftmax(
getParamValue('x', node, tensorMap, context) as Tensor);]

return [tfOps.fused.sparseToDense(
getParamValue('sparseIndices', node, tensorMap, context) as number[]);]

return [tfOps.fused.softmax(
getParamValue('x', node, tensorMap, context) as Tensor);]

return [tfOps.fused.logSoftmax(
getParamValue('x', node, tensorMap, context) as Tensor);]
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export const CATEGORY = 'normalization';

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 *
 *=============================================================================

import {Tensor, Tensor1D, Tensor2D} from '@tensorflow/tfjs-core';
import * as tfOps from '@tensorflow/tfjs-core/dist/ops/ops_for_converter';
import {NamedTensorsMap} from '../../data/types';
import {ExecutionContext} from '../../executor/execution_context';
import {InternalOpExecutor, Node} from '../types';
import {getParamValue} from './utils';

export const executeOp: InternalOpExecutor =
    (node: Node, tensorMap: NamedTensorsMap,
     context: ExecutionContext): Tensor[] => {
      switch (node.op) {
        case 'Max': {
          const axis =
              getParamValue('axis', node, tensorMap, context) as number;
          const keepDims =
              getParamValue('keepDims', node, tensorMap, context) as boolean;
          return [tfOps.max(
              getParamValue('x', node, tensorMap, context) as Tensor, axis,
              keepDims)
          ];
        }
        case 'Mean': {
          const axis =
              getParamValue('axis', node, tensorMap, context) as number;
          const keepDims =
              getParamValue('keepDims', node, tensorMap, context) as boolean;
          return [tfOps.mean(
              getParamValue('x', node, tensorMap, context) as Tensor, axis,
              keepDims)
          ];
        }
        case 'Min': {
          const axis =
              getParamValue('axis', node, tensorMap, context) as number;
          const keepDims =
              getParamValue('keepDims', node, tensorMap, context) as boolean;
          return [tfOps.min(
              getParamValue('x', node, tensorMap, context) as Tensor, axis,
              keepDims)
          ];
        }
        case 'Sum': {
          const axis =
              getParamValue('axis', node, tensorMap, context) as number;
          const keepDims =
              getParamValue('keepDims', node, tensorMap, context) as boolean;
          return [tfOps.sum(
              getParamValue('x', node, tensorMap, context) as Tensor, axis,
              keepDims)
          ];
        }
        case 'All': {
          const axis =
              getParamValue('axis', node, tensorMap, context) as number;
          const keepDims =
              getParamValue('keepDims', node, tensorMap, context) as boolean;
          return [tfOps.all(
              getParamValue('x', node, tensorMap, context) as Tensor, axis,
              keepDims)
          ];
        }
        case 'Any': {
          const axis =
              getParamValue('axis', node, tensorMap, context) as number;
          const keepDims =
              getParamValue('keepDims', node, tensorMap, context) as boolean;
          return [tfOps.any(
              getParamValue('x', node, tensorMap, context) as Tensor, axis,
              keepDims)
          ];
        }
        case 'ArgMax': {
          const axis =
              getParamValue('axis', node, tensorMap, context) as number;
          return [tfOps.argmax(
              getParamValue('x', node, tensorMap, context) as Tensor, axis)
          ];
        }
        case 'ArgMin': {
          const axis =
              getParamValue('axis', node, tensorMap, context) as number;
          return [tfOps.argmin(
              getParamValue('x', node, tensorMap, context) as Tensor, axis)
          ];
        }
        case 'Prod': {
          const axis =
              getParamValue('axis', node, tensorMap, context) as number;
          const keepDims =
              getParamValue('keepDims', node, tensorMap, context) as boolean;
          return [tfOps.prod(
              getParamValue('x', node, tensorMap, context) as Tensor, axis,
              keepDims)
          ];
        }
        case 'Cumsum': {
          const axis =
              getParamValue('axis', node, tensorMap, context) as number;
          const exclusive =
              getParamValue('exclusive', node, tensorMap, context) as boolean;
          return [tfOps.cumsum(
              getParamValue('x', node, tensorMap, context) as Tensor, axis,
              exclusive)
          ];
        }
        case 'Bincount': {
          const x = getParamValue('x', node, tensorMap, context) as Tensor1D;
          const weights =
              getParamValue('weights', node, tensorMap, context) as Tensor1D;
          const size =
              getParamValue('size', node, tensorMap, context) as number;
          return [tfOps.bincount(x, weights, size)
          ];
        }
        default:
          throw TypeError(`Node type ${node.op} is not implemented`);
      }
    };

=============================================================================
```javascript
tensorMap, context) as Tensor1D

const weights = getParamValue('weights', node, tensorMap, context) as Tensor2D

const size = getParamValue('size', node, tensorMap, context) as number

const binaryOutput = getParamValue('binaryOutput', node, tensorMap, context) as boolean

return [tfOps.denseBincount(x, weights, size, binaryOutput)]

default:
throw TypeError('Node type ' + node.op + ' is not implemented');

export const CATEGORY = 'reduction';

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 */

import {Scalar, Tensor, Tensor1D, tidy, util} from '@tensorflow/tfjs-core';
import * as tfOps from '@tensorflow/tfjs-core/dist/ops/ops_for_converter';
import {NamedTensorsMap} from '../../data/types';
import {ExecutionContext} from '../../executor/execution_context';
import {InternalOpExecutor, Node} from '../types';
import {getParamValue} from './utils';

export const executeOp: InternalOpExecutor =
    (node: Node, tensorMap: NamedTensorsMap,

context: ExecutionContext): Tensor[] => {
      switch (node.op) {
        case 'ConcatV2':
        case 'Concat': {

          const n = getParamValue('n', node, tensorMap, context) as number;

          const axis =

          getParamValue('axis', node, tensorMap, context) as number;

          let inputs =

          getParamValue('tensors', node, tensorMap, context) as Tensor[];

          inputs = inputs.slice(0, n);

          return [tfOps.concat(inputs, axis)];
        }
        case 'Gather': {
          const input = getParamValue('x', node, tensorMap, context) as Tensor;

          const indices =

          getParamValue('indices', node, tensorMap, context) as Tensor1D;

          return [tfOps.gather(input, tfOps.cast(indices, 'int32'), 0)];
        }
        case 'GatherV2': {
          const axis =

          getParamValue('axis', node, tensorMap, context) as number;

          const batchDims =

          getParamValue('batchDims', node, tensorMap, context) as number;

          const input = getParamValue('x', node, tensorMap, context) as Tensor;

          const indices =

          getParamValue('indices', node, tensorMap, context) as Tensor;

          return [tfOps.gather(input, tfOps.cast(indices, 'int32'), axis, batchDims)];
        }
        case 'Reverse': {

          const dims =

          getParamValue('dims', node, tensorMap, context) as boolean[];

          const axis = [ ];

          for (let i = 0; i < dims.length; i++) {
            if (dims[i]) {
              axis.push(i);
            }
          }

          const input = getParamValue('x', node, tensorMap, context) as Tensor;

          return [tfOps.reverse(input, axis)];
        }
        case 'StridedSlice': {

          const begin =

          getParamValue('begin', node, tensorMap, context) as number[];

          const end =

          getParamValue('end', node, tensorMap, context) as number[];

          const strides =

          getParamValue('strides', node, tensorMap, context) as number[];

          return [tfOps.stridedSlice(x, node, tensorMap, context) as Tensor, begin, end, strides, beginMask, endMask, ellipsisMask, newAxisMask];
        }
      }
    };

```
```typescript
import { tfOps, ... } from '@tensorflow/tfjs-core';
import { ExecutionContext } from '../../executor/execution_context';
import { InternalOpExecutor, ... } from '../../data/types';
import { getParamValue, ... } from './utils';

export const executeOp: InternalOpExecutor =
    (node: Node, tensorMap, context): Tensor[]} => {
        switch (node.op) {
            case 'FFT': {
                return tfOps.fft(getParamValue('x', node, tensorMap, context) as Tensor);
            }
            case 'IFFT': {
                return tfOps.ifft(getParamValue('x', node, tensorMap, context) as Tensor);
            }
            case 'RFFT': {
                return tfOps.rfft(getParamValue('x', node, tensorMap, context) as Tensor);
            }
            case 'IRFFT': {
                return tfOps.irfft(getParamValue('x', node, tensorMap, context) as Tensor);
            }
            default:
                throw TypeError(`Node type ${node.op} is not implemented`);
        }
    };

export const CATEGORY = 'fft';
```
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---

```javascript
import {Tensor, Tensor4D} from '@tensorflow/tfjs-core';
import * as tfOps from '@tensorflow/tfjs-core/dist/ops/ops_for_converter';
import {NamedTensorsMap} from '../../data/types';
import {ExecutionContext} from '../../executor/execution_context';
import {InternalOpExecutor, Node} from '../types';
import {getParamValue} from './utils';

export const executeOp: InternalOpExecutor =
    (node: Node, tensorMap: NamedTensorsMap,
     context: ExecutionContext): Tensor[] => {
      switch (node.op) {
        case 'Cast': {
          return [tfOps.cast(
              getParamValue('x', node,
                      tensorMap, context) as Tensor,
              getParamValue('dtype', node, tensorMap, context) as 'int32' |
                      'float32' | 'bool')];
        }
        case 'ExpandDims': {
          const axis =
              getParamValue('axis', node,
                        tensorMap, context) as number;
          return [tfOps.expandDims(
              getParamValue('x', node, tensorMap,
                        context) as Tensor, axis)];
        }
        case 'Squeeze': {
          const axis =
              getParamValue('axis', node,
                        tensorMap, context) as number[];
          return [tfOps.squeeze(
              getParamValue('x', node, tensorMap,
                        context) as Tensor, axis)];
        }
        case 'Reshape': {
          return [tfOps.reshape(
              getParamValue('x', node, tensorMap,
                        context) as Tensor,
              getParamValue('shape', node, tensorMap,
                        context) as number[])];
        }
        case 'MirrorPad': {
          return [tfOps.mirrorPad(
              getParamValue('x', node, tensorMap,
                        context) as Tensor,
              getParamValue('padding', node, tensorMap,
                        context) as Array<never, number>[],
              getParamValue('mode', node, tensorMap, context) as 'reflect' |
              'symmetric');
        }
        case 'PadV2': {
          return [tfOps.pad(
              getParamValue('x', node, tensorMap,
                        context) as Tensor,
              getParamValue('padding', node, tensorMap,
                        context) as Array<never, number>[],
              getParamValue('constantValue', node, tensorMap,
                        context) as never)];
        }
        case 'SpaceToBatchND': {
          const blockShape =
              getParamValue('blockShape', node, tensorMap, context) as number[];
          const paddings =
              getParamValue('paddings', node, tensorMap, context) as number[];
          return [tfOps.spaceToBatchND(
              getParamValue('x', node, tensorMap, context) as Tensor,
              blockShape, paddings)];
        }
        case 'BatchToSpaceND': {
          const blockShape =
              getParamValue('blockShape', node, tensorMap, context) as number[];
          const crops =
              getParamValue('crops', node, tensorMap, context) as number[];
          return [tfOps.batchToSpaceND(
              getParamValue('x', node, tensorMap, context) as Tensor,
              blockShape, crops)];
        }
        case 'DepthToSpace': {
          const blockSize =
              getParamValue('blockSize', node, tensorMap, context) as never;
          const dataFormat =
              getParamValue('dataFormat', node, tensorMap, context) as string;
          const NHWC =
              getParamValue('NHWC', node, tensorMap, context) as never;
          return [tfOps.depthToSpace(
              getParamValue('x', node, tensorMap, context) as Tensor,
              blockSize, dataFormat)];
        }
        case 'BroadcastTo': {
          return [tfOps.broadcastTo(
              getParamValue('x', node, tensorMap, context) as Tensor,
              getParamValue('shape', node, tensorMap, context) as number[])];
        }
        default:
          throw TypeError(`Node type ${node.op} is not implemented`);
      }
    };

export const CATEGORY = 'transformation';
```


import * as tfc from '@tensorflow/tfjs-core';

import {NamedTensorsMap} from '../data/types';
import {ExecutionContext} from '../executor/execution_context';
import {ResourceManager} from '../executor/resource_manager';

import {NodeValueImpl} from './custom_op/node_value_impl';
import {getRegisteredOp} from './custom_op/register';
import * as arithmetic from './executors/arithmetic_executor';
import * as basicMath from './executors/basic_math_executor';
import * as control from './executors/control_executor';
import * as convolution from './executors/convolution_executor';
import * as creation from './executors/creation_executor';
import * as dynamic from './executors/dynamic_executor';
import * as evaluation from './executors/evaluation_executor';
import * as graph from './executors/graph_executor';
import * as hashTable from './executors/hash_table_executor';
import * as image from './executors/image_executor';
import * as logical from './executors/logical_executor';
import * as matrices from './executors/matrices_executor';
import * as normalization from './executors/normalization_executor';
import * as sliceJoin from './executors/slice_join_executor';
import * as spectral from './executors/spectral_executor';
import * as transformation from './executors/transformation_executor';
import {Node} from './types';

/**
 * Executes the op defined by the node object.
 * @param node
 * @param tensorMap contains tensors for executed nodes and weights
 * @param context contains tensors and information for running the current node.
 * @param resourceManager Optional. Contains global resources of the model.
 */
export function executeOp(
    node: Node, tensorMap: NamedTensorsMap, context: ExecutionContext,
    resourceManager?: ResourceManager):
    tfc.Tensor[] | Promise<tfc.Tensor[]> {
  const value =
      ((node: Node, tensorMap: NamedTensorsMap, context:
        ExecutionContext) => {
        switch (node.category) {
          case 'arithmetic':
            return tfc.tidy(
                () => arithmetic.executeOp(node, tensorMap, context));
          case 'basic_math':
            return tfc.tidy(
                () => basicMath.executeOp(node, tensorMap, context));
          case 'control':
            return control.executeOp(node, tensorMap, context);
          case 'convolution':
            return tfc.tidy(
                () => convolution.executeOp(node, tensorMap, context));
          case 'creation':
            return creation.executeOp(node, tensorMap, context);
          case 'dynamic':
            return dynamic.executeOp(node, tensorMap, context);
          case 'evaluation':
            return tfc.tidy(
                () => evaluation.executeOp(node, tensorMap, context));
          case 'image':
            return tfc.tidy(() => image.executeOp(node, tensorMap, context));
          case 'graph':
            return tfc.tidy(() => graph.executeOp(node, tensorMap, context));
          case 'logical':
            return tfc.tidy(() => logical.executeOp(node, tensorMap, context));
          case 'matrices':
            return tfc.tidy(() => matrices.executeOp(node, tensorMap, context));
          case 'normalization':
            return tfc.tidy(() => normalization.executeOp(node, tensorMap, context));
          case 'reduction':
            return tfc.tidy(() => reduction.executeOp(node, tensorMap, context));
          case 'slice_join':
            return tfc.tidy(() => sliceJoin.executeOp(node, tensorMap, context));
          case 'spectral':
            return tfc.tidy(() => spectral.executeOp(node, tensorMap, context));
          case 'transformation':
            return tfc.tidy(() => transformation.executeOp(node, tensorMap, context));
          case 'hash_table':
            return tfc.tidy(() => hashTable.executeOp(node, tensorMap, context, resourceManager));
          const opMapper = getRegisteredOp(node.op);
          if (opMapper && opMapper.customExecutor) {
            return opMapper.customExecutor(
                new NodeValueImpl(node, tensorMap, context));
          } else {
            throw TypeError(`Custom op '${node.op}' is not registered.`);
          }
        }
      })(node, tensorMap, context);
  if (tfc.util.isPromise(value)) {
    return (value as Promise<tfc.Tensor>).then((data) => 
        data.concat());
  }
  return value.concat();
}

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 */

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https://github.com/tensorflow/tfjs-issues so we can add if`+n`, or register a custom execution with
tf.registerOp();

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---

import {Tensor} from '@tensorflow/tfjs-core';
import {NamedTensorsMap, TensorArrayMap, TensorListMap} from './data/types';
import {TensorArray} from './tensor_array';
import {TensorList} from './tensor_list';
import {FunctionExecutor} from './types';

export interface ExecutionContextInfo {
  id: number;
  name: string;
  frameName: string;
  iterationId: number;
}

/**
 *
 * ExecutionContext captures the runtime environment of the node. It keeps * track of the current frame and iteration
 * for the control flow ops. * For example, typical Dynamic RNN model may contain loops, for which the
 * TensorFlow will generate graphs with Enter/Exit nodes to control the * current execution frame, and NextIteration
 * Nodes for iteration id increment.
 * * Set the current context
 */
export class ExecutionContext {
  private rootContext = {id: 0, name: '', frameName: '', iterationId: 0};
  private contexts = [this.rootContext];
  private lastId = 0;

  constructor(
    readonly weightMap: NamedTensorsMap = {},
    readonly tensorArrayMap: TensorArrayMap = {},
    readonly tensorListMap: TensorListMap = {},
    readonly functionMap: {[key: string]: FunctionExecutor} = {},
  ) {
    this.generateCurrentContextIds();
  }

  private newFrame(id: number, frameName: string) {
    return {id, frameName, iterationId: 0};
  }

  /**
   * Set the current context
   *
   * @param contexts: ExecutionContextInfo[] the current path of execution
   */
  setCurrentContext(contexts: ExecutionContextInfo[]) {
    if (this.contexts !== contexts) {
      this.contexts = contexts;
      this.generateCurrentContextIds();
    }
  }

  get currentContext(): ExecutionContextInfo[] {
    return this.contexts;
  }

  /**
   * Returns the current context in string format.
   */
  get currentContextId(): string {
    return this._currentContextIds[0];
  }

  /**
   * Returns the current context and all parent contexts
   * in string format.
   * This allow access to the nodes in the current and parent frames.
   */
  get currentContextIds(): string[] {
    return this._currentContextIds;
  }

  private generateCurrentContextIds() {
    const names = [];
    for (let i = 0; i < this.contexts.length - 1; i++) {
      const contexts = this.contexts.slice(0, this.contexts.length - i);
      names.push(this.contextIdForContexts(contexts));
    }
    names.push('');
    this._currentContextIds = names;
  }

  private contextIdForContexts(contexts: ExecutionContextInfo[]) {
    return contexts ?
      contexts.map(context => (context.id === 0 && context.iterationId === 0) ? '' :
        `${context.frameName}-${context.iterationId}`)
      .join('/') :
      '';
  }

  /**
   * Enter a new frame, a new context is pushed on the current context list.
   */
  enterFrame(frameId: string) {
    if (this.contexts) {
      this.lastId++;
      this.contexts = this.contexts.slice();
      this.contexts.push(this.newFrame(this.lastId, frameId));
      this._currentContextIds.unshift(this.contextIdForContexts(this.contexts));
    }
  }

  /**
   * Exit the current frame, the last context is removed from the current
   */
  exitFrame() {
    if (this.contexts && this.contexts.length > 1) {
      this.contexts = this.contexts.slice();
      this.contexts.splice(-1);
      this.currentContextIds.shift();
    } else {
      throw new Error('Cannot exit frame, the context is empty');
    }
  }

  nextIteration() {
    if (this.contexts && this.contexts.length > 1) {
      this.contexts = this.contexts.slice();
      this.contexts.splice(1);
      this.contexts.shift();
    } else {
      throw new Error('Cannot increase frame iteration, the context is empty');
    }
  }

  getWeight(name: string): Tensor[] {
    return this.weightMap[name];
  }

  addTensorArray(tensorArray: TensorArray) {
    this.tensorArrayMap[tensorArray.id] = tensorArray;
  }

  getTensorArray(id: number): TensorArray {
    return this.tensorArrayMap[id];
  }

  addTensorList(tensorList: TensorList) {
    this.tensorListMap[tensorList.id] = tensorList;
  }

  getTensorList(id: number): TensorList {
    return this.tensorListMap[id];
  }

  dispose(keepIds: Set<number>) {
    for (const key in this.tensorArrayMap) {
      this.tensorArrayMap[key].dispose(keepIds);
    }
  }
}
Given graph inputs and desired outputs, find the minimal set of nodes to execute in order to compute the outputs. In addition return other useful info such:
- Whether the subgraph contains dynamic ops (control flow, dynamic shape).
- Alternative inputs in order to avoid async (dynamic op) execution.
- Missing inputs needed to compute the output.
- Whether the graph is a dead end since we already have their values. If a node isn't a dead end and it's one of the user-provided inputs, then it's a dead end since it's one of the user-provided inputs. If a node isn't a dead end and it doesn't have any inputs, then it's a dead end since it's one of the user-provided inputs. If a node isn't a dead end and it doesn't have any inputs, then it's a dead end since it's one of the user-provided inputs. If a node isn't a dead end and it doesn't have any inputs, then it's a dead end since it's one of the user-provided inputs.
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```javascript
'NonMaxSuppressionV3', 'NonMaxSuppressionV5', 'Where'

```

const HASH_TABLE_OPS = ['HashTable', 'HashTableV2', 'LookupTableImport', 'LookupTableImportV2', 'LookupTableFind', 'LookupTableFindV2']

```javascript
export function isControlFlow(node: Node) {
  return CONTROL_FLOW_OPS.indexOf(node.op) >= 0;
}

export function isDynamicShape(node: Node) {
  return DYNAMIC_SHAPE_OPS.indexOf(node.op) >= 0;
}

export function isHashTable(node: Node) {
  return HASH_TABLE_OPS.indexOf(node.op) >= 0;
}

```

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 * limitations under the License.
 *
 *=============================================================================

import {DataType, NamedTensorMap, Tensor, tidy, util} from '@tensorflow/tfjs-core';

import {ISignatureDef} from '../data/compiled_api';
import {NamedTensorsMap, TensorArrayMap, TensorInfo, TensorListMap} from '../data/types';
import {getNodeNameAndIndex, getParamValue, getTensor, getTensorsForCurrentContenxt, parseNodeName} from '../operations/executors/utils';
import {executeOp} from '../operations/operation_executor';
import {Graph, Node} from '../operations/types';

import {ExecutionContext, ExecutionContextInfo} from './execution_context';
import {getExecutionSubgraph, getNodesInTopologicalOrder, isControlFlow} from './model_analysis';
import {ResourceManager} from './resource_manager';
import {FunctionExecutor} from './types';

interface NodeWithContexts {
  contexts: ExecutionContextInfo[];
  node: Node;
}

export class GraphExecutor implements FunctionExecutor {
  private compiledMap: Map<string, Node>[] = new Map();
  private _weightMap: NamedTensorsMap = {};
  private _weightIds: number[] = [];
  private _signature: ISignatureDef;
  private _inputs: Node[] = [];
  private _outputs: Node[] = [];
  private _initNodes: Node[] = [];
  private SEPERATOR = ',';
  private _functions: {[key: string]: Graph} = {};
  private _functionExecutorMap: {[key: string]: FunctionExecutor} = {};
  private _resourceManager: ResourceManager;

  get weightIds(): number[] {
    return this.parent ? this.parent.weightIds : this._weightIds;
  }

  get functionExecutorMap(): {[key: string]: FunctionExecutor} {
    return this.parent ? this.parent.functionExecutorMap : this._functionExecutorMap;
  }

  get weightMap(): NamedTensorsMap {
    return this.parent ? this.parent.weightMap : this._weightMap;
  }

  set weightMap(weightMap: NamedTensorsMap) {
    const weightIds = Object.keys(weightMap).map(key =>
      weightMap[key].map(tensor => tensor.id));
    this._weightIds = [].concat(...weightIds);
    this._weightMap = weightMap;
  }

  /**
   *
   * @param graph Graph the model or function graph to be executed.
   * @param parent When building function exector you need to set the parent
   * executor. Since the weights and function executor maps are set at
   */

```
paragraph
  * level, that function executor can access the function maps and weight maps

  constructor(private graph: Graph, private parent?: GraphExecutor) {
    this.outputs = graph.outputs;
    this.paths = graph.paths;
    this.inputs = graph.inputs;
    this_initNodes = graph.initNodes;
    this_signature = graph.signature;
    this_functions = graph.functions;
    // create sub-graph executors
    if (graph.functions != null) {
      Object.keys(graph.functions).forEach(name => {
        this.functionExecutorMap[name] =
          new
          GraphExecutor(graph.functions[name], this);
      });
    }
    this._outputs = graph.outputs;
    this._inputs = graph.inputs;
    this._initNodes = graph.initNodes;
    this._signature = graph.signature;
    this._functions = graph.functions;
    // create sub-graph executors
    if (graph.functions != null) {
      Object.keys(graph.functions).forEach(name => {
        this.functionExecutorMap[name] =
          new
          GraphExecutor(graph.functions[name], this);
      });
    }
    this._initNodes = graph.initNodes;
    this._signature = graph.signature;
    this._functions = graph.functions;
    // create sub-graph executors
    if (graph.functions != null) {
      Object.keys(graph.functions).forEach(name => {
        this.functionExecutorMap[name] =
          new
          GraphExecutor(graph.functions[name], this);
      });
    }
  }

  private getCompilationKey(inputs: Node[],
    outputs: Node[]): string {
    const sortedInputs = inputs.map(node => node.name).sort();
    const sortedOutputs =
      outputs.map(node => node.name).sort();
    throw new Error('Cannot compute the outputs
    from the provided inputs
    ');
  }

  private compile(inputs: NamedTensorMap, outputs: Node[]): Node[] {
    const executionInfo =
      getExecutionSubgraph(inputs,
        outputs, this.weightMap, this._initNodes);
    const {missingInputs, dynamicNode, syncInputs} = executionInfo;
    if (dynamicNode != null) {
      throw new Error('This execution contains the node
      ');
    }
    if (missingInputs.length > 0) {
      throw new Error('Cannot compute the outputs
      from the provided inputs
      ');
    }
    return getNodesInTopologicalOrder(
      this.graph, this.weightMap, executionInfo);
  }

  execute(inputs: NamedTensorMap, outputs?: string[]):
    Tensor[] {
    inputs = this.mapInputs(inputs);
    Object.keys(inputs).sort();
    this.checkInputs(inputs);
    this.checkInputShapeAndType(inputs);
    outputs = this.mapOutputs(outputs);
    this.checkOutputs(outputs);
    const inputNodes =
      Object.keys(inputs).map(name => this.graph.nodes[
        parseNodeName(name)[0]
      ]); const outputNodeNames = outputs.map(name => parseNodeName(name)[0]);
    for (let i = 0; i <
      outputNodeNames.length; i++) {
      const node =
        this.graph.nodes[outputNodeNames[i]];
      if (node.name ==
        this.graph.nodes[outputNodeNames[i]].name) {
        const tensorsToKeep =
          this.getFrozenTensorIds(tensorsMap);
        const intermediateTensorConsumerCount: {
          key: number,
          number: number
        }[] = {}
        for (let i = 0; i <
          orderedNodes.length; i++) {
          const node = orderedNodes[i];
          if (node.name ==
            tensorsMap[node.name]) {
            const tensors =
              executeOp(node, tensorsMap, context,
                this._resourceManager) as
              Tensor[];
          }
        }
    }
  }

  private getFrozenTensorIds(tensorsMap: NamedTensorsMap): Set<number> {
    return new Set<number>[
      Object.keys(tensorsMap)
    ];
  }

  private executeOp(node, tensorsMap, context, this._resourceManager) as
    Tensor[] {
    if (util.isPromise(tensors)) {
      throw new Error('The execution of the op
      ');
    }
    return model.executeAsync() as
    Tensor[];
  }

  executeAsync(): Promise<
    NamedTensorMap> Set<number> {
    const ids = [
      Object.keys(tensorsMap)
    ];
  }

  execute(inputs: NamedTensorMap, outputs: Node[]):
    NamedTensorMap {
    inputs = this.mapInputs(inputs);
    Object.keys(inputs).sort();
    this.checkInputs(inputs);
    this.checkInputShapeAndType(inputs);
.map(key => tensorMap[key])\n .map(tensors => tensors.map(tensor => tensor.id));\n return new
 Set(ids);\n } \n private checkTensorForDisposal(nodeName: string, node: Node, tensorMap:\n NamedTensorsMap, context: ExecutionContext, tensorsToKeep: Set<number>,\n outputNames: string[][],\n intermediateTensorConsumerCount: {{[key: string; number]}}\n ) {\n // Skip output nodes and any control flow\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 != null) {\n const count =\n intermediateTensorConsumerCount[tensor.id];\n delete intermediateTensorConsumerCount[tensor.id];\n } else if (count != null) {\n only\n intermediate nodes have count set, inputs and weights are not.\n }\n }\n \n /**\n * Executes the inference for given input tensors in Async fashion.\n * @param inputs Tensor map for the model\n inputs, keyed by the input node\n * names.\n * @param outputs output node name from the Tensorflow\n model, if no outputs\n * are specified, the default outputs of the model would be used. You can\n * inspect\n intermediate nodes of the model by adding them to the outputs\n * array.\n * @param async executeAsync(inputs: NamedTensorMap,\n outputs?: string[]): Promise<Tensor[]>\n * return this._executeAsync(inputs, outputs);\n */\n \n async executeFunction(inputs: Tensor[], tensorArrayMap: TensorArrayMap,\n tensorListMap: TensorListMap): Promise<Tensor[]>\n {\n const tensorArrayMap = new TensorArrayMap();\n const tensorListMap = new TensorListMap();\n const keepIds = new Set<number>();\n const keys = Object.keys(inputs);\n inputs.forEach(key => {\n \n if (keepIds.has(key)) {\n keepIds.delete(key);\n }\n }\n \n async executeFunctionAsync(inputs: NamedTensorMap,\n outputs?: string[]): Promise<Tensor[]>\n * return this._executeAsync(inputs, outputs);\n */\n * @param inputs placeholder tensors for the graph.\n * @param context the execution

context object for current execution.

* @param outputNames Optional. output node name from the TensorFlow model.
* @param isFunctionExecution Flag for executing a function.
* @param inputs NamedTensorMap, context: ExecutionContext, outputNames?: string[]; isFunctionExecution?: boolean): Promise<NamedTensorsMap> {
  const names = Object.keys(inputs);
  const inputNodes = names.map(name =>
    this.graph.nodes[parseNodeName(name)[0]]);
  const outputNodeNames = outputNames.map(name =>
    parseNodeName(name)[0]);
  let outputNodes = outputNodeNames.map(name =>
    this.graph.nodes[name]);
  // If no outputs are specified, then use the default outputs of the model.
  if (outputNodes.length == 0) {
    outputNodes = this._outputs;
  }
  const {usedNodes, missingInputs, dynamicNode, syncInputs} =
    getExecutionSubgraph(inputs, outputNodes, this.weightMap, this._initNodes);
  // First nodes to execute include inputNodes, weights, and initNodes.
  const stack: NodeWithContexts[] = [
    ...inputNodes,
    ...this.graph.weights,
    ...(this._initNodes || [])
  ].map(node => {
    return {node, contexts: context.currentContext};
  });
  const tensorsMap: NamedTensorsMap = {...this.weightMap};
  Object.keys(inputs).forEach(name => {
    const [nodeName, index] = parseNodeName(name);
    const tensors: Tensor[] = [
      tensorsMap[nodeName];
    ];
    tensors[index] = inputs[name];
    tensorsMap[nodeName] = tensors;
  });
  const intermediateTensorConsumerCount: {
    [key: number]: number
  } = {};
  const tensorsToKeep =
    this.getFrozenTensorIds(tensorsMap);
  const added: {
    [key: string]: boolean
  } = {};
  while (stack.length > 0) {
    const promises = this.processStack(
      inputNodes, stack, context, tensorsMap, added, tensorsToKeep,
      outputNodeNames, intermediateTensorConsumerCount, usedNodes);
    await Promise.all(promises);
  }
  if (dynamicNode == null && !isFunctionExecution) {
    console.warn(`This model execution did not contain any nodes with control flow ` +
      `or dynamic output shapes. You can use model.execute()` +
      `instead.`);
  }
  const missingOutputs =
    outputNodes
      .filter(
        node => !isControlFlow(node) &&
            !getTensor(node.name, tensorsMap, context))
    .map(node =>
      `Cannot compute the outputs $[${missingOutputs}]` +
        `from the provided $[${names}]`. Consider providing the following inputs: ` +
      `$[${missingInputs}]`. Alternatively, to avoid the dynamic ops, use model.execute() ` +
      `and specify the inputs $[${syncInputs}]`;
    );
    throw new Error(`
      $[${missingOutputs}]` +
        `from the provided $[${names}]`. Consider providing the following inputs: ` +
      `$[${missingInputs}]`. Alternatively, to avoid the dynamic ops, use model.execute() ` +
      `and specify the inputs $[${syncInputs}]`;
    );
  }
  return tensorsMap;
}

private processStack(
  inputNodes: Node[], stack: NodeWithContexts[], context: ExecutionContext,
  tensorMap: NamedTensorsMap,
  added: {
    [key: string]: boolean
  },
  tensorsToKeep: Set<string>, outputNames: string[],
  intermediateTensorConsumerCount: {
    [key: number]: number
  },
  intermediateTensorConsumerCount: {
    [key: number]: number
  },
  usedNodes: Set<string>) {
  const promises: Array<Promise<Tensor[]>> = [
    // The tensor of the Enter op with isConstant set should be set in
    // the parent scope, so it will be available as constant for the
    // whole loop.
    if (item.node.op === 'Enter' &&
        getParamValue('isConstant', item.node, tensorMap, context)) {
      const nodeName = getTensorNameAndIndex(item.node.name, context);
      if (nombre) {
        const tensors =
          executeOp(item.node, tensorMap, context, this._resourceManager);
        if (node) {
          const tensors =
            executeOp(item.node, tensorMap, context, this._resourceManager);
        } else {
          const tensors =
            executeOp(item.node, tensorMap, context, this._resourceManager);
        }
      } else {
        const tensors =
          executeOp(item.node, tensorMap, context, this._resourceManager);
        if (node) {
          const tensors =
            executeOp(item.node, tensorMap, context, this._resourceManager);
        } else {
          const tensors =
            executeOp(item.node, tensorMap, context, this._resourceManager);
        }
      }
    }
  }
  return tensorsMap;
}
this.processChildNodes(item.node, stack, context, tensorMap, added, usedNodes);
return promises;
}

private processChildNodes(node: Node, stack, context, tensorMap, added, usedNodes: Set<string>) {
  node.children.forEach((childNode) => {
    const [nodeName, ] = getNodeNameAndIndex(childNode.name, context);
    if (added[nodeName] || !usedNodes.has(childNode.name)) {
      return;
    }
    // Merge op can be pushed if any of its inputs has value.
    if (childNode.op === 'Merge') {
      if (childNode.inputNames.some(name => {
        return !!getTensor(name, tensorMap, context);
      })) {
        added[nodeName] = true;
        stack.push({contexts: context.currentContext, node: childNode});
      }
    } else {
      // Otherwise all inputs must to have value.
      if (childNode.inputNames.every(name => {
        return !!getTensor(name, tensorMap, context);
      })) {
        added[nodeName] = true;
        stack.push({contexts: context.currentContext, node: childNode});
      }
    }
  });
}

/**
 * Releases the memory used by the weight tensors.
 */
dispose() {
  Object.keys(this.weightMap).
    .forEach(
      key => this.weightMap[key].forEach(tensor => tensor.dispose()));
}

private checkInputShapeAndType(inputs: NamedTensorMap) {
  Object.keys(inputs).forEach(name => {
    const input = inputs[name];
    const [nodeName, ] = parseNodeName(name);
    const node = this.graph.nodes[nodeName];
    if (node.attrParams['shape'] && node.attrParams['shape'].value) {
      const shape = node.attrParams['shape'].value as number[];
      const match = shape.length === input.shape.length &&
        input.shape.every((dim, index) =>
          shape[index] === -1 || shape[index] === dim);
      util.assert(match, () => `The shape of ` +
        `dict['${node.name}'] provided in ` +
        `model.execute(dict) must be [${shape}], but was ` +
        `[${input.shape}]);
    }
    if (node.attrParams['dtype'] && node.attrParams['dtype'].value) {
      util.assert(input.dtype === node.attrParams['dtype'].value as string,
        () => `The dtype of ` +
          `dict['${node.name}'] provided in ` +
          `model.execute(dict) must be ` +
          `${node.attrParams['dtype'].value}, but was ${input.dtype});
    }
  });
}

private mapInputs(inputs: NamedTensorMap) {
  const result: NamedTensorMap = {};
  for (const inputName in inputs) {
    if (this._signature != null && this._signature.inputs != null &&
      this._signature.inputs[inputName] != null) {
      const tensor = this._signature.inputs[inputName];
      result[tensor.name] = inputs[inputName];
    } else {
      result[inputName] = inputs[inputName];
    }
  }
  return result;
}

private checkInputs(inputs: NamedTensorMap) {
  const notInGraph = Object.keys(inputs).filter(name => {
    const [nodeName] = parseNodeName(name);
    return this.graph.nodes[nodeName] == null;
  });
  if (notInGraph.length > 0) {
    throw new Error(`The dict provided in model.execute(dict) has ` +
      `keys: [${notInGraph}] that are ` +
      `not part of graph`);}
}

private mapOutputs(outputs: string[]) {
  return outputs.map(name => {
    if (this._signature != null &
      & this._signature.outputs != null &
      & this._signature.outputs[name] != null) {
      const tensor = this._signature.outputs[name];
      return returnName;
    }
    const returnName = name;
    return returnName;
  }, {});
}

private checkOutputs(outputs: string[]): void {
  outputs.forEach(name => {
    const [normalizedName] = parseNodeName(name);
    if (this.graph.nodes[normalizedName]) {
      throw new Error(`The output ` +
        `S['${name}'] is not found in the graph`);}
  });
}

/*@
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 * limitations under the License.
 */
import {HashTableMap, NamedTensorMap} from '../data/types';
import {HashTable} from './hash_table';

/**
 * Contains global resources of a model.
 */
constructor(readonly hashTableNameToHandle: NamedTensorMap = {})
readonly hashTableMap: HashTableMap = {};

/*@
 * The `HashTable`
can be retrieved by `resourceManager.getHashTableById`
* where id is the table handle tensor's id.
* @param name Op node name that creates the 'HashTable'
* @param hashTable The 'HashTable' to be added to resource manager.
* *@/n
  addHashTable(name: string, hashTable: HashTable) {
    this.hashTableNameToHandle[name] = hashTable.handle;
    this.hashTableMap[hashTable.id] = hashTable;
  }

  getHashTableHandleByName(name: string) {
    return this.hashTableNameToHandle[name];
  }

  getHashTableById(id: number): HashTable {
    return this.hashTableMap[id];
  }

  dispose() {
    for (const key in this.hashTableMap) {
      this.hashTableMap[key].clearAndClose();
      delete this.hashTableMap[key];
    }

    for (const name in this.hashTableNameToHandle) {
      this.hashTableNameToHandle[name].dispose();
      delete this.hashTableNameToHandle[name];
    }
  }
}

import {InferenceModel, io, ModelPredictConfig, NamedTensorMap, Tensor} from '@tensorflow/tfjs-core';
import {NamedTensorsMap, TensorInfo} from '../data/types';
import {OperationMapper} from '../operations/operation_mapper';
import {GraphExecutor} from './graph_executor';
import {ResourceManager} from './resource_manager';

export const TFHUB_SEARCH_PARAM = '?tfjs-format=file';
export const DEFAULT_MODEL_NAME = 'model.json';

export class GraphModel implements InferenceModel {
  private executor: GraphExecutor;
  private version = 'n/a';
  private handler: io.IOHandler;
  private artifacts: io.ModelArtifacts;
  private initializer: GraphExecutor;

  private resourceManager: ResourceManager;
  private signature: tensorflow.ISignatureDef;

  get modelVersion(): string {
    return this.version;
  }

  get inputNodes(): string[] {
    return this.executor.inputNodes;
  }

  get outputNodes(): string[] {
    return this.executor.outputNodes;
  }

  get inputs(): TensorInfo[] {
    return this.executor.inputs;
  }

  get outputs(): TensorInfo[] {
    return this.executor.outputs;
  }

  get weights(): NamedTensorsMap {
    return this.executor.weightMap;
  }

  get metadata(): {} {
    return this.artifacts.userDefinedMetadata;
  }

  get modelSignature(): {} {
    return this.signature;
  }

  constructor(
      private modelUrl: string|io.IOHandler,
      private loadOptions: io.LoadOptions = {}) {
    if (loadOptions == null) {
      this.loadOptions = {};
    }
    this.resourceManager = new ResourceManager();
  }

  private findIOHandler() {
    const path = this.modelUrl;
    if ((path as io.IOHandler).load != null) {
      // Path is an IO Handler.
      this.handler = path as io.IOHandler;
    } else if (this.loadOptions.requestInit != null) {
      this.handler = io.browserHTTPRequest(path as string,
        this.loadOptions);
    } else {
      const handlers = io.getLoadHandlers(path as string,
        this.loadOptions);
      if (handlers.length === 0) {
        // For backward compatibility: if no load handler can be found,
        // assume it is...
a relative http path.

```javascript
handlers.push(io.browserHTTPRequest(path as string, this.loadOptions)); } else if (handlers.length > 1) { throw new Error(‘Found more than one (${handlers.length}) load handlers for `+` URL `$[{path}]`’); }
this.handler = handlers[0];

/**
 * Loads the model and weight files, construct the in memory weight map and
 * compile the inference graph.
 */
* async load(): Promise<boolean> {
  this.findIOHandler();

  if (this.handler.load == null) {
    throw new Error(‘Cannot proceed with model loading because the IOHandler provided `+` does not have the ‘load’ method implemented.’);
  }

  const artifacts = await this.handler.load();

  return this.loadSync(artifacts);
}

/**
 * Synchronously construct the in memory weight map and compile the inference graph. Also initialize hashtable if any.
 */
loadSync(artifacts: io.ModelArtifacts) {
  this.artifacts = artifacts;
  const graph = this.artifacts.modelTopology as tensorflow.IGraphDef;

  let signature;
  if (this.artifacts.userDefinedMetadata != null &&
      (this.artifacts.userDefinedMetadata as any).signature != null) {
    signature = (this.artifacts.userDefinedMetadata as any).signature as tensorflow.ISignatureDef;
  } else {
    signature = this.artifacts.signature;
  }

  this.version = `${graph.versions.producer}.${graph.versions.minConsumer}`;
  const weightMap = io.decodeWeights(this.artifacts.weightData, this.artifacts.weightSpecs);

  this.executor = new GraphExecutor(OperationMapper.Instance.transformGraph(graph, this.signature));

  this.executor.weightMap = this.convertTensorMapToTensorsMap(weightMap);
  this.executor.resourceManager = this.resourceManager;

  if (artifacts.modelInitializer != null &&
      (artifacts.modelInitializer as tensorflow.IGraphDef).node != null) {
    const initializer = OperationMapper.Instance.transformGraph(artifacts.modelInitializer);
    this.initializer = new GraphExecutor(initializer);
    this.initializer.weightMap = this.executor.weightMap;
    this.initializer.executeAsync({}, [
      this.initializer.executeAsync([], []);
    ])[0] = true;
  }

  return true;
}
handlerOrURL = handlers[0];
    } if (handlerOrURL.save == null) {
      throw new Error('GraphModel.save() cannot proceed because the IOHandler ' + 'provided does not have the `save` attribute defined. ');
    } return handlerOrURL.save(this.artifacts);
  }

  /**
   * Execute the inference for the input tensors.
   *
   * @param input The input tensors, when there is single input for the model,
   * it * inputs param should be a `tf.Tensor`. For models with multiple inputs,
   * it * inputs params should be in either `tf.Tensor[]` if the
   * input order isn't fixed, or otherwise NamedTensorMap format.
   *
   * For model with multiple inputs, we recommend you use NamedTensorMap as the
   * * input type, if you use `tf.Tensor[]`, the order of the array needs to
   * follow the order of inputNodes array. @see [@link GraphModel.inputNodes]
   *
   * You can also feed any intermediate nodes using the NamedTensorMap as the
   * * input type. For example, given the graph
   * Node => Intermediate => OutputNode * you can execute the subgraph Intermediate => OutputNode by
   *
   * * model.execute('IntermediateNode' : tf.tensor(...));
   *
   * This is useful for models that uses tf.dynamic_rnn, where the intermediate
   * state needs to be fed manually.
   *
   * For batch inference execution, the tensors for each input need to be
   * * concatenated together. For example with mobilenet, the required input shape
   * is [1, 244, 244, 3], which represents the [batch, height, width, channel].
   * If we are provide a batched data of 100 images, the input tensor should
   * in the shape of [100, 244, 244, 3].
   *
   * @param config Prediction configuration for specifying the batch size and
   * output node names. Currently the batch size option is ignored for graph
   * model.
   *
   * @returns Inference result tensors. The output would be
   * single `tf.Tensor` if model has single output node, otherwise Tensor[] or NamedTensorMap[] * will be
   * returned for model with multiple outputs.
   *
   * @doc {heading: 'Models', subheading: 'Classes'}
   */
  predict(inputs: Tensor|Tensor[], outputs?: string|undefined) {
    return this.execute(inputs, this.outputNodes);
  }

  private normalizeInputs(inputs: Tensor|Tensor[]) {
    if (!(inputs
      instanceof Tensor) && !Array.isArray(inputs)) {
      // The input is already a NamedTensorMap.
      return inputs;
    }
    inputs = Array.isArray(inputs) ? inputs : [inputs]
    if (inputs.length !== this.inputNodes.length) {
      throw new Error('Input tensor count mismatch,' + `the graph model has ${this.inputNodes.length} placeholders, ` + `while there are ${inputs.length} input tensors.`);
    }
    return this.inputNodes.reduce((map, inputName, i) => {
      map[inputName] = (inputs as Tensor[])[i];
      return map;
    }, {} as NamedTensorMap);
  }

  private execute(inputs: Tensor|Tensor[], outputs?: string|undefined) {
    inputs = this.normalizeInputs(inputs);
    outputs = this.normalizeOutputs(outputs);
    const result = this.executor.execute(inputs, outputs);
    return result.length > 1 ? result : result[0];
  }

  /**
   * Executes inference for the model for given input tensors.
   *
   * @param inputs tensor, tensor array or tensor map of the inputs for the
   * model, keyed by the input node names.
   *
   * @returns A single tensor if provided with a single output or no outputs
   * are provided and there is only one default output, otherwise return a
   * tensor array. The order of the tensor array is the same as the outputs
   * if provided, otherwise the order of outputNodes attribute of the model.
   *
   * @doc {heading: 'Models', subheading: 'Classes'}
   */
  async executeAsync(inputs: Tensor|Tensor[], outputs?: string|undefined) {
    inputs = this.normalizeInputs(inputs);
    outputs = this.normalizeOutputs(outputs);
    const result = await this.executor.executeAsync(inputs, outputs);
    return result.length > 1 ? result : result[0];
  }

  executeAsync(inputs: Tensor|Tensor[], outputs?: string|undefined) { // Async method is not defined in the code snippet.
    // Implementation for async execution is not provided in the code snippet.
    // Possible implementation:
    // return new Promise((resolve, reject) => {
    //   // Execute async operations here
    //   resolve(result);
    // });
  }

  // Additional methods and implementations for NamedTensorMap are not provided in the code snippet.

  // Constructor for NamedTensorMap
  constructor(inputNodes: string[], outputNodes: string[]) {
    this.inputNodes = inputNodes;
    this.outputNodes = outputNodes;
  }

  // Methods for NamedTensorMap
  // ...
this.executor.executeAsync(inputs, outputs);
    return result.length > 1 ? result[0] : null;
  }

  private convertTensorMapToTensorsMap(map: NamedTensorMap): NamedTensorsMap {
    return Object.keys(map).reduce((newMap: NamedTensorsMap, key) => {
      newMap[key] = [map[key]];
      return newMap;
    }, {});

  }

  /**
   * Releases the memory used by the weight tensors and resourceManager.
   * @doc {heading: 'Models', subheading: 'Classes'}
   */
  dispose() {
    this.executor.dispose();

    if (this.initializer) {
      this.initializer.dispose();
    }

    this.resourceManager.dispose();
  }
}

/**
 * Load a graph model given a URL to the model definition.
 * @param modelUrl The url or an 'io.IOHandler' that loads the model.
 * @param options Options for the HTTP request, which allows to send credentials and custom headers.
 * @param fromTFHub Whether the model URL is from a TF Hub.
 * @doc {heading: 'Models', subheading: 'Loading'}
 */
export async function loadGraphModel(
    modelUrl: string|io.IOHandler,
    options: io.LoadOptions = {}): Promise<GraphModel> {
  if (modelUrl == null) {
    throw new Error('modelUrl in loadGraphModel() cannot be null. Please provide a url or an IOHandler that loads the model.' +
        'You may obtain a copy of the License at http://www.apache.org/licenses/LICENSE-2.0
    * You may not use this file except in compliance with the License. You may obtain a copy of the License at
    * http://www.apache.org/licenses/LICENSE-2.0.
    * You may not use this file except in compliance with the License. You may obtain a copy of the License at
    * http://www.apache.org/licenses/LICENSE-2.0
    */
  const modelUrl = modelUrl + $\{DEFAULT_MODEL_NAME\}${TFHUB_SEARCH_PARAM};
  const model = await tf.loadGraphModel(modelUrl, options);
  return model;
}

export default {
  color,
  controllers,
  dom,
  gui,
  GUI
};

export default function(color, forceCSSHex) {
  const colorFormat = color.__state.conversionName.toString();

  const r = Math.round(color.r);
  const g = Math.round(color.g);
  const b = Math.round(color.b);
  const a = color.a;
  const h = Math.round(color.h);
  const s =}

---

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Open Source Used In Cisco Meeting Server (formerly Acano Server) 3.4 3960

```javascript
function(original) {
  const test = original.match(/\(\[A-F0-9]\)([A-F0-9]\](\[A-F0-9]\])\)/i);
  if (test === null) {
    return false;
  }
  return original;
}

function color(r, g, b) {
  return {
    r: r,
    g: g,
    b: b
  };
}

const interpret = function() {
  toReturn = false;
  const original = arguments.length > 1
    ? common.toArray(arguments) : arguments[0];
  common.each(INTERPRETATIONS, function(family) {
    if (toReturn === false && result !== false) {
      toReturn = result;
    }
    common.isNumber(original.v) {
      return {
        space: 'HSV',
        h: original.h,
        s: original.s,
        v: original.v
      };
    }
    return false;
  },

  write: function(color) {
    return {
      space: 'RGB',
      r: color.r,
      g: color.g,
      b: color.b
    };
  }
}

const HSVA_OBJ = {:
  read: function(original) {
    if (original.length !== 4) {
      return false;
    }
    return {
      space: 'HSV',
      r: original.r,
      g: original.g,
      b: original.b,
      a: original.a
    };
}

write: function(color) {
  return {
    space: 'HSV',
    h: color.h,
    v: color.v,
    a: color.a
  };
}

const SIX_CHAR_HEX = {:
  read: function(original) {
    return {
      space: 'HEX',
      hex: original
    };
  }
}

write: toString
}

CSS_RGBA: {:
  read: function(original) {
    const test = original.match(/\(\s*#([A-F0-9]{6})\s*\)/);
    if (test === null) {
      return false;
    }
    return {
      space: 'RGB',
      r: parseFloat(test[1]),
      g: parseFloat(test[2]),
      b: parseFloat(test[3]),
      a: parseFloat(test[4])
    };
  }
}

write: toString
}

CSS_RGB: {:
  read: function(original) {
    const test = original.match(/\(\s*([0-9]+)\s*,\s*([0-9]+)\s*,\s*([0-9]+)\s*\)/);
    if (test === null) {
      return false;
    }
    return {
      space: 'RGB',
      r: original.r,
      g: original.g,
      b: original.b
    };
  }
}

write: toString
}

HEX: {:
  read: function(original) {
    const test = original.match(/\(\s*([A-F0-9]+)\s*\)/);
    if (test === null) {
      return false;
    }
    return {
      space: 'HEX',
      hex: parseInt('0x' + test[1].toString(), 0)
    };
  }
}

write: toString
}

RGBA_OBJ: {:
  read: function(original) {
    if (original.length !== 4) {
      return false;
    }
    return {
      space: 'RGBA',
      r: original.r,
      g: original.g,
      b: original.b,
      a: original.a
    };
  }
}

write: toString
}

RGB_OBJ: {:
  read: function(original) {
    if (original.length !== 3) {
      return false;
    }
    return {
      space: 'RGB',
      r: original.r,
      g: original.g,
      b: original.b
    };
  }
}

write: toString
}

RGB_ARRAY: {:
  read: function(original) {
    if (original.length !== 4) {
      return false;
    }
    return {
      space: 'RGB',
      r: original.r,
      g: original.g,
      b: original.b,
      a: original.a
    };
  }
}

write: toString
}

RGBA_ARRAY: {:
  read: function(original) {
    if (original.length !== 3) {
      return false;
    }
    return {
      space: 'RGBA',
      r: original.r,
      g: original.g,
      b: original.b,
      a: original.a
    };
  }
}

write: toString
}

HSVA_OBJ: {:
  read: function(original) {
    if (original.isNumber(original.r) &&
      original.isNumber(original.g) &&
      original.isNumber(original.b) &&
      original.isNumber(original.a)) {
      return {
        space: 'HSV',
        h: original.h,
        v: original.v,
        a: original.a
      };
    }
    return false;
  }
}

write: function(color) {
  return {
    space: 'HSV',
    h: color.h,
    v: color.v,
    a: color.a
  };
}

HSV_OBJ: {:
  read: function(original) {
    if (original.isNumber(original.h) &&
      original.isNumber(original.s) &&
      original.isNumber(original.v) &&
      original.isNumber(original.a)) {
      return {
        space: 'HSV',
        h: original.h,
        s: original.s,
        v: original.v
      };
    }
    return false;
  }
}

write: function(color) {
  return {
    space: 'HSV',
    h: color.h,
    s: color.s,
    v: color.v
  };
}

(result = conversion.read(original));
if (toReturn !== false && result !== false) {
  toReturn = result;
```
Open Source Used in Cisco Meeting Server (formerly Acano Server) 3.4

```javascript
result.conversionName = conversionName;
result.conversion = conversion;
return common.BREAK;
}

function Color() {
  this.__state = interpret.apply(this, arguments);
  if (this.__state === false) {
    throw new Error('Failed to interpret color arguments');
  }
  this.__state.a = this.__state.a || 1;
}

function defineRGBComponent(target, component, componentHexIndex) {
  Object.defineProperty(target, component, {
    get: function() {
      if (this.__state.space === 'RGB') {
        return this.__state[component];
      }
      Color.recalculateRGB(this, component, componentHexIndex);
      return this.__state[component];
    },
    set: function(v) {
      if (this.__state.space !== 'RGB') {
        Color.recalculateRGB(this, component, componentHexIndex);
      }
      this.__state[component] = v;
    }
  });
}

function defineHSVComponent(target, component) {
  Object.defineProperty(target, component, {
    get: function() {
      if (this.__state.space === 'HSV') {
        return this.__state[component];
      }
      Color.recalculateHSV(this);
      return this.__state[component];
    },
    set: function(v) {
      if (this.__state.space !== 'HSV') {
        Color.recalculateHSV(this);
        this.__state.space = 'HSV';
      }
      this.__state[component] = v;
    }
  });
}

Color.recalculateRGB = function(color, component, componentHexIndex) {
  if (color.__state.space === 'HEX') {
    color.__state[component] = math.component_from_hex(color.__state.hex, componentHexIndex);
  } else if (color.__state.space === 'HSV') {
    common.extend(color.__state, math.hsv_to_rgb(color.__state.h, color.__state.s, color.__state.v));
  } else {
    throw new Error('Corrupted color state');
  }
}

Color.recalculateHSV = function(color) {
  const result = math.rgb_to_hsv(color.r, color.g, color.b);
  common.extend(color.__state, {
    s: result.s,
    v: result.v
  });
  if (!common.isNaN(result.h)) {
    color.__state.h = result.h;
  } else if (common.isUndefined(color.__state.h)) {
    color.__state.h = 0;
  }
}

Color.COMPONENTS = ['r', 'g', 'b', 'h', 's', 'v', 'hex', 'a'];
defineRGBComponent(Color.prototype, 'r');
defineRGBComponent(Color.prototype, 'g');
defineRGBComponent(Color.prototype, 'b');
defineRGBComponent(Color.prototype, 'h');
defineHSVComponent(Color.prototype, 's');
defineHSVComponent(Color.prototype, 'v');
defineRGBComponent(Color.prototype, 'a');
defineRGBComponent(Color.prototype, 'hex');
```

---

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Unless required by applicable law or agreed to in writing, software distributed under the License is distributed on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied. See the License for the specific language governing permissions and limitations under the License.
function(elem, hor, vert) {
  let vertical = vert;
  let horizontal = hor;
  if (common.isUndefined(horizontal)) {
    horizontal = true;
  }
  if (common.isUndefined(vertical)) {
    vertical = true;
  }
  elem.style.position = 'absolute';
  if (horizontal) {
    elem.style.left = 0;
    elem.style.right = 0;
  }
  if (vertical) {
    elem.style.top = 0;
    elem.style.bottom = 0;
  }
  common/***/
  @param eventType
  * @param params
  */
  fakeEvent: function(eventType, params, aux) {
    let horizontal = hor;
    let vertical = vert;

    if (common.isUndefined(horizontal)) {
      horizontal = true;
    }
    if (common.isUndefined(vertical)) {
      vertical = true;
    }
    elem.style.position = 'absolute';
    if (horizontal) {
      elem.style.left = 0;
      elem.style.right = 0;
    }
    if (vertical) {
      elem.style.top = 0;
      elem.style.bottom = 0;
    }
  },

  /**
   *
   * @param elem
   * @param eventType
   * @param params
   */
  fakeEvent: function(elem, eventType, pars, aux) {
    const
    params = pars || {};
    const className = EVENT_MAP_INV[eventType];
    if (!className) {
      throw new Error('Event type ' + eventType + ' not supported.');
    }
    const evt = document.createEvent(className);
    switch (className) {
      case 'MouseEvents':
        {
          const clientX = params.x || params.clientX || 0;
          const clientY = params.y || params.clientY || 0;
          evt.initMouseEvent(eventType, params.bubbles || false, params.cancelable || true, window,
            params.clientX, params.clientY, false, false, false, 0, null);
          break;
        }
      case 'KeyboardEvents':
        {
          const init = evt.initKeyboardEvent || evt.initKeyEvent; // webkit || moz
          common.defaults(params, {
            cancelable: true,
            ctrlKey: false,
            altKey: false,
            shiftKey: false,
            metaKey: false,
            keyCode: undefined,
            charCode: undefined
          });
          init(eventType, params.bubbles || false, params.cancelable, window,
            params.ctrlKey, params.altKey, params.metaKey, params.keyCode, params.charCode);
          break;
        }
      default:
        {
          evt.initEvent(eventType, params.bubbles || false, params.cancelable || true);
          break;
        }
    }
    elem.dispatchEvent(evt);
  },

  /**
   *
   * @param elem
   * @param event
   * @param func
   * @param bool
   */
  bind: function(elem, event, func, newBool) {
    const bool = newBool || false;
    if (elem.addEventListener) {
      elem.addEventListener(event, func, bool);
    } else if (elem.attachEvent) {
      elem.attachEvent('on' + event, func);
    }
    return dom;
  },

  /**
   *
   * @param elem
   * @param className
   */
  addClass: function(elem, className) {
    if (elem.className === undefined) {
      elem.className = className;
    } else if (elem.className !== className) {
      const classes = elem.className.split(/ +/);
      if (classes.indexOf(className) === -1) {
        classes.push(className);
        elem.className = classes.join(' ');
      }
    }
    return dom;
  },

  /**
   *
   * @param elem
   * @param className
   */
  removeClass: function(elem, className) {
    if (className) {
      if (elem.className === className) {
        elem.removeAttribute('class');
      } else {
        const classes = elem.className.split(/ +/);
        const index = classes.indexOf(className);
        if (index !== -1) {
          classes.splice(index, 1);
          elem.className = classes.join(' ');
        }
      }
    } else {
      elem.className = undefined;
    }
    return dom;
  },

  hasClass: function(elem, className) {
    return new RegExp('(?:^|\\s+)' + className + '(?:\\s+|$)').test(elem.className) || false;
  },

  /**
   *
   * @param elem
   */
  getWidth: function(elem) {
    const style = getComputedStyle(elem);
    return cssValueToPixels(style['border-left-width']) +
      cssValueToPixels(style['border-right-width']) +
      cssValueToPixels(style['padding-left']) +
      cssValueToPixels(style['padding-right']) +
      cssValueToPixels(style.width);
  },

  /**
   *
   * @param elem
   */
  getHeight: function(elem) {
    const style = getComputedStyle(elem);
    return cssValueToPixels(style['border-top-width']) +
      cssValueToPixels(style['border-bottom-width']) +
      cssValueToPixels(style['padding-top']) +
      cssValueToPixels(style['padding-bottom']) +
      cssValueToPixels(style.height);
  },

  /**
   *
   * @param elem
   */
  getOffset: function(elem) {
    let elem = elem;
    const offset = { left: 0, top: 0 };
    if (elem.offsetParent) {
      do {
        offset.left += elem.offsetLeft;
        offset.top += elem.offsetTop;
        elem = elem.offsetParent;
      } while (elem);
    }
    return offset;
  },

  isActive: function(elem) {
    return elem === document.activeElement && (elem.type || elem.href);
  }

};

export default dom;

/*
 * dat-gui JavaScript Controller Library
 * http://code.google.com/p/dat-gui
 *
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 */

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import Controller from './Controller';
import dom from '../dom/dom';

/**
 * @class Provides a checkbox input to alter the boolean property of an object.
 * @extends dat.controllers.Controller
 * @param {Object} object The object to be manipulated
 * @param {string} property The name of the property to be manipulated
 */

class BooleanController extends Controller {

  constructor(object, property) {
    super(object, property);
    const _this = this;
    this.__prev = this.getValue();

    this.__checkbox = document.createElement('input');
    this.__checkbox.setAttribute('type', 'checkbox');

    function onChange() {
      _this.setValue(!_this.__prev);
    }

    dom.bind(this.__checkbox, 'change', onChange);
    this.domElement.appendChild(this.__checkbox);

    // Match original value
    this.updateDisplay();
    }]]

    return super.updateDisplay();
  }

  setValue(v) {
    const toReturn = super.setValue(v);
    if (this.__onFinishChange) {
      this.__onFinishChange.call(this, this.getValue());
    }
    this.__prev = this.getValue();
    return toReturn;
  }

  updateDisplay() {
    if (this.getValue() === true) {
      this.__checkbox.setAttribute('checked', 'checked');
      this.__checkbox.checked = true;
    } else {
      this.__checkbox.checked = false;
    }

    return super.updateDisplay();
  }
}

export default BooleanController;

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import Controller from './Controller';
import dom from '../dom/dom';
import common from '../utils/common';

/**
 * @class Provides a select input to alter the property of an object, using a list of acceptable string values.
 * @extends dat.controllers.Controller
 * @param {Object} object The object to be manipulated
 * @param {string} property The name of the property to be manipulated
 * @param {Object|string[]} options A map of labels to acceptable values, or a list of acceptable string values.
 */

class OptionController extends Controller {

  constructor(object, property, opts) {
    super(object, property);
    let options = opts;
    const _this = this;

    /**
     * The drop down menu
     * @ignore
     */
    this.__select = document.createElement('select');

    if (common.isArray(options)) {
      const map = {};
      common.each(options, function(element) {
        map[element] = element;
      });
      options = map;
    }

    common.each(options, function(value, key) {
      const opt = document.createElement('option');
      opt.innerHTML = key;
      opt.setAttribute('value', value);
      _this.__select.appendChild(opt);
    });

    // Acknowledge original value
    this.updateDisplay();

    dom.bind(this.__select, 'change', function() {
      const desiredValue = this.options[this.selectedIndex].value;
      _this.setValue(desiredValue);
    });

    this.domElement.appendChild(this.__select);
  }

  setValue(v) {
    const toReturn = super.setValue(v);
    if (this.__onFinishChange) {
      this.__onFinishChange.call(this, this.getValue());
    }
    return toReturn;
  }

  updateDisplay() {
    if (dom.isActive(this.__select)) return this; // prevent number from updating if user is trying to manually update
    this.__select.value = this.getValue();
    return super.updateDisplay();
  }
}

export default OptionController;

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import Controller from './Controller';
import dom from '../dom/dom';

/**
 * @class Provides a text input to alter the string property of an object.
 * @extends dat.controllers.Controller
 * @param {Object} object The object to be manipulated
 * @param {string} property The name of the property to be manipulated
 */

class StringController extends Controller {

  constructor(object, property) {
    super(object, property);
    const _this = this;

    function onChange() {
      _this.setValue(_this.__input.value);
    }

    function onBlur() {
      if (_this.__onFinishChange) {
        _this.__onFinishChange.call(_this, _this.getValue());
      }
    }

    this.__input = document.createElement('input');
    this.__input.setAttribute('type', 'text');
    this.__input.setAttribute('value', _this.getValue());
    this.__input.onBlur = onBlur();

    this.domElement.appendChild(this.__input);

    // prevent number from updating if user is trying to manually update
    this.__input.value = this.getValue();
    return super.updateDisplay();
  }

  setValue(v) {
    const toReturn = super.setValue(v);
    if (this.__onFinishChange) {
      this.__onFinishChange.call(this, this.getValue());
    }
    return toReturn;
  }

  updateDisplay() {
    if (dom.isActive(this.__input)) return this; // prevent number from updating if user is trying to manually update
    this.__input.value = this.getValue();
    return super.updateDisplay();
  }
}

export default StringController;

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import Controller from './Controller';
import dom from '../dom/dom';

/**
 * @class Provides a text input to alter the string property of an object.
 * @extends dat.controllers.Controller
 * @param {Object} object The object to be manipulated
 * @param {string} property The name of the property to be manipulated
 */

class StringController extends Controller {

  constructor(object, property) {
    super(object, property);
    const _this = this;

    function onChange() {
      _this.setValue(_this.__input.value);
    }

    function onBlur() {
      if (_this.__onFinishChange) {
        _this.__onFinishChange.call(_this, _this.getValue());
      }
    }

    this.__input = document.createElement('input');
    this.__input.setAttribute('type', 'text');
    this.__input.onBlur = onBlur();

    this.domElement.appendChild(this.__input);

    // prevent number from updating if user is trying to manually update
    this.__input.value = this.getValue();
    return super.updateDisplay();
  }

  setValue(v) {
    const toReturn = super.setValue(v);
    if (this.__onFinishChange) {
      this.__onFinishChange.call(this, this.getValue());
    }
    return toReturn;
  }

  updateDisplay() {
    if (dom.isActive(this.__input)) return this; // prevent number from updating if user is trying to manually update
    this.__input.value = this.getValue();
    return super.updateDisplay();
  }
}

export default StringController;
```javascript
dom.bind(this.__input, 'keydown', function(e) {
  if (e.keyCode === 13) {
    this.blur();
  }
});

this.updateDisplay();
this.domElement.appendChild(this.__input);

this.domElement.appendChild(this.__input);

this.updateDisplay();

    this.domElement.appendChild(this.__input);
  }

  updateDisplay() {
    // Stops the caret from moving on account of:
    // keyup -> setValue -> updateDisplay
    if (!dom.isAlive(this.__input)) {
      this.__input.value = this.getValue();
    }
    return super.updateDisplay();
  }
}

export default
StringController;

/**
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 * http://code.google.com/p/dat-gui
 */

import Controller from './Controller';
import common from '../utils/common';

function numDecimals(x) {
  const _x = x.toString();
  if (_x.indexOf('.') > -1) {
    return _x.length - _x.indexOf('.') - 1;
  }

  return 0;
}

/**
 * @class
 * Represents a given property of an object that is a number.
 * @extends dat.controllers.Controller
 * @param {Object} object The object to be manipulated
 * @param {string} property The name of the property to be manipulated
 * @param {Object} [params] Optional parameters
 * @param {Number} [params.min] Minimum allowed value
 * @param {Number} [params.max] Maximum allowed value
 * @param {Number} [params.step] Increment by which to change value
 */
class NumberController extends Controller {
  constructor(object, property, params) {
    super(object, property);

    const _params = params || {};

    this.__min = _params.min;
    this.__max = _params.max;
    this.__step = _params.step;

    if (common.isUndefined(this.__step)) {
      if (this.initialValue === 0) {
        this.__impliedStep = 1; // What are we, psychics?
      } else {
        this.__impliedStep = Math.pow(10, Math.floor(Math.log(Math.abs(this.initialValue)) / Math.LN10) / 10);
      }
    } else {
      this.__impliedStep = this.__step;
    }

    this.__precision = numDecimals(this.__impliedStep);
  }

  setValue(v) {
    let _v = v;

    if (this.__min !== undefined && _v < this.__min) {
      _v = this.__min;
    } else if (this.__max !== undefined && _v > this.__max) {
      _v = this.__max;
    }

    if (this.__step !== undefined && _v % this.__step !== 0) {
      _v = Math.round(_v / this.__step) * this.__step;
    }

    return super.setValue(_v);
  }

  /**
   * Specify a minimum value for <code>object[property]</code>.
   * @param {Number} minValue The minimum value for
   * <code>object[property]</code>
   * @returns
   */
  min(minValue) {
    this.__min = minValue;
    return this;
  }

  /**
   * Specify a maximum value for <code>object[property]</code>.
   * @param {Number} maxValue The maximum value for
   * <code>object[property]</code>
   * @returns
   */
  max(maxValue) {
    this.__max = maxValue;
    return this;
  }

  /**
   * Specify a step value that dat.controllers.NumberController
   * increments by. @param {Number} stepValue The step value for
   * dat.controllers.NumberController
   * @default if minimum and maximum specified increment is 1% of the
   * difference otherwise stepValue is 1
   * @returns
   */
  step(stepValue) {
    this.__step = stepValue;
    this.__impliedStep = stepValue;
    this.__precision = numDecimals(stepValue);
    return this;
  }
}

export default NumberController;

/**
 * dat-gui JavaScript Controller Library
 * http://code.google.com/p/dat-gui
 */

import NumberController from './NumberController';
import dom from '../dom/dom';
import common from '../utils/common';

function roundToDecimal(value, decimals) {
  const tenTo = Math.pow(10, decimals);
  return Math.round(value * tenTo) / tenTo;
}

/**
 * @class
 * Represents a given property of an object that is a number.
 * @extends dat.controllers.Controller
 * @param {Object} object The object to be manipulated
 * @param {string} property The name of the property to be manipulated
 * @param {Object} [params] Optional parameters
 * @param {Number} [params.min] Minimum allowed value
 * @param {Number} [params.max] Maximum allowed value
 * @param {Number} [params.step] Increment by which to change value
 */
class NumberControllerBox extends NumberController {
  constructor(object, property, params) {
    super(object,
```
```javascript
property, params);

    this.__truncationSuspended = false;
    this.__input.value = '');

    this.__input.onblur = function() {
      this.__updateDisplay();
      this.__input.value = '');

    this.__input.onfocus = function() {
      this.__updateDisplay();
      this.__input.value = '');

    this.__input.onchange = function() {
      const attempted = parseFloat(this.__input.value);
      if (!common.isNaN(attempted)) {
        this.setValue(attempted);
      }

    this.__onFinishChange.call(this, this.getValue());

    this.__onBlur();

    function onChange() {
      const attempted = parseFloat(this.__input.value);
      if (!common.isNaN(attempted)) {
        this.setValue(attempted);
      }

    this.__onFinishChange.call(this, this.getValue());

    this.__onBlur();

    function onFinish() {
      if (this.__onFinishChange) {
        this.__onFinishChange.call(this, this.getValue());
      }

    this.__onBlur();

    function onDrag(e) {
      e.preventDefault();

      const diff = prevY - e.clientY;
      this.setValue(this.getValue() + diff * this.__impliedStep);

      prevY = e.clientY;
    }

    function onmouseup() {
      this.__input.blur();

      this.__onFinishChange.call(this, this.getValue());
    }

    this.updateDisplay();

    this.domElement.appendChild(this.__input);
  }

  updateDisplay() {
    this.__input.value = '');

    super.updateDisplay();
  }
}

export default NumberControllerBox;
```

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 *
 * http://www.apache.org/licenses/LICENSE-2.0
 */

import NumberController from './NumberController';
import dom from '../dom/dom';

function map(v, i1, i2, o1, o2) {
  return o1 + (o2 - o1) * ((v - i1) / (i2 - i1));
}

/**
 * @class Represents a given property of an object that is a number, contains
 * a minimum and maximum, and
 * provides a slider element with which to manipulate it. It should be noted that the slider element is made up of
 * &lt;div&gt; tags, <strong>not</strong> the html5
 * &lt;slider&gt; element.
 *
 * @extends dat.controllers.Controller
 * @extends dat.controllers.NumberController
 *
 * @param {Object} object The object to be manipulated
 * @param {string} property The name of the property to be manipulated
 *
 * @param {Number} minValue Minimum allowed value
 * @param {Number} maxValue Maximum allowed value
 * @param {Number} stepValue Increment by which to change value
 */
class NumberControllerSlider extends NumberController {
  constructor(object, property, min, max, step) {
    super(object, property, { min: min, max: max, step: step });

    this.__background = document.createElement('div');
    this.__foreground = document.createElement('div');

    dom.bind(this.__background, 'mousedown', onMouseDown);
    dom.bind(this.__foreground, 'mousedown', onMouseDown);

    function onMouseDown(e) {
      document.activeElement.blur();

      dom.bind(window, 'mousemove', onMouseDrag);
      dom.bind(window, 'mouseup', onMouseUp);

      onMouseDrag(e);
    }

    function onMouseDrag(e) {
      const diff = prevY - e.clientY;
      this.setValue(this.getValue() + diff * this.__impliedStep);

      prevY = e.clientY;
    }

    function onMouseUp() {
      dom.unbind(window, 'mousemove', onMouseDrag);
      dom.unbind(window, 'mouseup', onMouseUp);
      this.__onFinishChange.call(this, this.getValue());
    }

    function onTouchStart(e) {
      if (e.touches.length !== 1) { return; }
      dom.bind(window, 'touchmove', onTouchMove);
      dom.bind(window, 'touchend', onTouchEnd);
      onTouchMove(e);
    }

    function onTouchMove(e) {
      const clientX = e.touches[0].clientX;
      const rect = this.__background.getBoundingClientRect();

      this.setValue(map(clientX, rect.left, rect.right, this.__min, this.__max));

    this.__onFinishChange.call(this, this.getValue());
    }

    function onTouchEnd() {
      dom.unbind(window, 'touchmove', onTouchMove);
      dom.unbind(window, 'touchend', onTouchEnd);
    }

    this.updateDisplay();

    this.domElement.appendChild(this.__background);
    this.domElement.appendChild(this.__foreground);

    this.domElement.appendChild(this.__input);
  }

  updateDisplay() {
    this.__input.value = '');

    super.updateDisplay();
  }
}
this._foreground.style.width = pct * 100 + '%';
return super.updateDisplay();
}
}

export default NumberControllerSlider;

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 * http://www.apache.org/licenses/LICENSE-2.0
 */

import Controller from './Controller';
import dom from '../dom/dom';
import Color from '../color/Color';
import interpret from '../color/interpret';
import common from '../utils/common';

/**
 * @class Represents a given property of an object that is a color.
 * @param {Object} object
 * @param {string} property
 */
class ColorController extends Controller {
  constructor(object, property) {
    super(object, property);

    this.__color = new Color(this.getValue());
    this.__temp = new Color(0);

    const _this = this;

    this.domElement = document.createElement('div');

    dom.makeSelectable(this.domElement, false);

    this.__selector = document.createElement('div');
    this.__selector.className = 'selector';

    this.__saturation_field = document.createElement('div');
    this.__saturation_field.className = 'saturation-field';

    this.__field_knob = document.createElement('div');
    this.__field_knob.className = 'field-knob';
    this.__field_knob.style.border = '2px solid ' + (this.__color.v < 0.5 ? '#fff' : '#000');
    this.__field_knob.style.boxShadow = '0px 1px 3px rgba(0,0,0,0.5)';
    this.__field_knob.style.borderRadius = '12px';
    this.__field_knob.style.zIndex = 1;

    this.__hue_knob = document.createElement('div');
    this.__hue_knob.className = 'hue-knob';
    this.__hue_knob.style.position = 'absolute';
    this.__hue_knob.style.width = '15px';
    this.__hue_knob.style.height = '2px';
    this.__hue_knob.style.borderRight = '4px solid #fff';
    this.__hue_knob.style.zIndex = 1;

    this.__hue_field = document.createElement('div');
    this.__hue_field.className = 'hue-field';
    this.__hue_field.style.width = '100px';
    this.__hue_field.style.height = '100px';
    this.__hue_field.style.border = '1px solid #555';
    this.__hue_field.style.marginRight = '3px';
    this.__hue_field.style.display = 'inline-block';
    this.__hue_field.style.cursor = 'pointer';

    this.domElement.appendChild(this.__selector);
    this.domElement.appendChild(this.__field_knob);
    this.domElement.appendChild(this.__hue_knob);
    this.domElement.appendChild(this.__hue_field);
    this.domElement.appendChild(this.__saturation_field);
    this.domElement.appendChild(this.__input);
  }

  fire() {
    if (this.__onChange) {
      this.__onChange.call(this);
    }
    const color = this.getValue();
    if (this.__onFinishChange) {
      this.__onFinishChange.call(this, color);
    }
  }

  get value() {
    return this.__color.getRGB();
  }

  set value(color) {
    this.__color = interpret(color);
    this.updateDisplay();
  }

  updateDisplay() {
    const pct = (this.getValue() - this.__min) / (this.__max - this.__min);
    this.__foreground.style.width = pct * 100 + '%';
    return super.updateDisplay();
  }
}

export default ColorController;
this.__color.toString();

    common.extend(this.__input.style, {
      backgroundColor: this.__color.toHexString(),
      color: 'rgb(' + flip + ',' + flip + ',' + flip + ')',
      textShadow: this.__input_textShadow + 'rgba(' + _flip + ',' + _flip + ',' + _flip + ',.7)'
    });
  }
}

const vendors = ['-moz-', '-o-', '-webkit-', '-ms-'];

function linearGradient(elem, x, a, b) {
  elem.style.background = '';
  common.each(vendors, function(vendor) {
    elem.style.cssText += 'background: ' + vendor + 'linear-gradient(' + x + ', ' + a + ' 0%, ' + b + ' 100%); ';
  });
}

function hueGradient(elem) {
  elem.style.background = '';
  elem.style.cssText += 'background: -moz-linear-gradient(top,  #ff0000 0%, #ff00ff 17%, #0000ff 34%, #00ffff 50%, #00ff00 67%, #ffff00 84%, #ff0000 100%);';
  elem.style.cssText += 'background: -webkit-linear-gradient(top, #ff0000 0%,#ff00ff 17%,#0000ff 34%,#00ffff 50%,#00ff00 67%,#ffff00 84%,#ff0000 100%);';
}

export default ColorController;

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 *
 * http://www.apache.org/licenses/LICENSE-2.0
 */

const css = {
  load: function(url, indoc) {
    const doc = indoc || document;
    const link = doc.createElement('link');
    link.type = 'text/css';
    link.rel = 'stylesheet';
    link.href = url;
    doc.getElementsByTagName('head')[0].appendChild(link);
  },

  inject: function(cssContent, indoc) {
    const doc = indoc || document;
    const injected = document.createElement('style');
    injected.type = 'text/css';
    injected.innerHTML = cssContent;
    const head = doc.getElementsByTagName('head')[0];
    try {
      head.appendChild(injected);
    } catch (e) { // Unable to inject CSS, probably because of a Content Security Policy
    }
  }
};

export default css;

const saveDialogContents = `<div id="dg-save" class="dialogue">

  Here's the new load parameter for your <code>GUI</code>'s constructor:

  <textarea id="dg-new-constructor"></textarea>

  <div id="dg-save-locally">

    <input id="dg-local-storage" type="checkbox"/> Automatically save
    values to <code>localStorage</code> on exit.

    <div id="dg-local-explain">The values saved to <code>localStorage</code> will
      override those passed to <code>dat.GUI</code>'s constructor; you can override these saved values by
      passing different values to your <code>GUI</code>'s constructor. And, the values saved to
      <code>localStorage</code> will only be accessible to the <code>dat.GUI</code> that
      saved them. But, <code>localStorage</code> is fragile; your friends may not see the same values
      you do. So, you might want to consider saving only temporary values to <code>localStorage</code>.

    </div>

  </div>

</div>`;

export default saveDialogContents;

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 */

import OptionController from './OptionController';
import NumberControllerBox from './NumberControllerBox';
import NumberControllerSlider from './NumberControllerSlider';
import StringController from './StringController';
import FunctionController from './FunctionController';
import common from '../utils/common';

const ControllerFactory = function(object, property) {
  const initialValue = object[property];

  // Providing options?
  if (common.isArray(arguments[2]) || common.isObject(arguments[2])) {
    return new OptionController(object, property, arguments[2]);
  }

  // Providing a map?
  if (common.isNumber(initialValue)) {
    // Has min and max? (slider)
    if (common.isNumber(arguments[2]) && common.isNumber(arguments[3])) {
      // Has step?
      if (common.isNumber(arguments[4])) {
        return new NumberControllerSlider(object, property,
          arguments[2], arguments[3], arguments[4]);
      }

      return new NumberControllerSlider(object, property,
        arguments[2], arguments[3]);
    }

    // number box
    if (common.isNumber(arguments[4])) { // Has step
      return new NumberControllerBox(object, property,
    }

    return new NumberControllerBox(object, property,
  }

  if (common.isString(initialValue)) {
    return new StringController(object, property);
  }

  return new StringController(object, property);
};

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if (common.isFunction(initialValue)) {
  return new FunctionController(object, property, ");
}
if (common.isBoolean(initialValue)) {
  return new BooleanController(object, property);
}
return null;
}

export default ControllerFactory;

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 * http://www.apache.org/licenses/LICENSE-2.0
 */

function requestAnimationFrame(callback) {
  setTimeout(callback, 1000 / 60);
}

export default
window.requestAnimationFrame ||
    window.webkitRequestAnimationFrame ||
    window.mozRequestAnimationFrame ||
    window.oRequestAnimationFrame ||
    window.msRequestAnimationFrame ||
    requestAnimationFrame;

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 */

import dom from '../dom/dom';
import common from
'../utils/common';

class CenteredDiv {
  constructor() {
    this.backgroundElement =
document.createElement('div');
    common.extend(this.backgroundElement.style, {
      backgroundColor: 'rgba(0,0,0,0.8)',
      top: 0, left: 0, display: 'none',
      zIndex: '1001',
      opacity: 0,
      WebkitTransition: 'opacity 0.2s linear',
      transition: 'opacity 0.2s linear')
    }
    dom.makeFullscreen(this.backgroundElement);
    this.backgroundElement.style.position = 'fixed';
    this.domElement = document.createElement('div');
    common.extend(this.domElement.style, {
      position: 'fixed',
      display: 'none',
      zIndex: '1001',
      opacity: 0,
      WebkitTransition: '-webkit-transform 0.2s ease-out, opacity 0.2s linear',
      transition: 'transform 0.2s ease-out, opacity 0.2s linear'});
    document.body.appendChild(this.backgroundElement);
    document.body.appendChild(this.domElement);
    const _this = this;
    dom.bind(this.backgroundElement, 'click', function() {
      _this.hide();
    });

    this.domElement.style.display = 'block';
    this.domElement.style.opacity = 0;
    this.domElement.style.top = '52%';
    this.domElement.style.webkitTransform = 'scale(1.1)';
    this.layout();
    common.defer(function()
    { _this.backgroundElement.style.opacity = 1;
      _this.domElement.style.opacity = 1;
      _this.domElement.style.webkitTransform = 'scale(1)';
      _this.domElement.style.opacity = 1;
    });
    ** Hide centered div
    *An hide() { _this.domElement.style.opacity = 0;
      _this.domElement.style.display = 'none';
      dom.unbind(_this.domElement, 'webkitTransitionEnd',
      'transitionEnd', hide);
      dom.unbind(_this.domElement, 'transitionEnd', hide);
      dom.unbind(_this.domElement, 'oTransitionEnd', hide);
      dom.unbind(_this.domElement, 'oTransitionEnd', hide);
      dom.bind(_this.domElement, 'transitionEnd', hide);
    });
    dom.bind(_this.domElement.style.opacity = 0;
    this.domElement.style.opacity = 0;
    this.domElement.style.webkitTransform = 'scale(1.1)';
    this.layout();
    dom.bind(this.domElement.style.left = window.innerWidth / 2 - dom.getWidth(this.domElement) / 2 + 'px';
    this.domElement.style.top = window.innerHeight / 2 - dom.getHeight(this.domElement) / 2 + 'px';
    this.domElement.style.wi

    if (common.isFunction(initialValue)) {
      return new FunctionController(object, property, ");
    }
    if (common.isBoolean(initialValue)) {
      return new BooleanController(object, property);
    }
    return null;
  }

  return

  return

  return

  return null;
};

export default ControllerFactory;

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 */

function requestAnimationFrame(callback) {
  setTimeout(callback, 1000 / 60);
}

export default
window.requestAnimationFrame ||
    window.webkitRequestAnimationFrame ||
    window.mozRequestAnimationFrame ||
    window.oRequestAnimationFrame ||
    window.msRequestAnimationFrame ||
    requestAnimationFrame;

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 */

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import common from
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document.createElement('div');
    common.extend(this.backgroundElement.style, {
      backgroundColor: 'rgba(0,0,0,0.8)',
      top: 0, left: 0, display: 'none',
      zIndex: '1001',
      opacity: 0,
      WebkitTransition: 'opacity 0.2s linear',
      transition: 'opacity 0.2s linear')
    }
    dom.makeFullscreen(this.backgroundElement);
    this.backgroundElement.style.position = 'fixed';
    this.domElement = document.createElement('div');
    common.extend(this.domElement.style, {
      position: 'fixed',
      display: 'none',
      zIndex: '1001',
      opacity: 0,
      WebkitTransition: '-webkit-transform 0.2s ease-out, opacity 0.2s linear',
      transition: 'transform 0.2s ease-out, opacity 0.2s linear'});
    document.body.appendChild(this.backgroundElement);
    document.body.appendChild(this.domElement);
    const _this = this;
    dom.bind(this.backgroundElement, 'click', function() {
      _this.hide();
    });

    this.domElement.style.display = 'block';
    this.domElement.style.opacity = 0;
    this.domElement.style.top = '52%';
    this.domElement.style.webkitTransform = 'scale(1.1)';
    this.layout();
    common.defer(function()
    { _this.backgroundElement.style.opacity = 1;
      _this.domElement.style.opacity = 1;
      _this.domElement.style.webkitTransform = 'scale(1)';
      _this.domElement.style.opacity = 1;
    });
    ** Hide centered div
    *An hide() { _this.domElement.style.opacity = 0;
      _this.domElement.style.display = 'none';
      dom.unbind(_this.domElement, 'webkitTransitionEnd',
      'transitionEnd', hide);
      dom.unbind(_this.domElement, 'transitionEnd', hide);
      dom.unbind(_this.domElement, 'oTransitionEnd', hide);
      dom.unbind(_this.domElement, 'oTransitionEnd', hide);
      dom.bind(_this.domElement.style.opacity = 0;
    this.domElement.style.opacity = 0;
    this.domElement.style.webkitTransform = 'scale(1.1)';
    this.layout();
    dom.bind(this.domElement.style.left = window.innerWidth / 2 - dom.getWidth(this.domElement) / 2 + 'px';
    this.domElement.style.top = window.innerHeight / 2 - dom.getHeight(this.domElement) / 2 + 'px';
    this.domElement.style.wi
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```javascript
// DOM Importing
import dom from '../dom/dom';
import common from '../utils/common';

import styleSheet from './style.scss'; // CSS to embed in build

css.inject(styleSheet);

/** @ignore Outer-most className for GUI's */
const CSS_NAMESPACE = 'dg';

const HIDE_KEY_CODE = 72;

/** @ignore The only value shared between the JS and SCSS. Use caution. */
const CLOSE_BUTTON_HEIGHT = 20;

const DEFAULT_DEFAULT_PRESET_NAME = 'Default';

const SUPPORTS_LOCAL_STORAGE = (function() {
  try {
    return !!window.localStorage;
  } catch (e) {
    return false;
  }
}());

let SAVE_DIALOGUE;

/** @ignore Have we yet to create an autoPlace GUI? */
let autoPlaceVirgin = true;

/** @ignore Fixed position div that auto place GUI's go inside */
let autoPlaceContainer;

/** @ignore Are we hiding the GUI's? */
let hide = false;

/** @ignore GUI's which should be hidden */
const hideableGuis = [];

/**
 * @class A lightweight controller library for JavaScript. It allows you to easily
 * manipulate variables and fire functions on the fly.
 *
 * @example
 * // Creating a GUI with options.
 * var gui = new dat.GUI({name: 'My GUI'});
 *
 * @example
 * // Creating a GUI and a subfolder.
 * var gui = new dat.GUI();
 * var folder1 = gui.addFolder('Flow Field');
 *
 * @param {Object}
 * @param {String} name
 * @param {Object} load
 * @param {dat.gui.GUI} parent
 * @param {Boolean} autoPlace=true
 * @param {Boolean} hideable=true
 * @param {Boolean} closed=false
 * @param {Boolean} closeOnTop=false
 */
const GUI = function(pars) {
  const _this = this;

  let params = pars || {};

  /**
   * Outermost DOM Element
   *
   * @type {DOMElement}
   */
  this.domElement = document.createElement('div');
  this.__ul = document.createElement('ul');
  this.domElement.appendChild(this.__ul);

  dom.addClass(this.domElement, CSS_NAMESPACE);

  /**
   * Nested GUI's by name
   * @ignore
   */
  this.__folders = {};

  this.__controllers = [];

  /**
   * List of objects I'm remembering for save, only used in top level GUI
   * @ignore
   */
  this.__rememberedObjects = [];

  /**
   * Maps the index of remembered objects to a map of
   * controllers, only used in top level GUI.
   * @ignore
   */
  this.__rememberedObjectIndecesToControllers = {};

  this.__listening = [];

  // Default parameters
  params = common.defaults(params, {
    closeOnTop: false,
    autoPlace: true,
    width: 600
  });

  params = common.defaults(params, {
    resizable: params.autoPlace,
    hideable: params.autoPlace
  });

  if (!common.isUndefined(params.load)) {
    // Explicit preset
    if (params.preset) {
      params.load.preset = params.preset;
    }
  } else {
    params.load = { preset: DEFAULT_DEFAULT_PRESET_NAME }
  }

  if (common.isUndefined(params.parent) && params.hideable) {
    hideableGuis.push(this);
  }

  // Not part of params because I don't
  // want people passing this in via a constructor. Should be a 'remembered' value.
  let useLocalStorage = SUPPORTS_LOCAL_STORAGE &&
    localStorage.getItem(getLocalStorageHash(this, 'isLocal')) === 'true';

  let saveToLocalStorage;
  let titleRow;

  Object.defineProperties(this,
    /**
     * The parent <code>GUI</code>
     * @type dat.gui.GUI
     */
    {parent: {
      get: function() {
        return params.parent;
      },
    }},

    /**
     * Handles <code>GUI</code>'s element placement for you
     * @type Boolean
     */
    {autoPlace: {
      get: function() {
        return params.load.autoPlace;
      },
    }},

    /**
     * The identifier for a set of saved values
     * @type String
     */
    {preset: {
      get: function() {
        return params.load.preset;
      },
    }},

    /**
     * Only root level GUI's are resizable
     * @param {Boolean} resizable
     */
    {resizable: {
      get: function() {
        return params.load.resizable;
      },
    }},

    /**
     * Not part of params because I don't
     * want people passing this in via a function.
     * @type Boolean
     */
    {useLocalStorage: {
      get: function() {
        return useLocalStorage;
      },
    }},

    /**
     * Only root level GUI's are resizable
     * @param {Boolean} resizable
     */
    {resizable: {
      get: function() {
        return params.load.resizable;
      },
    }},

    /**
     * Not part of params because I don't
     * want people passing this in via a function.
     * @type Boolean
     */
    {useLocalStorage: {
      get: function() {
        return useLocalStorage;
      },
    }}
  )
```

---

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'.//dom/CenteredDiv';

```javascript
import dom from '../dom/dom';
import common from '../utils/common';

import styleSheet from './style.scss'; // CSS to embed in build

css.inject(styleSheet);

/** @ignore Outer-most className for GUI's */
const CSS_NAMESPACE = 'dg';

const HIDE_KEY_CODE = 72;

/** @ignore The only value shared between the JS and SCSS. Use caution. */
const CLOSE_BUTTON_HEIGHT = 20;

const DEFAULT_DEFAULT_PRESET_NAME = 'Default';

const SUPPORTS_LOCAL_STORAGE = (function() {
  try {
    return !!window.localStorage;
  } catch (e) {
    return false;
  }
}());

let SAVE_DIALOGUE;

/** @ignore Have we yet to create an autoPlace GUI? */
let autoPlaceVirgin = true;

/** @ignore Fixed position div that auto place GUI's go inside */
let autoPlaceContainer;

/** @ignore Are we hiding the GUI's? */
let hide = false;

/** @ignore GUI's which should be hidden */
const hideableGuis = [];

/**
 * @class A lightweight controller library for JavaScript. It allows you to easily
 * manipulate variables and fire functions on the fly.
 *
 * @example
 * // Creating a GUI with options.
 * var gui = new dat.GUI({name: 'My GUI'});
 *
 * @example
 * // Creating a GUI and a subfolder.
 * var gui = new dat.GUI();
 * var folder1 = gui.addFolder('Flow Field');
 *
 * @param {Object}
 * @param {String} name
 * @param {Object} load
 * @param {dat.gui.GUI} parent
 * @param {Boolean} autoPlace=true
 * @param {Boolean} hideable=true
 * @param {Boolean} closed=false
 * @param {Boolean} closeOnTop=false
 */
const GUI = function(pars) {
  const _this = this;

  let params = pars || {};

  /**
   * Outermost DOM Element
   *
   * @type {DOMElement}
   */
  this.domElement = document.createElement('div');
  this.__ul = document.createElement('ul');
  this.domElement.appendChild(this.__ul);

  dom.addClass(this.domElement, CSS_NAMESPACE);

  /**
   * Nested GUI's by name
   * @ignore
   */
  this.__folders = {};

  this.__controllers = [];

  /**
   * List of objects I'm remembering for save, only used in top level GUI
   * @ignore
   */
  this.__rememberedObjects = [];

  /**
   * Maps the index of remembered objects to a map of
   * controllers, only used in top level GUI.
   * @ignore
   */
  this.__rememberedObjectIndecesToControllers = {};

  this.__listening = [];

  // Default parameters
  params = common.defaults(params, {
    closeOnTop: false,
    autoPlace: true,
    width: 600
  });

  params = common.defaults(params, {
    resizable: params.autoPlace,
    hideable: params.autoPlace
  });

  if (!common.isUndefined(params.load)) {
    // Explicit preset
    if (params.preset) {
      params.load.preset = params.preset;
    }
  } else {
    params.load = { preset: DEFAULT_DEFAULT_PRESET_NAME }
  }

  if (common.isUndefined(params.parent) && params.hideable) {
    hideableGuis.push(this);
  }

  // Not part of params because I don't
  // want people passing this in via a function.
  let useLocalStorage = SUPPORTS_LOCAL_STORAGE &&
    localStorage.getItem(getLocalStorageHash(this, 'isLocal')) === 'true';

  let saveToLocalStorage;
  let titleRow;

  Object.defineProperties(this,
    /**
     * The parent <code>GUI</code>
     * @type dat.gui.GUI
     */
    {parent: {
      get: function() {
        return params.parent;
      },
    }},

    /**
     * Handles <code>GUI</code>'s element placement for you
     * @type Boolean
     */
    {autoPlace: {
      get: function() {
        return params.load.autoPlace;
      },
    }},

    /**
     * Only root level GUI's are resizable
     * @param {Boolean} resizable
     */
    {resizable: {
      get: function() {
        return params.load.resizable;
      },
    }},

    /**
     * Not part of params because I don't
     * want people passing this in via a function.
     * @type Boolean
     */
    {useLocalStorage: {
      get: function() {
        return useLocalStorage;
      },
    }}
  )
```
params.load.preset = v;

    setPresetSelectIndex(this);
    _this.revert();
  }
}

/**
   * The width of <code>GUI</code> element
   * @type Number
   */
  width: {
    get: function() {
      return params.width;
    },
    set: function(v) {
      params.width = v;
     setWidth(_this, v);
    }
  },

  /**
   * The name of <code>GUI</code>. Used for folders. i.e. 
   * a folder's name
   * @type String
   * @name: 
   * @get: function()
   * @return return.params.name
   */
  name: {
    get: function() {
      return params.name;
    },
    set: function(v) {
      // TODO Check for collisions among sibling folders
      params.name = v;
      if (titleRow) {
        titleRow.innerHTML = params.name;
      }
    }
  },

  /**
   * Whether the <code>GUI</code> is collapsed or not
   * @type Boolean
   */
  closed: {
    get: function() {
      return params.closed;
    },
    set: function(v) {
      params.closed = v;
      if (params.closed) {
        dom.addClass(_this.__ul, GUI.CLASS_CLOSED);
      } else {
        dom.removeClass(_this.__ul, GUI.CLASS_CLOSED);
      }
    }
  },

  /**
   * Contains all presets
   * @type Object
   */
  load: {
    get: function() {
      return params.load;
    }
  },

  /**
   * Determines whether or not to use 
   * @a href="https://developer.mozilla.org/en/DOM/Storage#localStorage">localStorage</a> as
   * the means for
   * @type Boolean
   */
  useLocalStorage: {
    get: function() {
      return useLocalStorage;
    },
    set: function(bool) {
      if (SUPPORTS_LOCAL_STORAGE) {
        useLocalStorage = bool;
        if (bool) {
          dom.bind(window, 'unload', saveToLocalStorage);
        } else {
          dom.unbind(window, 'unload', saveToLocalStorage);
        }
        localStorage.setItem(getLocalStorageHash(_this, 'isLocal'), bool);
      }
    }
  }

  // Are we a root level GUI?
  if (common.isUndefined(params.parent)) {
    this.closed = params.closed || false;
    dom.addClass(this.domElement, GUI.CLASS_MAIN);
    dom.makeSelectable(this.domElement, false);
    // Are we supposed to be loading locally?
    if (SUPPORTS_LOCAL_STORAGE) {
      if (useLocalStorage) {
        _this.useLocalStorage = true;
        const savedGui = localStorage.getItem(getLocalStorageHash(_this, 'gui'));
        if (savedGui) {
          params.load = JSON.parse(savedGui);
        }
      }
    }
    this.__closeButton = document.createElement('div);
    this.__closeButton.innerHTML = GUI.TEXT_CLOSED;
    dom.addClass(this.__closeButton, GUI.CLASS_CLOSE_BUTTON);
    if (params.closeOnTop) {
      dom.addClass(this.__closeButton, GUI.CLASS_CLOSE_TOP);
      this.domElement.insertBefore(this.__closeButton, this.domElement.childNodes[0]);
    } else {
      dom.addClass(this.__closeButton, GUI.CLASS_CLOSE_BOTTOM);
      this.domElement.appendChild(this.__closeButton);
    }
    dom.bind(this.__closeButton, 'click', function() {
      _this.closed = !_this.closed;
    });
  } else {
    if (params.closed === undefined) {
      params.closed = true;
    }
    const titleRowName = document.createTextNode(params.name);
    dom.addClass(titleRowName, 'controller-name');
    titleRow = addRow(_this, titleRowName);
    const onClickTitle = function(e) {
      e.preventDefault();
      _this.closed = !_this.closed;
      return false;
    };
    dom.addClass(titleRow, 'title');
    dom.bind(titleRow, 'click', onClickTitle);
    if (!params.closed) {
      this.closed = false;
    }
    if (params.load) {
      _this.load = params.load;
    }
    dom.bind(titleRow, 'click', onClickTitle);
    if (!params.autoPlace) {
      if (autoPlaceVirgin) {
        autoPlaceContainer = document.createElement('div');
        dom.addClass(titleRowName, 'controller-name');
        titleRow = addRow(_this, titleRowName);
        const onClickTitle = function(e) {
          e.preventDefault();
          _this.closed = !_this.closed;
        };
        dom.addClass(titleRow, 'title');
        dom.bind(titleRow, 'click', onClickTitle);
        if (!params.autoPlace) {
          if (autoPlaceVirgin) {
            autoPlaceContainer = document.createElement('div');
            dom.addClass(autoPlaceContainer, CSS_NAMESPACE);
            dom.addClass(autoPlaceContainer, GUI.CLASS_AUTO_PLACE_CONTAINER);
            document.body.appendChild(autoPlaceContainer);
            autoPlaceVirgin = false;
          } else {
            // Put it in the dom for you.
            autoPlaceContainer.appendChild(this.domElement);
            // Apply the auto styles
            dom.addClass(this.domElement, GUI.CLASS_AUTO_PLACE);
          } // Make it not elastic.
        } else {
          if (autoPlaceVirgin) {
            autoPlaceContainer = document.createElement('div');
            dom.addClass(autoPlaceContainer, CSS_NAMESPACE);
            dom.addClass(autoPlaceContainer, GUI.CLASS_AUTO_PLACE_CONTAINER);
            document.body.appendChild(autoPlaceContainer);
          } // Make it not elastic.
        }
      }
    }
  }
  if (params.autoPlace) {
    if (common.isUndefined(params.parent)) {
      if (autoPlaceVirgin) {
        autoPlaceContainer = document.createElement('div');
        dom.addClass(autoPlaceContainer, CSS_NAMESPACE);
        dom.addClass(autoPlaceContainer, GUI.CLASS_AUTO_PLACE_CONTAINER);
        document.body.appendChild(autoPlaceContainer);
      }
    }
We need to pass down the autoPlace trait so that we can attach event listeners to open/close folder actions to ensure that a scrollbar appears if the window is too short.

Do we have saved appearance data for this folder?

Were we loaded?

Was my parent a dead-end?

Did daddy remember me?

Start me closed if I was closed

Pass down the loaded data

We need to pass down the autoPlace trait so that we can attach event listeners to open/close folder actions to ensure that a scrollbar appears if the window is too short.

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We need to pass down the autoPlace trait so that we can attach event listeners to open/close folder actions to ensure that a scrollbar appears if the window is too short.
this.load.remembered = {};

this.load.remembered[this.preset] = getCurrentPreset(this);

markPresetsModified(this, false);

function(presetName) {
  if (!this.load.remembered) {
    // Retain default values upon first save
    this.load.remembered = {};
    this.load.remembered[DEFAULT_DEFAULT_PRESET_NAME] = getCurrentPreset(this);
  }

  this.preset = presetName;
  addPresetOption(this, presetName, true);
  this.saveToLocalStorageIfPossible();
}

markPresetModified(this.getRoot(), false);

this.saveAs(folder.getFolderName, function() {
  this.markPresetsModified();
  this.saveToLocalStorageIfPossible();
}, this)

this.revert: function(gui) {
  common.each(this.__controllers, function(controller) {
    if (!gui) {
      // Make revert work on Default
      if (!this.getRoot().load.remembered) {
        controller.setValue(controller.initialValue);
      } else {
        recallSavedValue(gui || this.getRoot(), controller);
      }
    } else {
      recallSavedValue(gui, controller); // fire onFinishChange callback
    }
  }, this);
}

listen: function(controller) {
  const init = this.__listening.length === 0;

  this.__listening.push(controller);

  if (init) {
    updateDisplays(this.__listening);
  }
}

updateDisplay: function() {
  common.each(this.__controllers, function(controller) {
    controller.updateDisplay();
  });

  common.each(this.__folders, function(folder) {
    folder.updateDisplay();
  });
}

/**
 * Add a row to the end of the GUI or before another row.
 *
 * @param gui
 * @param [newDom] If specified, inserts the dom content in the new row
 * @param [liBefore] If specified, places the new row before another row
 *
 * @ignore
 */
function addRow(gui, newDom, liBefore) {
  const li = document.createElement('li');

  if (newDom) {
    li.appendChild(newDom);
  }

  if (liBefore) {
    gui.__ul.insertBefore(li, liBefore);
  } else {
    gui.__ul.appendChild(li);
  }

  gui.onResize();
  return li;
}

function removeListeners(gui) {
  dom.unbind(window, 'resize', gui.__resizeHandler);

  if (gui.saveToLocalStorageIfPossible) {
    dom.unbind(window, 'unload', gui.saveToLocalStorageIfPossible);
  }
}

function markPresetModified(gui, modified) {
  const opt = gui.__preset_select[gui.__preset_select.selectedIndex];

  if (modified) {
    opt.innerHTML = opt.value + '*';
  } else {
    opt.innerHTML = opt.value;
  }
}

function augmentController(gui, li, controller) {
  controller.__li = li;
  controller.__gui = gui;

  common.extend(controller.prototype, {options: function(options) {
    if (arguments.length > 1) {
      const nextSibling = controller.__li.nextElementSibling;
      controller.remove();

      return add(
        gui,
        controller.object,
        controller.property,
        {
          before: nextSibling,
          factoryArgs: [common.toArray(arguments)]
        }
      );
    } else if (common.isArray(options) || common.isObject(options)) {
      const nextSibling = controller.__li.nextElementSibling;
      controller.remove();

      return add(
        gui,
        controller.object,
        controller.property,
        {
          before: nextSibling,
          factoryArgs: [options]
        }
      );
    } else {
      * Sets the name of the controller
      * Sets controller to listen for changes on its underlying object
      * Removes the controller from its parent GUI
      controller.remove();
    }
  }}

  // All sliders should be accompanied by a box.
  if (controller instanceof NumberControllerSlider) {
    const box = new NumberControllerBox(controller.object, controller.property,
      { min: controller.__min, max: controller.__max, step: controller.__step });

      function(method) {
      const pc = controller[method];
      const pb = box[method];

      controller[method] = function() {
        const args = Array.prototype.slice.call(arguments);
        pb.apply(box, args);
        pc.apply(controller, args);
      }
    });

    dom.addClass(li, ‘has-slider’);
    controller.domElement.insertBefore(box.domElement, controller.domElement.firstElementChild);
  } else if (controller instanceof NumberControllerBox) {
    const r = function(returned) { // Have we defined both
boundaries?
if (common.isNumber(controller.__min) && common.isNumber(controller.__max)) {
  // Well, then let's just replace this with a slider.
  // let's remember if the old controller had a specific name or
  // was listening
  const oldName = controller.__li.firstElementChild.firstElementChild.innerHTML;
  const wasListening = controller.__gui.__listening.indexOf(controller) > -1;
  controller.remove();
  const newController = add(gui, controller.object, controller.property, { 
    // before: controller.__li.nextElementSibling,
    factoryArgs: [controller.__min, controller.__max, controller.__step]
  });
  newController.name(oldName);
  return newController;
} else if (controller instanceof BooleanController) {
  dom.bind(li, 'click', function() {
    dom.fakeEvent(controller.__checkbox, 'click');
  });
  dom.bind(controller.__checkbox, 'click', function(e) {
    e.stopPropagation(); // Prevents double-toggle
  });
} else if (controller instanceof FunctionController) {
  dom.bind(li, 'click', function() {
    dom.fakeEvent(controller.__button, 'click');
  });
  dom.bind(li, 'mouseover', function() {
    dom.addClass(controller.__button, 'hover');
  });
  dom.bind(li, 'mouseout', function() {
    dom.removeClass(controller.__button, 'hover');
  });
} else if (controller instanceof ColorController) {
  dom.addClass(li, 'color');
  controller.updateDisplay = common.compose(function(val) {
    li.style.borderLeftColor = controller.__color.toString();
    return val;
  }, controller.updateDisplay);
  controller.updateDisplay();
}
controller.setValue = common.compose(function(val) {
  if (gui.getRoot().__preset_select && controller.isModified()) {
    markPresetModified(gui.getRoot(), true);
  }
  return val;
}, controller.setValue);

function recallSavedValue(gui, controller) {
  // Find the topmost GUI, that's where remembered objects live.
  const root = gui.getRoot();
  // Does the object we're
  // controlling match anything we've been told to remember?
  const matchedIndex = root.__rememberedObjects.indexOf(controller.object);
  // Why yes, it does! If (matchedIndex !== -1) {
    // Let me fetch a map of controllers for this object:
    let controllerMap = root.__rememberedObjectIndecesToControllers[matchedIndex];
    // Ohp, I believe this is the first controller
    // we've created for this object. Let's make the map fresh.
    if (controllerMap === undefined) {
      controllerMap = {};
      root.__rememberedObjectIndecesToControllers[matchedIndex] = controllerMap;
      // Keep track of this controller
      controllerMap[controller.property] = controller;
      // Okay, now have we saved any values for this controller?
      if (root.load && root.load.remembered) {
        const presetMap = root.load.remembered;
        // Which preset are we trying to load?
        let preset = presetMap[gui.preset];
        // Did the loaded object remember the
        // value of this property for this guy ...
        // const value = preset[matchedIndex][controller.property];
        // And that's what it is.
        const initialValue = value;
        controller.setVal(value);
      }
    } else if (presetsMap[DEFAULT_DEFAULT_PRESET_NAME]) {
      // Uh, you can have the default instead?
      preset = presetsMap[DEFAULT_DEFAULT_PRESET_NAME];
      // Nada, return;
    }
    // Did the loaded object remember the
    // value of this property for this guy ...
    // const value = preset[matchedIndex][controller.property];
    // And that's what it is.
    const initialValue = value;
    controller.setVal(value);
  }
  // Did the loaded object remember the
  // value of this property for this guy ...
  // const value = preset[matchedIndex][controller.property];
  // And that's what it is.
  const initialValue = value;
  controller.setVal(value);
}

function add(gui, object, property, params) {
  if (object[property] === undefined) {
    throw new Error(`Object "${object}" has no property "${property}"`);
  }
  let controller;
  if (params.color) {
    controller = new ColorController(object, property);
  } else {
    const factoryArgs = [object, property].concat(params.factoryArgs);
    controller = ControllerFactory.apply(gui, factoryArgs);
  }
  if (params.before instanceof Controller) {
    params.before = params.before.__li;
  }
  recallSavedValue(gui, controller);
  dom.addClass(controller.domElement, 'c');
  const name = document.createElement('span');
  dom.addClass(name, 'property-name');
  name.innerHTML = controller.property;
  const container = document.createElement('div');
  container.appendChild(name);
  container.appendChild(controller.domElement);
  const li = addRow(gui, container, params.before);
  dom.addClass(li, GUI.CLASS_CONTROLLER_ROW);
  if (controller instanceof ColorController) {
    dom.addClass(li, 'color');
  } else {
    dom.addClass(li, typeof controller.getValue());
  }
}
augmentController(gui, li, controller);
  gui.__controllers.push(controller);
  return controller;
}

function getLocalStorageHash(gui, key) {
  const opt = document.createElement('option');
  opt.innerHTML = name;
  opt.value = name;
  gui.__preset_select.appendChild(opt);
  if (setSelected) {
    gui.__preset_select.selectedIndex = gui.__preset_select.selectedIndex - 1;
  }
  return gui.useLocalStorage ? 'block' : 'none';
}

function addPresetOption(gui, name, setSelected) {
  const opt = document.createElement('option');
  opt.innerHTML = name;
  opt.value = name;
  gui.__preset_select.appendChild(opt);
  if (setSelected) {
    gui.__preset_select.selectedIndex = gui.__preset_select.length - 1;
  }
}

function showHideExplain(gui, explain) {
  explain.style.display = gui.useLocalStorage ? 'block' : 'none';
}

function addSaveMenu(gui) {
  const div = gui.__save_row = document.createElement('li');
  dom.addClass(gui.domElement, 'has-save');
  gui.__ul.insertBefore(div, gui.__ul.firstChild);
  dom.addClass(div, 'save-row');
  const gears = document.createElement('span');
  gears.innerHTML = ' ';
  dom.addClass(gears, 'button gears');
  const button = document.createElement('span');
  button.innerHTML = 'Save';
  dom.addClass(button, 'button save');
  const button2 = document.createElement('span');
  button2.innerHTML = 'New';
  dom.addClass(button2, 'save-as');
  const button3 = document.createElement('span');
  button3.innerHTML = 'Revert';
  dom.addClass(button3, 'button revert');
  dom.bind(button2, 'click', function() {
    const presetName = prompt('Enter a new preset name.');
    if (presetName) {
      gui.saveAs(presetName);
    }
  });
  dom.bind(button3, 'click', function() {
    gui.revert();
  });
  dom.bind(gears, 'click', function() {
    newConstructorTextArea.innerHTML = JSON.stringify(gui.getSaveObject(), undefined, 2);
    SAVE_DIALOGUE.show();
    newConstructorTextArea.focus();
    newConstructorTextArea.select();
  });
  div.appendChild(button);
  div.appendChild(button2);
  div.appendChild(button3);
  gui.domElement.insertBefore(div, gui.domElement.firstElementChild);
  gui.domElement.style.width = w + 'px';
}

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have to
// set the width manually if we want it to bleed to the edge
if (gui.__save_row & gui.autoPlace) {
  gui.__save_row.style.width = w + 'px';
} else if (gui.__closeButton) {
  gui.__closeButton.style.width = w + 'px';
}

function getCurrentPreset(gui, useInitialValues) {
  const toReturn = {};

  common.each(gui.__rememberedObjects, function(val, index) {
    const savedValues = {};

    const controllerMap =
      gui.__rememberedObjectIndicesToControllers[index];

    common.each(controllerMap, function(controller, property) {
      savedValues[property] = useInitialValues ? controller.initialValue : controller.getValue();
    });

    toReturn[index] = savedValues;
  });

  return toReturn;
}

function setPresetSelectIndex(gui) {
  for (let index = 0; index < gui.__preset_select.length; index++) {
    if (gui.__preset_select[index].value === gui.preset) {
      gui.__preset_select.selectedIndex = index;
    }
  }
}

function updateDisplays(controllerArray) {
  if (controllerArray.length !== 0) {
    requestAnimationFrame.call(window, function() {
      updateDisplays(controllerArray);
    });
  }

  common.each(controllerArray, function(c) {
    c.updateDisplay();
  });
}

export default GUI;

// stats.js -
http://github.com/mrdoob/stats.js
(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();
u(++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,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/1048576,d.jsHeapSizeLimit/1048576)}}};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);
b.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=.9;b.fillRect(0,0,h,w);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+w-
   a,a,p);b.fillStyle=l;b.globalAlpha=0;b.fillRect((d+n-a,a,g(1-h/w)*p)));}
function r,f:";++*n *license
* Copyright 2019 Google LLC. All Rights Reserved.
* Licensed under the Apache License, Version 2.0 (the
* "License"); you may not use this file except in compliance with the License.
* You may obtain a copy of the License at
* http://www.apache.org/licenses/LICENSE-2.0
* Unless required by applicable law or agreed to in writing, software
* distributed under the License is distributed on an "AS IS" BASIS,
* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
* See the License for the specific language governing permissions and
* limitations under the License.
* IMPORTANT:

*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 " 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 + \" \\n\")})
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.sigmoid(),sigmoid(),offsets:o.squeeze(),displacementFwd:s.squeeze(),displacementBwd:a.squeeze()}}),e.prototype.dispose
        =function(){this.model.dispose()},e.prototype.dequeue=function(){var e=+this.priorityQueue[0];return this.exchange(0,this.priorityQueue--)}
}(),
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.priorityQueue--),this.priorityQueue[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+11)&&&ttt, 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 r=this.priorityQueue[e];this.priorityQueue[e]=this.priorityQueue[t],this.priorityQueue[t]=r}
}();
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","rightAnkle"],NUM_KEYPOINTS=partNames.length,
partIds=partNames.reduce(function(e,t,r){return e[t]=r,e},{}),connectedPartNames=["leftHip","leftShoulder","leftElbow","leftWrist","leftHip","leftKnee","leftAnkle"],
partChannels=["left_face","right_face","right_upper_leg_front","right_lower_leg_front","left_upper_leg_front","left_lower_leg_front","right_upper_leg_back","right_lower_leg_back","left_upper_leg_back","left_lower_leg_back","right_upper_arm_front","right_upper_arm_back","right_lower_arm_front","right_lower_arm_back","left_upper_arm_front","left_upper_arm_back","left_lower_arm_front","left_lower_arm_back","right_hand","right_lower_arm_front","left_hand"],
POSE_CHANNELS=["left_face","right_face","left_upper_face","left_lower_face","right_upper_face","right_lower_face","left_upper_body","left_lower_body","right_upper_body","right_lower_body","left_hand","right_hand","left_elbow","left_upper_elbow","right_upper_elbow","right_lower_elbow","left_knee","right_knee","left_upper_knee","right_upper_knee","left_ankle","right_ankle","left_upper_ankle","right_upper_ankle","left_upper_arm","right_upper_arm","left_lower_arm","right_lower_arm","left_upper_leg","right_upper_leg","left_lower_leg","right_lower_leg"],
function getOffsetPoint(e,t,r){var y:n.get(e,t,x:n.get(e,t+NUM_KEYPOINTS))
  return getImageCoords(e,t,r)
t=getBoundingBox(e),r=t.minX,n=t.minY,o=t.maxX,i=t.maxY:return [[x,r,y:a],[x,o,y:i],[x,o,y:i]]
function toTensorBuffer(e){return void 0==&e(?="float32",_await(e,void 0,0,0,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,2),r)]})})function toTensorBuffers3D(e){return _await(e,void 0,0,0,function(){var r=return _generator(this,function(t){return 2,Promise.all(e.map(function(e){return
TensorBuffer(e,"float32")}}))})function scalePose(e,r,n){return void 0===n&&o(0),score:e.score,kepoints:e.keypoints.map(function(e){var i=e.score,s=e.part,as=e.position;return {score:i,part:s,position:{x:a.x+r+o.y:y*t+n}}})})function scalePoses(e,r,n){return score:e.score,part:e.keypoints.map(function(e){var r=n.score,kepoints:n.keypoints.map(function(e){var r=n.score,kepoints:n.keypoints.map(function(e){var r=n.score,kepoints:n.keypoints.map(function(e){var r=n.score,kepoints:n.keypoints.map(function(e){var r=n.score,kepoints:n.keypoints.map(function(e){var i=e.score,s=e.part,as=e.position;return {score:i,part:s,position:{x:a.x+r+o.y:y*t+n}}})})function scalePoses(e,r,n){return score:e.score,part:e.keypoints.map(function(e){var r=n.score,kepoints:n.keypoints.map(function(e){var i=e.score,s=e.part,as=e.position;return {score:i,part:s,position:{x:a.x+r+o.y:y*t+n}}})})function scalePoses(e,r,n){return score:e.score,part:e.keypoints.map(function(e){var r=n.score,kepoints:n.keypoints.map(function(e){var i=e.score,s=e.part,as=e.position;return {score:i,part:s,position:{x:a.x+r+o.y:y*t+n}}})})function scalePoses(e,r,n){return score:e.score,part:e.keypoints.map(function(e){var r=n.score,kepoints:n.keypoints.map(function(e){var i=e.score,s=e.part,as=e.position;return {score:i,part:s,position:{x:a.x+r+o.y:y*t+n}}})})function scalePoses(e,r,n){return score:e.score,part:e.keypoints.map(function(e){var r=n.score,kepoints:n.keypoints.map(function(e){var i=e.score,s=e.part,as=e.position;return {score:i,part:s,position:{x:a.x+r+o.y:y*t+n}}})})function flipHorizontal(e,t){return{score:e.score,part:e.keypoints.map(function(e){var r=e.score,n=e.part,o=e.position;return{score:r,part:o,position:{x:t-1-o.x,y:o.x*t+n}}})})function flipPosesHorizontal(e,t){return t<0?e.map(function(e){return flipHorizontal(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}}})function scaleAndFlipPoses(e,t,r,n,o){return void 0===n&&(n=0),void 0===o&&(o=0),{score:e.score,part:e.keypoints.map(function(e){var i=e.score,s=e.part,as=e.position;return{score:i,part:s,position:{x:a.x*r+o.y:y*t+n}}})})function flipHorizontal(e,t){return{score:e.score,part:e.keypoints.map(function(e){var r=e.score,n=e.part,o=e.position;return{score:r,part:o,position:{x:t-1-o.x,y:o.x*t+n}}})})function flipPosesHorizontal(e,t){return t<=0?e:e.map(function(e){return flipHorizontal(e,t)})})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++)n[o]=e.get(o,r,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){return tidy(function(){var n=getOffsetVectors(e,t);return e.toTensor().mul(scalar(t,"int32"))),e.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 p.sent(),s=n.o,i=1,a=2[4,2,4,2],toTensorBuffer(l=toGetOffsets(l,u,a))]);case 2:return p.sent(),c=Array.from(getPointsConfidence(s,u)),d=toMap(function(e,t){return n++=e,[position:{y:f.get(t,0),x:f.get(t,1)}],partNames[t],score:e.function()});o.dispose(),l.dispose(),[2,[keypoints,d.score:n/d.length]])}])var MOBILENET_BASE_URL="https://storage.googleapis.com/tfjs-models/savedmodel/mobilenetv/"RESNET50_BASE_URL="https://storage.googleapis.com/tfjs-models/savedmodel/savedmodel/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[r]+"/"+o:MOBILENET_BASE_URL+"quant"+"+"+n[r]+"/"+o}function toFloatIfInt$1(e){return tidy(function(){"int32"===e.dtype&&(e=e.toFloat());var r=toTensorBuffer(e),t=toTensorBuffer(t),o=toTensorBuffer(o,"int32"));case 1:return n=0,o=argmax2d(e).[4,Promise.all([toTensorBuffer(e),toTensorBuffer(t),toTensorBuffer(o,"int32")])];case 1:return p.sent(),s=n.o,i=1,a=2[4,2,4,2],toTensorBuffer(l=toGetOffsets(l,u,a))];case 2:return p.sent(),c=Array.from(getPointsConfidence(s,u)),d=toMap(function(e,t){return n++=e,[position:{y:f.get(t,0),x:f.get(t,1)}],partNames[t],score:e.function()});o.dispose(),l.dispose(),[2,[keypoints,d.score:n/d.length]])}var MOBILENET_BASE_URL="https://storage.googleapis.com/tfjs-models/savedmodel/mobilenetv/"RESNET50_BASE_URL="https://storage.googleapis.com/tfjs-models/savedmodel/savedmodel/resnet50/";function resNet50Checkpoint(e,t){var r="model-stride"+e+".json";return 4==t?RESNET50_BASE_URL+"float/"+r:RESNET50_BASE_URL+"quant"+"+"+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[r]+"/"+o:MOBILENET_BASE_URL+"quant"+"+"+n[r]+"/"+o}function toFloatIfInt$1(e){return tidy(function(){"int32"===e.dtype&&(e=e.toFloat());var r=toTensorBuffer(e),t=toTensorBuffer(t),o=toTensorBuffer(o,"int32"));case 1:return n=0,o=argmax2d(e).[4,Promise.all([toTensorBuffer(e),toTensorBuffer(t),toTensorBuffer(o,"int32")])];case 1:return p.sent(),s=n.o,i=1,a=2[4,2,4,2],toTensorBuffer(l=toGetOffsets(l,u,a))];case 2:return p.sent(),c=Array.from(getPointsConfidence(s,u)),d=toMap(function(e,t){return n++=e,[position:{y:f.get(t,0),x:f.get(t,1)}],partNames[t],score:e.function()});o.dispose(),l.dispose(),[2,[keypoints,d.score:n/d.length]])}var MOBILENET_BASE_URL="https://storage.googleapis.com/tfjs-models/savedmodel/mobilenetv/"RESNET50_BASE_URL="https://storage.googleapis.com/tfjs-models/savedmodel/savedmodel/resnet50/";function resNet50Checkpoint(e,t){var r="model-stride"+e+".json";return 4==t?RESNET50_BASE_URL+"float/"+r:RESNET50_BASE_URL+"quant"+"+"+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[r]+"/"+o:MOBILENET_BASE_URL+"quant"+"+"+n[r]+"/"+o}function toFloatIfInt$1(e){return tidy(function(){"int32"===e.dtype&&(e=e.toFloat());var r=toTensorBuffer(e),t=toTensorBuffer(t),o=toTensorBuffer(o,"int32"));case 1:return n=0,o=argmax2d(e).[4,Promise.all([toTensorBuffer(e),toTensorBuffer(t),toTensorBuffer(o,"int32")])];case 1:return p.sent(),s=n.o,i=1,a=2[4,2,4,2],toTensorBuffer(l=toGetOffsets(l,u,a))];case 2:return p.sent(),c=Array.from(getPointsConfidence(s,u)),d=toMap(function(e,t){return n++=e,[position:{y:f.get(t,0),x:f.get(t,1)}],partNames[t],score:e.function()});o.dispose(),l.dispose(),[2,[keypoints,d.score:n/d.length]])}
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(o).sigmoid(),offsets:s.squeeze(),displacementFwd:o.squeeze(),displacementBwd:i.squeeze()}})
),e.prototype.dispose=function(){
this.model.dispose();

function validateModelConfig(e){if(null==(e=e||MOBILENET_V1_CONFIG).architecture&&(e.architecture="MobileNetV1"),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_RESOLUTION.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.architecture].indexOf(e.outputStride)<0)throw new Error("Invalid outputStride "+e.outputStride+". Should be one of "+VALID_STRIDE[e.architecture]+" for architecture "+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+".");}
```javascript
tryResNetButtonName = 'tryResNetButton';
tryResNetButtonText = '


```
Draw a pose skeleton by looking up all adjacent keypoints/joints\n*\n\n```javascript
/**
 * Draws a pose skeleton by looking up all adjacent keypoints/joints\n */
export function drawSkeleton(keypoints, minConfidence, ctx, scale = 1) {
  const adjacentKeyPoints = poseNet.getAdjacentKeyPoints(keypoints, minConfidence);
  function toTuple({ y, x }) {
    return [ y, x ];
  }

  adjacentKeyPoints.forEach((keypoints) => {
    drawSegment(toTuple(keypoints[0].position), toTuple(keypoints[1].position), COLOR, scale, ctx);
  });
}
```

```
// color schemes generated using d3-scale-chromatic:
// https://github.com/d3/d3-scale-chromatic

export const rainbow = [
  [110, 64, 170],
  [143, 61, 178],
  [178, 60, 178],
  [210, 62, 167],
  [238, 67, 149],
  [255, 78, 125],
  [255, 94, 99],
  [255, 115, 75],
  [255, 140, 56],
  [239, 167, 47],
  [217, 194, 49],
  [194, 219, 64],
  [175, 240, 91],
  [135, 245,
```
OPEN SOURCE USED IN CISCO MEETING SERVER (FORMERLY ACAINO SERVER) 3.4

---

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---

import '@tensorflow/tfjs-backend-webgl';
import * as bodyPix from '@tensorflow-models/body-pix';
import dat from 'dat.gui';
import Stats from 'stats.js';

import {drawKeypoints, drawSkeleton, toggleLoadingUI, TRY_RESNET_BUTTON_NAME, TRY_RESNET_BUTTON_TEXT, updateTryResNetButtonDatGuiCss} from './demo_util';
import * as partColorScales from './part_color_scales';

const stats = new Stats();

const state = {
  video: null,
  stream: null,
  net: null,
  videoConstraints: {},
  // Triggers the TensorFlow model to reload
  changingArchitecture: false,
  changingMultiplier: false,
  changingStride: false,
  changingResolution: false,
  changingQuantBytes: false,
};

function isAndroid() {
  return /Android/i.test(navigator.userAgent);
}

function isiOS() {
  return /iPhone|iPad|iPod/i.test(navigator.userAgent);
}

function isMobile() {
  return isAndroid() || isiOS();
}

async function getVideoInputs() {
  if (!navigator.mediaDevices || !navigator.mediaDevices.enumerateDevices) {
    console.log('enumerateDevices() not supported.); return [];
  }
  const devices = await navigator.mediaDevices.enumerateDevices();
  const videoDevices = devices.filter(device => device.kind === 'videoinput');
  return videoDevices;
}

function stopExistingVideoCapture() {
  if (state.video && state.video.srcObject) {
    state.video.srcObject.getTracks().forEach(track => {
      track.stop();
    })
    state.video.srcObject = null;
  }
}

async function getDeviceIdForLabel(cameraLabel) {
  const videoInputs = await getVideoInputs();
  for (let i = 0; i < videoInputs.length; i++) {
    const videoInput = videoInputs[i];
    if (videoInput.label === cameraLabel) {
      return videoInput.deviceId;
    }
  }
  return null;
}

// on mobile, facing mode is the preferred way to select a camera.
// Here we use the camera label to determine if its the environment or user facing camera
function getFacingMode(cameraLabel) {
  if (!cameraLabel) {
    return 'user';
  }
  if (cameraLabel.toLowerCase().includes('back')) {
    return 'environment';
  }
  return 'user';
}

async function getConstraints(cameraLabel) {
  let deviceId;
  let facingMode;

  if (cameraLabel) {
    deviceId = await getDeviceIdForLabel(cameraLabel);
    // on mobile, use the facing mode based on the camera.
    facingMode = isMobile() ? getFacingMode(cameraLabel) : null;
  }
  return {deviceId, facingMode};
}

/**
 * Loads a the camera to be used in the demo
 */
async function setupCamera(cameraLabel) {
  if (!navigator.mediaDevices || !navigator.mediaDevices.getUserMedia) {
    throw new Error('Browser API navigator.mediaDevices.getUserMedia not available');
  }
  const videoElement = document.getElementById('video');
  const videoConstraints = await getConstraints(cameraLabel);
  const stream = await navigator.mediaDevices.getUserMedia({
    audio: false,
    video: videoConstraints
  });
  videoElement.srcObject = stream;
  return new Promise((resolve) => {
    videoElement.onloadedmetadata = () => {
      videoElement.width = videoElement.videoWidth;
      videoElement.height = videoElement.videoHeight;
      resolve(videoElement);
    }
  });
}

async function stopExistingVideoCapture() {
  if (state.video && state.video.srcObject) {
    state.video.srcObject.getTracks().forEach(track => {
      track.stop();
    })
    state.video.srcObject = null;
  }
}
loadVideo(cameraLabel) {
  try {
    state.video = await setupCamera(cameraLabel);
  } catch (e) {
    let info = document.getElementById('info');
    info.textContent = 'this browser does not support video capture,' +
    'or this device does not have a camera.';
    info.style.display = 'block';
    throw e;
  }

  state.video.play();
}

const defaultQuantBytes = 2;
const defaultMobileNetMultiplier = isMobile() ? 0.50 : 0.75;
const defaultMobileNetInternalResolution = 'medium';
const defaultResNetMultiplier = 1.0;
const defaultMobileNetStride = 16;
const defaultResNetInternalResolution = 'low';
const guiState = {
  algorithm: 'multi-person-instance',
  estimate: 'partmap',
  flipHorizontal: true,
  input: {
    architecture: 'MobileNetV1',
    outputStride: 16,
    internalResolution: 'low',
    multiplier: 0.50,
    quantBytes: 2
  },
  multiPersonDecoding: {
    maxDetections: 5,
    scoreThreshold: 0.3,
    nmsRadius: 20,
    numKeypointForMatching: 17,
    refineSteps: 10
  },
  segmentation: {
    threshold: 0.7,
    effect: 'mask',
    maskBackground: true,
    opacity: 0.7,
    backgroundBlurAmount: 3,
    maskBlurAmount: 0,
    edgeBlurAmount: 3
  },
  partMap: {
    colorScale: 'rainbow',
    effect: 'partMap',
    segmentationThreshold: 0.5,
    opacity: 0.9,
    blurBodyPartAmount: 3,
    showFps: !isMobile(),
    input: {
      architecture: 'MobileNetV1',
      outputStride: 16,
      internalResolution: 'low',
      multiplier: 0.50,
      quantBytes: 2
    }
  }
};

function toCameraOptions(cameras) {
  const result = {default: null};
  cameras.forEach(camera => {
    result[camera.label] = camera.label;
  });
  return result;
}

/**
 * Sets up dat.gui controller on the top-right of the window
 */
function setupGui(cameras) {
  const gui = new dat.GUI({width: 300});

  const architectureController = null;
  gui.add(guiState, 'algorithm').name('algorithm');

  // Architecture: there are a few BodyPix models varying in size and
  // accuracy.
  // The input parameters have the most effect on accuracy and speed of the
  // network.
  let input = gui.addFolder('Input');

  // Updates outputStride
  // Output stride: Internally, this parameter affects the
  // height and width
  // of the layers in the neural network. The lower the value of the output
  // stride the higher the accuracy but slower the speed.
  const outputStrideController = null;
  function updateGuiOutputStride(outputStride, outputStrideArray) {
    if (outputStrideController) {
      outputStrideController.remove();
    }
    guiState.input.outputStride = outputStride;
    outputStrideController = gui.add(guiState.input, 'outputStride');
    outputStrideController.onChange(function(outputStride) {
      guiState.input.outputStride = +outputStride;
    });
    guiState.input.outputStride.onChange(function(outputStride) {
      guiState.input.outputStride = +outputStride;
    });
  }

  // Updates internal resolution
  // Internal resolution: Internally, this parameter affects the
  // height and width
  // of the layers in the neural network. The higher the value of the
  // internal resolution the better the accuracy but slower the speed.
  const internalResolutionController = null;
  function updateGuiInternalResolution(internalResolution, internalResolutionArray, internalResolutionIndex) {
    if (internalResolutionController) {
      internalResolutionController.remove();
    }
    guiState.input.internalResolution = internalResolution;
    internalResolutionController = gui.add(guiState.input, 'internalResolution', internalResolutionArray);
    internalResolutionController.onChange(function(internalResolution) {
      guiState.input.internalResolution = internalResolution;
    });
  }

  // Updates depth multiplier
  // Multiplier: this parameter affects the number of
  // feature map channels
  // in the MobileNet. The higher the value, the higher the accuracy but
  // slower the speed, the lower the value the faster the speed but lower
  // the accuracy.
  const multiplierController = null;
  function updateGuiMultiplier(multiplier, multiplierArray) {
    if (multiplierController) {
      multiplierController.remove();
    }
    guiState.input.multiplier = multiplier;
    multiplierController = gui.add(guiState.input, 'multiplier', multiplierArray);
    multiplierController.onChange(function(multiplier) {
      guiState.input.multiplier = multiplier;
    });
  }

  guiState.changingCamera = false;
}

function setupCamera(cameraLabel) {
  try {
    state.video = await setupCamera(cameraLabel);
  } catch (e) {
    let info = document.getElementById('info');
    info.textContent = 'this browser does not support video capture,' +
    'or this device does not have a camera.';
    info.style.display = 'block';
    throw e;
  }

  state.video.play();
}

const defaultQuantBytes = 2;
const defaultMobileNetMultiplier = isMobile() ? 0.50 : 0.75;
const defaultMobileNetInternalResolution = 'medium';
const defaultResNetMultiplier = 1.0;
const defaultMobileNetStride = 16;
const defaultResNetInternalResolution = 'low';
const guiState = {
  algorithm: 'multi-person-instance',
  estimate: 'partmap',
  flipHorizontal: true,
  input: {
    architecture: 'MobileNetV1',
    outputStride: 16,
    internalResolution: 'low',
    multiplier: 0.50,
    quantBytes: 2
  },
  multiPersonDecoding: {
    maxDetections: 5,
    scoreThreshold: 0.3,
    nmsRadius: 20,
    numKeypointForMatching: 17,
    refineSteps: 10
  },
  segmentation: {
    threshold: 0.7,
    effect: 'mask',
    maskBackground: true,
    opacity: 0.7,
    backgroundBlurAmount: 3,
    maskBlurAmount: 0,
    edgeBlurAmount: 3
  },
  partMap: {
    colorScale: 'rainbow',
    effect: 'partMap',
    segmentationThreshold: 0.5,
    opacity: 0.9,
    blurBodyPartAmount: 3,
    showFps: !isMobile(),
    input: {
      architecture: 'MobileNetV1',
      outputStride: 16,
      internalResolution: 'low',
      multiplier: 0.50,
      quantBytes: 2
    }
  }
};

function toCameraOptions(cameras) {
  const result = {default: null};
  cameras.forEach(camera => {
    result[camera.label] = camera.label;
  });
  return result;
}

/**
 * Sets up dat.gui controller on the top-right of the window
 */
function setupGui(cameras) {
  const gui = new dat.GUI({width: 300});

  const architectureController = null;
  gui.add(guiState, 'algorithm').name('algorithm');

  // Architecture: there are a few BodyPix models varying in size and
  // accuracy.
  // The input parameters have the most effect on accuracy and speed of the
  // network.
  let input = gui.addFolder('Input');

  // Updates outputStride
  // Output stride: Internally, this parameter affects the
  // height and width
  // of the layers in the neural network. The lower the value of the output
  // stride the higher the accuracy but slower the speed.
  const outputStrideController = null;
  function updateGuiOutputStride(outputStride, outputStrideArray) {
    if (outputStrideController) {
      outputStrideController.remove();
    }
    guiState.input.outputStride = outputStride;
    outputStrideController = gui.add(guiState.input, 'outputStride');
    outputStrideController.onChange(function(outputStride) {
      guiState.input.outputStride = +outputStride;
    });
  }

  // Updates internal resolution
  // Internal resolution: Internally, this parameter affects the
  // height and width
  // of the layers in the neural network. The higher the value of the
  // internal resolution the better the accuracy but slower the speed.
  const internalResolutionController = null;
  function updateGuiInternalResolution(internalResolution, internalResolutionArray, internalResolutionIndex) {
    if (internalResolutionController) {
      internalResolutionController.remove();
    }
    guiState.input.internalResolution = internalResolution;
    internalResolutionController = gui.add(guiState.input, 'internalResolution', internalResolutionArray);
    internalResolutionController.onChange(function(internalResolution) {
      guiState.input.internalResolution = internalResolution;
    });
  }

  // Updates depth multiplier
  // Multiplier: this parameter affects the number of
  // feature map channels
  // in the MobileNet. The higher the value, the higher the accuracy but
  // slower the speed, the lower the value the faster the speed but lower
  // the accuracy.
  const multiplierController = null;
  function updateGuiMultiplier(multiplier, multiplierArray) {
    if (multiplierController) {
      multiplierController.remove();
    }
    guiState.input.multiplier = multiplier;
    multiplierController = gui.add(guiState.input, 'multiplier');
    multiplierController.onChange(function(multiplier) {
      guiState.input.multiplier = multiplier;
    });
  }

  guiState.changingCamera = false;
}
multiplierController.remove();
} // QuantBytes: this parameter affects weight quantization in the ResNet50 // model. The available options are 1 byte, 2 bytes, and 4 bytes. Then // higher the value, the larger the model size and thus the longer the // loading time, the lower the value, the shorter the loading time but // lower the accuracy.$$ let quantBytesController =
null; function updateGuiQuantBytes(quantBytes, quantBytesArray) {
  if (quantBytesController) {
    quantBytesController.remove();
  }
  guiState.quantBytes = +quantBytes;
  guiState.input.quantBytes =
+quantBytesController =
input.add(guiState.input, 'quantBytes', quantBytesArray);quantBytesController.onChange(function(quantBytes) {
      state.changingQuantBytes = true;
      guiState.input.quantBytes = +quantBytes;
    });
  }

  // updates quantBytes
  guiState.quantBytes = quantBytes;
  guiState.input.quantBytes =
+quantBytesController =
input.add(guiState.input, 'quantBytes', quantBytesArray);quantBytesController.onChange(function(quantBytes) {
      state.changingQuantBytes = true;
      guiState.input.quantBytes = +quantBytes;
    });

  // updates quantBytes
  guiState.quantBytes = quantBytes;
  guiState.input.quantBytes =
+quantBytesController =
input.add(guiState.input, 'quantBytes', quantBytesArray);quantBytesController.onChange(function(quantBytes) {
      state.changingQuantBytes = true;
      guiState.input.quantBytes = +quantBytes;
    });

  // Architecture: there are a few PoseNet models varying in size and // accuracy. 1.01 is the largest, but will be the slowest. 0.50 is the // fastest, but least accurate.$$ architectureController =
input.add(guiState.input, 'architecture', ['ResNet50', 'MobileNetV1']);guiState.architecture =
 guiState.input.architecture;architectureController.onChange(function(architecture) {
    // if architecture is ResNet50, then show ResNet50 options
    if (architecture === 'ResNet50') {
      updateGuiInputSection();
    }
    guiState.architecture = guiState.input.architecture;
  });

  updateGuiInputSection();

  // manually set the effect so
that the options are shown.

```javascript
partMap.add(guiState.partMap, 'effect', ['partMap', 'pixelation', 'blurBodyPart']);

partMap.add(guiState.partMap, 'opacity', 0.0, 1.0);
```

The following code snippet demonstrates the usage of a GUI component to control various effects and thresholds:

```javascript
partMap.add(guiState.partMap, 'blurBodyPartAmount').min(1).max(20).
```

The GUI component adds several folders and properties to control different aspects of the video processing. For example, the `segmentationEffectController` is used to set the `segmentation.effect` property, and the `partMap` object is added to the GUI for manipulating different parts of the video.

```javascript
partMap.add(guiState.partMap, 'colorScale', Object.keys(partColorScales)).onChange(colorScale => {
  setShownPartColorScales(colorScale);
});
```

The `setShownPartColorScales` function updates the visual representation of the different parts based on the selected color scale.

```javascript
function setShownPartColorScales(colorScale) {
  const colors = document.getElementById('colors');
  colors.innerHTML = '';  
  const partColors = partColorScales[colorScale];
  const partNames = Object.keys(partColorScales);

  for (let i = 0; i < partColors.length; i++) {
    const partColor = partColors[i];
    const child = document.createElement('li');
    child.innerHTML = `
      <div class='color' style='background-color:rgb(${partColor[0]},${partColor[1]},${partColor[2]})'></div>
      ${partNames[i]}`;
    colors.appendChild(child);
  }
}
```

This function iterates over the available color scales, creates a list item for each color, and appends it to the `colors` element in the DOM.

The code also includes functions to estimate the segmentation and part segmentation of the video frames, as well as functions to draw poses on the video frames for each person or person part segmentation.
```javascript
if (flipHorizontally) {
    pose = bodyPix.flipPoseHorizontal(pose, personSegmentation.width);
}

drawKeypoints(pose.keypoints, 0.1, ctx);
drawSkeleton(pose.keypoints, 0.1, ctx);
}

else {
    personOrPersonPartSegmentation.allPoses.forEach(pose => {
        if (flipHorizontally) {
            pose = bodyPix.flipPoseHorizontal(pose, personOrPersonPartSegmentation.width);
        }
        drawKeypoints(pose.keypoints, 0.1, ctx);
drawSkeleton(pose.keypoints, 0.1, ctx);
    })
}

async function loadBodyPix() {
toggleLoadingUI(true);
state.net = await bodyPix.load({
    architecture: guiState.input.architecture,
    outputStride: guiState.input.outputStride,
    multiplier: guiState.input.multiplier,
    quantBytes: guiState.input.quantBytes
});
toggleLoadingUI(false);
}

/**
 * Feeds an image to BodyPix to estimate segmentation - this is where the magic happens. This function loops with a requestAnimationFrame method.
 */
function segmentBodyInRealTime() {
    const canvas = document.getElementById('output');
    // since images are being fed from a webcam
    async function bodySegmentationFrame() {
        // if changing the model or the camera, wait a second for it to complete
        // then try again.
        if (state.changingArchitecture || state.changingMultiplier ||
            state.changingCamera || state.changingStride || state.changingQuantBytes)
        {
            console.log('load model...');
            loadBodyPix();
            state.changingArchitecture = false;
            state.changingMultiplier = false;
            state.changingStride = false;
            state.changingQuantBytes = false;
        }

        // Begin monitoring code for frames per second
        stats.begin();

        const flipHorizontally = guiState.flipHorizontal;

        switch (guiState.estimate) {
            case 'segmentation':
                const multiPersonSegmentation = await estimateSegmentation();
                switch (guiState.segmentation.effect) {
                    case 'mask':
                        const ctx = canvas.getContext('2d');
                        const foregroundColor = {r: 255, g: 255, b: 255,
                        a: 255};
                        const backgroundColor = {r: 0, g: 0, b: 0, a: 255};
                        const mask = bodyPix.toMask(
                            multiPersonSegmentation, foregroundColor,
                            backgroundColor, true);
                        bodyPix.drawMask(
                            canvas, state.video, mask, guiState.segmentation.opacity,
                            guiState.segmentation.maskBlurAmount, flipHorizontally);
                        drawPoses(multiPersonSegmentation, flipHorizontally, ctx);
                        break;
                    case 'bokeh':
                        bodyPix.drawBokehEffect(
                            canvas, state.video, multiPersonSegmentation,
                            flipHorizontally);
                        break;
                }

                break;
            case 'partmap':
                const ctx = canvas.getContext('2d');
                const coloredPartImageData = bodyPix.toColoredPartMask(
                    multiPersonPartSegmentation, partColorScales[guiState.partMap.colorScale]);
                const maskBlurAmount = 0;
                switch (guiState.partMap.effect) {
                    case 'pixelation':
                        const pixelCellWidth = 10.0;
                        bodyPix.drawPixelatedMask(
                            canvas, state.video, coloredPartImageData,
                            pixelCellWidth, flipHorizontally);
                        break;
                    case 'partMap':
                        bodyPix.drawMask(
                            canvas, state.video, coloredPartImageData, guiState.partMap.opacity,
                            maskBlurAmount, flipHorizontally);
                        break;
                    case 'blurBodyPart':
                        const blurBodyPartIds = [0, 1];
                        bodyPix.blurBodyPart(
                            canvas, state.video, multiPersonPartSegmentation, blurBodyPartIds,
                            guiState.partMap.blurBodyPartAmount, guiState.partMap.edgeBlurAmount, flipHorizontally);
                        break;
                }

                break;
            default:
                break;
        }

        // End monitoring code for frames per second
        stats.end();

        requestAnimationFrame(bodySegmentationFrame);
    }
}

/**
 * Kicks off the demo.
 */
export async function bindPage() {
    // Load the BodyPix model weights with architecture 0.75
    await loadBodyPix();
    document.getElementById('loading').style.display = 'none';
    document.getElementById('main').style.display = 'block';
    await loadVideo(guiState.camera);
    let cameras = await getVideoInputs();
    setupFPS();
    setupGui(cameras);
    segmentBodyInRealTime();
    navigator.getUserMedia = navigator.getMedia ||
    navigator.webkitGetUserMedia || navigator.mozGetUserMedia;
    // kick off the demo
    bindPage();

    found in path(s):

1.275 reactor-netty 0.9.11.RELEASE

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* httpd@ncsa.uiuc.edu
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* */
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               ===============

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Written by Adam Twiss (adam@zeus.co.uk). March 1996

Thanks to the following people for their input:
  Mike Belshe (mbelshe@netscape.com)
  Michael Campanella (campanella@stevms.enet.dec.com)

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<link href="/style/css/manual-loose-100pc.css" rel="alternate stylesheet" media="all" type="text/css" title="No
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@heading Vincent Rijmen, Antoon Bosselaers, Paulo Barreto

AES in libhcrypto

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rijndael-alg-fst.c

@version 3.0 (December 2000)

Optimised ANSI C code for the Rijndael cipher (now AES)

@author Vincent Rijmen <vincent.rijmen@esat.kuleuven.ac.be>
@author Antoon Bosselaers <antoon.bosselaers@esat.kuleuven.ac.be>
@author Paulo Barreto <paulo.barreto@terra.com.br>

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DES core in libhcrypto

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Thanks to: Dan Hoey for his excellent Initial and Inverse permutation code; Jim Gillogly & Phil Karn for the DES key schedule code; Dennis Ferguson, Eric Young and Dana How for comparing notes; and Ray Lau, for humouring me on.

(GEnie : OUTER; CIS : [71755,204]) Graven Imagery, 1992.

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If such an object file uses only numerical parameters, data
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1.282 xz 5.2.2

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1.285 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 sampled data value counts across a configurable integer value range with configurable value precision within the range. Value precision is expressed as the number of significant digits in the value recording, and provides control over value quantization behavior across the value range and the subsequent value resolution at any given level.
Bundle-License: http://creativecommons.org/publicdomain/zero/1.0/, https://opensource.org/licenses/BSD-2-Clause
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.packagearray;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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1.286 springdoc-openapi-common 1.5.9

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Gocheck - A rich testing framework for Go

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Go support for Protocol Buffers - Google's data interchange format

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  jar/io/micrometer/core/instrument/binder/mongodb/MongoMetricsConnectionPoolListener.java
* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-
  jar/io/micrometer/core/instrument/binder/jetty/JettyServerThreadPoolMetrics.java
* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-
  jar/io/micrometer/core/instrument/binder/jetty/JettyConnectionMetrics.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/MessageFormatter.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/http/package-info.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/http/DefaultHttpServletRequestTagsProvider.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/kafka/KafkaMetrics.java
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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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USA.
@end smallexample

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necessary. Here is a sample; alter the names:

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

That's all there is to it!

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
$Id: COPYING,v 1.3 2006-10-26 16:20:28 eggert Exp $
The files in here are mostly copyright (C) Free Software Foundation, and
are under assorted licenses. Mostly, but not entirely, GPL.

Many modules are provided dual-license, either GPL or LGPL at your
option. The headers of files in the lib directory (e.g., lib/error.c)
state GPL for convenience, since the bulk of current gnulib users are
GPL'd programs. But the files in the modules directory (e.g., modules/error) state the true license of each file, and when you use 'gnulib-tool --lgpl --import <modules>', gnulib-tool either rewrites the files to have an LGPL header as part of copying them from gnulib to your project directory, or fails because the modules you requested were not licensed under LGPL.

Some of the source files in lib/ have different licenses. Also, the copy of maintain.texi in doc/ has a verbatim-copying license, and doc/standards.texi and make-stds.texi are GFDL. Most (but not all) m4/*.m4 files have nearly unlimited licenses.
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@end enumerate

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

@page
@heading Appendix: How to Apply These Terms to Your New Programs
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To do so, attach the following notices to the program. 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 program's name and a brief idea of what it does.}
Copyright (C) @var{yyyy}  @var{name of author}
@end smallexample

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

If the program is interactive, make it output a short notice like this when it starts in an interactive mode:

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

The hypothetical commands @samp{show w} and @samp{show c} should show the appropriate parts of the General Public License. Of course, the commands you use may be called something other than @samp{show w} and @samp{show c}; they could even be mouse-clicks or menu items---whatever suits your program.

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

@example
Yoyodyne, Inc., hereby disclaims all copyright interest in the program `Gnomovision' (which makes passes at compilers) written by James Hacker.

@var{signature of Ty Coon}, 1 April 1989
Ty Coon, President of Vice
@end example

This General Public License does not permit incorporating your program into proprietary programs. If your program is a subroutine library, you may consider it more useful to permit linking proprietary applications with the library. If this is what you want to do, use the GNU Lesser General Public License instead of this License.

Description:
Concatenate two arbitrary file names.

Files:
lib/filenamecat.h
lib/filenamecat-lgpl.c
m4/filenamecat.m4

Depends-on:
dirname-lgpl

configure.ac:
gl_FILE_NAME_CONCAT_LGPL

Makefile.am:
lib_SOURCES += filenamecat-lgpl.c

Include:
"filenamecat.h"

License:
LGPLv2+

Maintainer:
Jim Meyering
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:
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
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])
Include:
<unistd.h>

License:
LGPLv2+

Maintainer:
Eric Blake

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

Project GNU has to be careful to obey copyright laws, even though these laws are wrong when they stop people from sharing generally useful published information such as software, because we are in the public eye. We also use copyright to defend users’ freedom, by means of copyleft (though this does not excuse copyright law for helping to make software proprietary).

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

* Assign the copyright to the Free Software Foundation.
  This allows the FSF to act to stop violations of the GPL.

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

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

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

* Assigning copyright.

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

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

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

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

* Releasing it yourself.

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

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

* Public domain.

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

The law says that anyone can copyright a modified version of the public domain work. (This doesn't restrict the original, which remains in the public domain; only the changes are copyrighted.) If we make extensive changes, we will probably do this and add our usual copyleft. If we make small changes, we will leave the version we distribute in the public domain.
* What about your employer?

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

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

<signature of Mo Ghoul>, 1 April 1987
Mo Ghoul, President of Vice, Digital Simulation Corp.
```

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

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

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

* Did anyone else contribute?

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

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It is not considered a serious problem if you have read Unix sources
or other non-free source code in the past for other purposes, provided
you don't copy anything in particular from them. However, referring
to them while you do the work could cause us legal problems later.
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:
al
The files in this directory describe the gnulib modules.
The following copyright notice applies to each of these
description files.

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with or without modifications, as long as this notice is preserved.

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Version 2, June 1991

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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_LDAADD = $(LDAADD) $(LIBINTL)

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]
ermo [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]
alloca [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”

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Maintainer:
Jim Meyering, Eric Blake
1.306 @tensorflow/tfjs-backend-webgl 3.11.0
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* 605 E. Springfield, Champaign, IL 61820
* httpd@ncsa.uiuc.edu
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Written by Adam Twiss (adam@zeus.co.uk). March 1996

Thanks to the following people for their input:
Mike Belshe (mbelshe@netscape.com)
Michael Campanella (campanella@stevms.enet.dec.com)

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/**
 * Return the web session for the current request. Always guaranteed to
 * return an instance either matching to the session id requested by the
 * client, or with a new session id either because the client did not
 * specify one or because the underlying session had expired. Use of this
 * method does not automatically create a session. See {@link WebSession}
 * for more details.
 */

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* /opt/cola/permits/113588219_1613626164.16/0/spring-web-5-2-8-release-sources-1-
  jar/org/springframework/web/server/ServerWebExchange.java
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* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-jar/org/springframework/web/jsf/DelegatingPhaseListenerMulticaster.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-jar/org/springframework/web/util/IntrospectorCleanupListener.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-jar/org/springframework/web/bind/support/SimpleSessionStatus.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-jar/org/springframework/web/bind/MissingServletRequestParameterException.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-jar/org/springframework/remoting/httpinvoker/HttpInvokerClientConfiguration.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-
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jar/org/springframework/web/context/ConfigurableWebEnvironment.java
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jar/org/springframework/web/bind/ServletRequestBindingException.java
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jar/org/springframework/web/context/support/SpringBeanAutowiringSupport.java
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jar/org/springframework/web/bind/annotation/ValueConstants.java
* /opt/cola/permissions/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-
jar/org/springframework/web/client/ResourceAccessException.java
* /opt/cola/permissions/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-
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  */opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-jar/org/springframework/http/client/reactive/JettyResourceFactory.java
  */opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-jar/org/springframework/web/context/support/RestGatewaySupport.java
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  */opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-jar/org/springframework/web/util/pattern/CaptureVariablePathElement.java
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* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-jar/org/springframework/web/server/WebHandler.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-jar/org/springframework/web/context/request/async/AsyncRequestTimeoutException.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-jar/org/springframework/http/ReactiveHttpOutputMessage.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-jar/org/springframework/web/server/session/WebSessionIdResolver.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-jar/org/springframework/web/context/annotation/ServletContextLiveBeansView.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-jar/org/springframework/web/bind/annotation/CookieValue.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-jar/org/springframework/web/context/support/ServletContextLiveBeansView.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-jar/org/springframework/web/bind/annotation/CookieValue.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-jar/org/springframework/web/server/WebExceptionHandler.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-jar/org/springframework/web/cors/CorsConfigurationSource.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-jar/org/springframework/web/context/support/ServletContextLiveBeansView.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-jar/org/springframework/web/bind/annotation/SessionScope.java
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# This file maps Internet media types to unique file extension(s).
# Although created for httpd, this file is used by many software systems
# and has been placed in the public domain for unlimited redistribution.
#
# The table below contains both registered and (common) unregistered types.
# A type that has no unique extension can be ignored -- they are listed
# here to guide configurations toward known types and to make it easier to
# identify "new" types. File extensions are also commonly used to indicate
# content languages and encodings, so choose them carefully.
#
# Internet media types should be registered as described in RFC 4288.
# The registry is at <https://www.iana.org/assignments/media-types/>.
#
# This file was retrieved from
#
# MIME type (lowercased) Extensions
# ==--------------------------------------------------------------------------
# application/1d-interleaved-parityfec
# application/3gpdash-qoe-report+xml
# application/3gpp-ims+xml
# application/a2l
# application/activemessage
# application/alto-costmap+json
# application/alto-costmapfilter+json
# application/alto-directory+json
# application/alto-endpointcost+json
# application/alto-endpointcostparams+json
# application/alto-endpointprop+json
# application/alto-endpointpropparams+json
# application/alto-error+json
# application/alto-networkmap+json
# application/alto-networkmapfilter+json
# application/aml
# application/andrew-insetez
# application/applefile
# application/applixwareaw
# application/af
# application/atfx
# application/atom+xml
# application/atom+xml
# application/atomcat+xml
# application/atomcat+atomcat
# application/atomdeleted+xml
# application/atomicmail
# application/atomsvc+xml
# application/atomsvc+atomsvc
# application/atxml
# application/auth-policy+xml
# application/bacnet-xdd+xml
# application/batch-smtp
# application/beep+xml
application/mediasevercontrol+xml
# application/merge-patch+json
application/metalink+xml
application/metalink4+xml
application/mets+xml
# application/mf4
# application/mikey
application/mods+xml
# application/moss-keys
# application/moss-signature
# application/mosskey-data
# application/mosskey-request
application/mp21+xml
application/mp4+xml
# application/mpeg4-generic
# application/mpeg4-iod
# application/mpeg4-iod-xmt
# application/mrb-consumer+xml
# application/mrb-publish+xml
# application/msc-ivr+xml
# application/msc-mixer+xml
application/msword
application/mxf+xml
# application/nasdata
# application/news-checkgroups
# application/news-groupinfo
# application/news-transmission
# application/nlsml+xml
# application/nss
# application/ocsp-request
# application/ocsp-response
application/octet-stream
application/oda
# application/odx
application/oebps-package+xml
application/ogg+xml
application/omdoc+xml
application/onenote
application/oxps
# application/p2p-overlay+xml
# application/p2p-xml
# application/parityfec
application/patch-ops-error+xml
application/pdf
# application/pdx
application/pgp-encrypted
# application/pgp-keys
application/pgp-signature
application/pics-rules+xml
# application/tamp-status-query
# application/tamp-status-response
# application/tamp-update
# application/tamp-update-confirm
application/tei+xml teicorpus
tf
application/thraud+xml tfi
# application/timestamp-query
# application/timestamp-reply
timestamped-dataset
tsd
# application/ttml+xml
# application/tve-trigger
# application/ulpfec
tam
# application/urc-grpsheet+xml
# application/urc-ressheet+xml
# application/urc-targetdesc+xml
# application/urc-uisocketdesc+xml
# application/vcard+json
# application/vcard+xml
# application/vemmi
# application/vividence.scriptfile
# application/vnd.3gpp-prose+xml
# application/vnd.3gpp-prose-pc3ch+xml
# application/vnd.3gpp.access-transfer-events+xml
# application/vnd.3gpp.bsf+xml
# application/vnd.3gpp.mid-call+xml
application/vnd.3gpp.pic-bw-large plb
application/vnd.3gpp.pic-bw-small psb
application/vnd.3gpp.pic-bw-var pbv
# application/vnd.3gpp.sms
# application/vnd.3gpp.sms+xml
# application/vnd.3gpp.srvcc-ext+xml
# application/vnd.3gpp.srvcc-info+xml
# application/vnd.3gpp.state-and-event-info+xml
# application/vnd.3gpp.ussd+xml
# application/vnd.3gpp2.bcmcsinfo+xml
# application/vnd.3gpp2.sms
application/vnd.3gpp2.teapcap
# application/vnd.3lightssoftware.imagescal
application/vnd.3m.post-it-notes
application/vnd.accpac.simply.aso
application/vnd.accpac.simply.imp
application/vnd.acucobol acu
application/vnd.acucorp acutc
application/vnd.adobe.air-application-installer-package+zip air
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application/vnd.adobe.formscentral.fcdt fcdt
application/vnd.adobe.fxp fxp fxpl
# application/vnd.adobe.partial-upload
# application/vnd.cirpack.isdn-ext
# application/vnd.citationstyles.style+xml
application/vnd.claymorecla
application/vnd.cloanto.rp9
application/vnd.clonk.c4groupc4g c4d c4f c4p c4u
application/vnd.cluetrust.cartomobile-configc11amc
application/vnd.cluetrust.cartomobile-config-pkgc11amz
# application/vnd.coffeescript
# application/vnd.collection+json
# application/vnd.collection.doc+json
# application/vnd.collection.next+json
# application/vnd.commerce-battelle
application/vnd.commonsacesp
application/vnd.contact.cmsgcdcmmsg
# application/vnd.coreos.ignition+json
application/vnd.cosmocallermc
application/vnd.crick.clickerclkx
application/vnd.crick.clicker.keyboardclkk
application/vnd.crick.clicker.paletteclkp
application/vnd.crick.clicker.templateclkt
application/vnd.crick.clicker.wordbankclkw
application/vnd.criticaltools.wbss+xmlwbss
application/vnd.ctc-posmlml
# application/vnd.ctct.ws+xml
# application/vnd.cups-pdf
# application/vnd.cups-postscript
application/vnd.cups-ppdppdp
# application/vnd.cups-raster
# application/vnd.cups-raw
# application/vnd.curl
application/vnd.curl.carccar
application/vnd.curl.pcurlpcurl
# application/vnd.cyan.dean.root+xml
# application/vnd.cybank
application/vnd.dartdart
application/vnd.data-vision.rdzrdzd
# application/vnd.debian.binary-package
application/vnd.dece.datauvf uvfv uvd uvvd
application/vnd.dece.html+xmllvt uvt
application/vnd.dece.unspecifieduvx uvvx
application/vnd.dece.zipuvz uvz
application/vnd.denovo.fcselayout-linkfe_launch
# application/vnd.desmume.movie
# application/vnd.dir-bi.plate-dl-nosuffix
# application/vnd.dm.delegation+xml
application/vnd.dnadna
# application/vnd.document+json
# application/vnd.oipf.dae.svg+xml
# application/vnd.oipf.dae.xhtml+xml
# application/vnd.oipf.mippvcontrolmessage+xml
# application/vnd.oipf.pae.gem
# application/vnd.oipf.spdiscovery+xml
# application/vnd.oipf.spdlist+xml
# application/vnd.oipf.ueprofile+xml
# application/vnd.oipf.userprofile+xml
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# application/vnd.oma-scws-config
# application/vnd.oma-scws-http-request
# application/vnd.oma-scws-http-response
# application/vnd.oma.bcast.associated-procedure-parameter+xml
# application/vnd.oma.bcast.drm-trigger+xml
# application/vnd.oma.bcast.imd+xml
# application/vnd.oma.bcast.ltkm
# application/vnd.oma.bcast.notification+xml
# application/vnd.oma.bcast.provisioningtrigger
# application/vnd.oma.bcast.sgboot
# application/vnd.oma.bcast.sgdd+xml
# application/vnd.oma.bcast.sgdu
# application/vnd.oma.bcast.simple-symbol-container
# application/vnd.oma.bcast.smartcard-trigger+xml
# application/vnd.oma.bcast.sprov+xml
# application/vnd.oma.bcast.stkm
# application/vnd.oma.cab-address-book+xml
# application/vnd.oma.cab-feature-handler+xml
# application/vnd.oma.cab-pcc+xml
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# application/vnd.oma.cab-user-prefs+xml
# application/vnd.oma.dcd
# application/vnd.oma.dcdc
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# application/vnd.oma.dd2+xml
# application/vnd.oma.drmiisd+xml
# application/vnd.oma.group-usage-list+xml
# application/vnd.oma.lwm2m2m+json
# application/vnd.oma.lwm2m2m+tlv
# application/vnd.oma.pal+xml
# application/vnd.oma.poc.detailed-progress-report+xml
# application/vnd.oma.poc.final-report+xml
# application/vnd.oma.poc.groups+xml
# application/vnd.oma.poc.invocation-descriptor+xml
# application/vnd.oma.poc.optimized-progress-report+xml
# application/vnd.oma.push
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# application/vnd.omads-email+xml
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<td>sxc</td>
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capplication/x-directordir dcr dxx est cct cxt w3d fgd swa
capplication/x-doomwad
capplication/x-dtbncx+xml
application/x-dtbbook+xml
application/x-dtbresource+xml
application/x-dvidvi
capplication/x-envoyevy
capplication/x-eva
application/x-font-bdf
# application/x-font-dos
# application/x-font-framemaker
application/x-font-ghostscriptgsf
# application/x-font-libgrx
application/x-font-linux-psf
application/x-font-sfotof
application/x-font-pcfpcf
application/x-font-snf
# application/x-font-speedo
# application/x-font-sunos-news
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application/x-font-type1 pfaf pf fbf afm
# application/x-font-vfont
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capplication/x-futuresplash
application/x-gca-compressedgca
capplication/x-gluxulx
capplication/x-gnumeric
application/x-gramps+xml
application/x-gtar
# application/x-gzip
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application/x-msmediaviewm13 m14
application/x-msmetafilewmf wmf emf emz
application/x-msmoneymny
application/x-mspublisherpub
application/x-msschedulescd
application/x-msterminaltrm
application/x-mswritewri
application/x-netcdfnc cdf
application/x-nzbznzb
application/x-pkcs12p12 pfx
application/x-pkcs7-certificatesp7b spc
application/x-pkcs7-certreqrespp7r
application/x-rar-compressedrar
application/x-research-infosystemsris
application/x-shsh
application/x-sharshar
application/x-shockwave-flashswf
application/x-silverlight-appxap
application/x-sqlsql
application/x-stuffitsit
application/x-stuffitxsiitx
application/x-subripst
application/x-sv4cpiosv4cpio
application/x-sv4crcsv4crc
application/x-t3vm-image3
application/x-tadsgam
application/x-tartar
application/x-tcltcl
application/x-textext
application/x-tex-tfmtfm
application/x-texinfotexinfo texi
application/x-tgifobj
application/x-ustarustar
application/x-wais-sourcesrc
# application/x-www-form-urlencoded
application/x-x509-ca-certder crt
application/x-xfigfig
application/x-xliff+xmlxmlxf
application/x-xpinstallxpi
application/x-xzxx
application/x-zmachinez1 z2 z3 z4 z5 z6 z7 z8
# application/x400-bp
# application/xacml+xml
application/xaml+xmlxaml
# application/xcap-att+xml

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* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1.jar/org/springframework/http/mime.types

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* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-jar/org/springframework/http/server/reactive/ReactorServerHttpRequest.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-jar/org/springframework/http/codec/support/BaseDefaultCodecs.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-jar/org/springframework/http/server/reactive/DefaultServerHttpRequestBuilder.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-jar/org/springframework/http/server/reactive/UndertowServerHttpResponse.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-jar/org/springframework/web/cors/reactive/CorsUtils.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-jar/org/springframework/web/server/handler/ExceptionHandlingWebHandler.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-jar/org/springframework/http/ResponseCookie.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-jar/org/springframework/http/codec/multipart/MultipartHttpMessageReader.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1.jar/org/springframework/http/code/xml/Jaxb2XmlDecoder.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1.jar/org/springframework/web/server/handler/ResponseStatusExceptionHandler.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1.jar/org/springframework/http/client/reactive/JettyClientHttpResponse.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1.jar/org/springframework/web/server/session/DefaultWebSessionManager.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1.jar/org/springframework/http/client/support/InterceptingHttpAccessor.java
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* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-jar/org/springframework/http/server/reactive/ServerHttpRequest.java
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* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-jar/org/springframework/web/bind/annotation/SessionAttributes.java
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* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-jar/org/springframework/web/filter/RequestContextFilter.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-jar/org/springframework/web/server/WebFilter.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-jar/org/springframework/web/server/WebFilterChain.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-jar/org/springframework/web/context/request/DestructionCallbackBindingListener.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-jar/org/springframework/http/client/AbstractClientHttpRequestFactoryWrapper.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-jar/org/springframework/web/filter/ CommonsRequestLoggingFilter.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-jar/org/springframework/http/ converter/HttpMessageConversionException.java
*/

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jar/org/springframework/web/multipart/MultipartResolver.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-
jar/org/springframework/http/HttpMessage.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-
jar/org/springframework/web/bind/support/SpringWebConstraintValidatorFactory.java
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jar/org/springframework/web/bind/annotation/ResponseStatus.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-
jar/org/springframework/http/client/OkHttp3ClientHttpResponse.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-
jar/org/springframework/http/converter/json/MappingJacksonInputMessage.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-
jar/org/springframework/web/bind/MethodArgumentNotValidException.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-
jar/org/springframework/http/client/AbstractAsyncClientHttpRequest.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-
jar/org/springframework/web/method/support/HandlerMethodReturnValueHandler.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-
jar/org/springframework/web/context/support/HttpRequestHandlerServlet.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-
jar/org/springframework/web/HttpMediaTypeNotSupportedException.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-
jar/org/springframework/remoting/caucho/HessianClientInterceptor.java
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* /opt/cola/permits/1135888219_1613626164_16/0/spring-web-5-2-8-release-sources-1-jar/org/springframework/web/bind/support/SessionAttributeStore.java
* /opt/cola/permits/1135888219_1613626164_16/0/spring-web-5-2-8-release-sources-1-jar/org/springframework/web/bind/ServletRequestDataBinder.java
* /opt/cola/permits/1135888219_1613626164_16/0/spring-web-5-2-8-release-sources-1-jar/org/springframework/web/context/request/async/DeferredResultProcessingInterceptorAdapter.java
* /opt/cola/permits/1135888219_1613626164_16/0/spring-web-5-2-8-release-sources-1-jar/org/springframework/http/client/HttpComponentsStreamingClientHttpRequest.java
* /opt/cola/permits/1135888219_1613626164_16/0/spring-web-5-2-8-release-sources-1-jar/org/springframework/remoting/httpinvoker/HttpInvokerClientInterceptor.java
* /opt/cola/permits/1135888219_1613626164_16/0/spring-web-5-2-8-release-sources-1-jar/org/springframework/web/context/request/AsyncWebRequestInterceptor.java
* /opt/cola/permits/1135888219_1613626164_16/0/spring-web-5-2-8-release-sources-1-jar/org/springframework/web/multipart/support/RequestPartServletServerHttpRequest.java
* /opt/cola/permits/1135888219_1613626164_16/0/spring-web-5-2-8-release-sources-1-jar/org/springframework/web/context/request/async/TimeoutCallableProcessingInterceptor.java
* /opt/cola/permits/1135888219_1613626164_16/0/spring-web-5-2-8-release-sources-1-jar/org/springframework/web/context/support/ContextExposingHttpServletRequest.java
* /opt/cola/permits/1135888219_1613626164_16/0/spring-web-5-2-8-release-sources-1-jar/org/springframework/web/context/support/StaticWebApplicationContext.java
* /opt/cola/permits/1135888219_1613626164_16/0/spring-web-5-2-8-release-sources-1-jar/org/springframework/web/server/i18n/LocaleContextResolver.java
* /opt/cola/permits/1135888219_1613626164_16/0/spring-web-5-2-8-release-sources-1-jar/org/springframework/http/converter/feed/RssChannelHttpMessageConverter.java
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* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-
jar/org/springframework/http/codec/cbor/Jackson2CborEncoder.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-
jar/org/springframework/web/context/request/async/DeferredResult.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-
jar/org/springframework/web/util/pattern/PathPatternRouteMatcher.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-
jar/org/springframework/web/filter/OncePerRequestFilter.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-
jar/org/springframework/web/method/support/HandlerMethodArgumentResolverComposite.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-
jar/org/springframework/web/server/session/InMemoryWebSessionStore.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-
jar/org/springframework/web/cors/CorsConfiguration.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-
jar/org/springframework/web/util/HtmlUtils.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-
jar/org/springframework/web/multipart/commons/CommonsMultipartFile.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-
jar/org/springframework/http/codec/protobuf/ProtobufEncoder.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-
jar/org/springframework/http/client/support/HttpAccessor.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-
jar/org/springframework/http/server/ServerHttpRequest.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-
jar/org/springframework/http/codec/xml/XmlEventDecoder.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-
jar/org/springframework/http/codec/support/ClientDefaultCodecsImpl.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-
jar/org/springframework/http/codec/support/DefaultServerCodecConfigurer.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-
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* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-
jar/org/springframework/web/session/InMemoryWebSessionStore.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-
jar/org/springframework/web/multipart/support/MultipartResolutionDelegate.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-
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* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-
jar/org/springframework/web/session/InMemoryWebSessionStore.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1-
jar/org/springframework/web/cors/CorsConfiguration.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1.jar/org/springframework/web/client/HttpStatusCodeException.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1.jar/org/springframework/http/server/PathContainer.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1.jar/org/springframework/http/server/reactive/AbstractListenerWriteFlushProcessor.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1.jar/org/springframework/http/CacheControl.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1.jar/org/springframework/http/client/RestOperations.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1.jar/org/springframework/web/filter/reactive/ServerWebExchangeContextFilter.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1.jar/org/springframework/http/HttpRange.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1.jar/org/springframework/web/bind/annotation/CrossOrigin.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1.jar/org/springframework/http/server/reactive/HttpHeadResponseDecorator.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1.jar/org/springframework/http/client/SimpleClientHttpResponse.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1.jar/org/springframework/web/accept/MediaTypeFileExtensionResolver.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1.jar/org/springframework/web/cors/UrlBasedCorsConfigurationSource.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1.jar/org/springframework/web/util/RestControllerAdvice.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1.jar/org/springframework/web/cors/UrlBasedCorsConfigurationSource.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1.jar/org/springframework/web/sql/SqlFilter.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1.jar/org/springframework/web/cors/CorsWebFilter.java
* /opt/cola/permits/1135888219_1613626164.16/0/spring-web-5-2-8-release-sources-1.jar/org/springframework/web/util/HtmlCharacterEntityDecoder.java

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* /opt/cola/permits/113588219_1613626164.16/0/spring-web-5-2-8-release-sources-1.jar/org/springframework/web/context/support/ServletContextPropertySource.java
* /opt/cola/permits/113588219_1613626164.16/0/spring-web-5-2-8-release-sources-1.jar/org/springframework/web/context/support/ServletContextPropertySource.java
* /opt/cola/permits/113588219_1613626164.16/0/spring-web-5-2-8-release-sources-1.jar/org/springframework/web/context/support/ServletContextPropertySource.java
* /opt/cola/permits/113588219_1613626164.16/0/spring-web-5-2-8-release-sources-1.jar/org/springframework/web/context/support/ServletContextPropertySource.java
* /opt/cola/permits/113588219_1613626164.16/0/spring-web-5-2-8-release-sources-1.jar/org/springframework/web/context/support/ServletContextPropertySource.java
* /opt/cola/permits/113588219_1613626164.16/0/spring-web-5-2-8-release-sources-1.jar/org/springframework/web/context/support/ServletContextPropertySource.java
* /opt/cola/permits/113588219_1613626164.16/0/spring-web-5-2-8-release-sources-1.jar/org/springframework/web/context/support/ServletContextPropertySource.java
* /opt/cola/permits/113588219_1613626164.16/0/spring-web-5-2-8-release-sources-1.jar/org/springframework/web/context/support/ServletContextPropertySource.java
* /opt/cola/permits/113588219_1613626164.16/0/spring-web-5-2-8-release-sources-1.jar/org/springframework/web/context/support/ServletContextPropertySource.java
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1.311 @tensorflow/tfjs-backend-wasm 3.11.0

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 *
 *=============================================================================

import {gather_util, GatherNd, GatherNdInputs, KernelConfig, TensorInfo} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {CppDType} from './types';

let wasmGatherNd: (xId: number, dtype: CppDType, indicesId: number, numSlices: number, sliceRank: number, sliceSize: number, strides: Uint8Array, outId: number) => void;
BackendWasm): void {
  wasmGatherNd = backend.wasm.cwrap(GatherNd, null /*void*/, [
    'number', // xId
    'number', // dtype
    'number', // indicesId
    'number', // numSlices
    'number', // sliceRank
    'number', // sliceSize
    'array',   // strides
    'number'   // outId
  ]);
  wasmGatherNd = backend.wasm.cwrap(GatherNd, null /*void*/, [
    'number', // xId
    'number', // dtype
    'number', // indicesId
    'number', // numSlices
    'number', // sliceRank
    'number', // sliceSize
    'array',   // strides
    'number'   // outId
  ]);
  wasmGatherNd = backend.wasm.cwrap(GatherNd, null /*void*/, [
    'number', // xId
    'number', // dtype
    'number', // indicesId
    'number', // numSlices
    'number', // sliceRank
    'number', // sliceSize
    'array',   // strides
    'number'   // outId
  ]);}

function gatherNd(args: {backend: BackendWasm,
  inputs: GatherNdInputs}):
  TensorInfo {
    const {backend, inputs} = args;
    const {params, indices} = inputs;
    const resultShape = indicesShape;
    const numSlices = indicesShape.length - 1;
    const xData = backend.dataIdMap.get(params.dataId);
    const xId = xData.id;
    const out = backend.makeOutput(resultShape, params.dtype);
    if (numSlices === 0) {
      return out;
    }
    const indicesShape = indicesShape;
    const sliceRank = indicesShape.length - 1;
    const xData = backend.dataIdMap.get(params.dataId);
    const xId = xData.id;
    const outId = backend.dataIdMap.get(out.dataId);
    const xData = backend.dataIdMap.get(indices.dataId);
    const indicesId = indicesData.id;
    const xData = backend.dataIdMap.get(indices.dataId);
    const outId = backend.dataIdMap.get(out.dataId);
    const xData = backend.dataIdMap.get(indices.dataId);
    const indicesId = indicesData.id;
    const xData = backend.dataIdMap.get(indices.dataId);
    const indicesId = indicesData.id;
    const xData = backend.dataIdMap.get(indices.dataId);
    const indicesId = indicesData.id;
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    const indicesId = indicesData.id;
    const xData = backend.dataIdMap.get(indices.dataId);
    const indicesId = indicesData.id;
    const xData = backend.dataIdMap.get(indices.dataId);
    const indicesId = indicesData.id;
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    const indicesId = indicesData.id;
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    const indicesId = indicesData.id;
    const xData = backend.dataIdMap.get(indices.dataId);
    const indicesId = indicesData.id;
    const xData = backend.dataIdMap.get(indices.dataId);
    const indicesId = indicesData.id;
import {backend_util, Concat, ConcatAttrs, ConcatInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';
import {concatImplCPU} from '../kernel_utils/shared';
import {identity} from './Identity';
import {reshape} from './Reshape';

export function concat(args: {inputs: ConcatInputs, backend: BackendWasm, attrs: ConcatAttrs}) {
  const {inputs, backend} = args;

  const axis = util.parseAxisParam(args.attrs.axis, inputs[0].shape)[0];

  let outShape = backend_util.computeOutShape(inputs.map(t => t.shape), axis);

  // Keep only non-empty tensors (ignore tensors
  // with 0 in their shape).
  const $inputs = inputs.filter(t => util.sizeFromShape(t.shape) > 0);
  if ($inputs.length === 1) {
    return identity({inputs: {x: $inputs[0]}, backend});
  }

  const out = backend.makeOutput(outShape, inputs[0].dtype);

  if (util.sizeFromShape(outShape) === 0) {
    return out;
  }

  const shapes = $inputs.map(t => t.shape);
  backend_util.assertParamsConsistent(shapes, axis);

  if ($inputs[0].dtype === 'string') {
    // Any concat of n-dimensional tensors across any axis can be reduced to
    // a concatenation of two-
    // dimensional tensors across the axis 1 by first
    // partitioning the axes of the original tensors into those less than
    // the
    // axis to be concatenated and the rest. Then reshape the tensors
    // into a two-dimensional tensor by collapsing
    // these two sets of axes and
    // concatenating the resulting matrices across the axis 1, finally
    // reshaping
    // the result to have the proper shape.
    const inputs2D = $inputs.map(t => {
      const innerSize = util.sizeFromShape(t.shape.slice(axis));
      const shape = [-1, innerSize];
      return reshape({inputs: {x: t}, backend, attrs: {shape}});
    });

    const inputsValShapes = inputs2D.map(t => {
      return {vals: backend.readSync(t.dataId), shape: t.shape};
    });

    // Concats 2d tensors along axis=1.
    outShape = backend_util.computeOutShape(inputs2D.map(t => t.shape), 1 /* axis */);
    const simplyConcat = inputs2D[0].shape[0] === 1;

    // const inputs = inputs.filter(t => (util.sizeFromShape(t.shape) > 0));
    // const inputs2D = $inputs.map(t => {
    //   const innerSize = util.sizeFromShape(t.shape.slice(axis));
    //   const shape = [-1, innerSize];
    //   return reshape({inputs: {x: t}, backend, attrs: {shape}});
    // });
    // const inputsValShapes = inputs2D.map(t => {
    //   return {vals: backend.readSync(t.dataId), shape: t.shape};
    // });
    // const input = inputs2D[0].shape[0] === 1;
    // const outValShapes = concats ImplCPU($inputsValShapes, outShape, inputs[0].dtype);
backend_util.computeOutShape(inputs.map(t => t.shape), axis);\n\nconst outData = backend.dataIdMap.get(out.dataId);\nconst outData.stringBytes = backend_util.fromStringArrayToUint8(outVals);\n\nbackend.fromStringArrayToUint8(outVals);\n\ninputs2D.forEach(t => backend.disposeData(t.dataId));

return out;
\n\nconst batchDim = util.sizeFromShape($inputs[0].shape.slice(0, axis));
const sumInnerDims = 0;
\n$inputs.map(input => {\n  const innerDim = util.sizeFromShape(input.shape.slice(axis));\n  const innerDim += innerDim;\n  const inVals = $inputs.map(input => input.shape.slice(0, axis));
  const outVals = backend.typedArrayFromHeap(out);
  \n  for (let b = 0; b < batchDim; b++) {\n    let outOffset = b * sumInnerDims;\n    \n    inputs2D.forEach(t => backend.disposeData(t.dataId));
  }
  return out;
\n  return out;
\n  const innerDim = util.sizeFromShape(input.shape.slice(axis));
  \n  inputs2D.forEach(t => backend.disposeData(t.dataId));

return out;
\nexport const concatConfig: KernelConfig = {
  kernelName: Concat,
  backendName: 'wasm',
  kernelFunc: concat as {} as KernelFunc,
};
function select(args: {inputs: SelectInputs, backend: BackendWasm}) {
  const {inputs, backend} = args;
  const {condition, t, e} = inputs;

  const conditionId = backend.dataIdMap.get(condition.dataId).id;
  const tId = backend.dataIdMap.get(t.dataId).id;
  const eId = backend.dataIdMap.get(e.dataId).id;
  const out = backend.makeOutput(t.shape, t.dtype);
  const outId = backend.dataIdMap.get(out.dataId).id;

  const cRank = condition.shape.length;
  const tRank = t.shape.length;

  const offset = cRank === 0 || cRank > 1 || tRank === 1 ? 1 :

  util.sizeFromShape(t.shape.slice(1));

  wasmSelect(conditionId, tId, eId, offset, outId);
  return out;
}

export const selectConfig: KernelConfig = {
  kernelName: Select,
  backendName: 'wasm',
  kernelFunc: select as {} as KernelFunc,
  setupFunc: setup
};
/**
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 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
 * implied. See the License for the specific language governing permissions and
 * limitations under the License.
 */

import * as tf from '@tensorflow/tfjs-core';
import {registerBackend, removeBackend, test_util, util} from
'@tensorflow/tfjs-core';
// tslint:disable-next-line:no-imports-from-dist
import {ALL_ENVS, BROWSER_ENVS, describeWithFlags} from
'@tensorflow/tfjs-core/dist/jasmine_util';

import {init, resetWasmPath} from './backend_wasm';
import {BackendWasm, setWasmPath, setWasmPaths} from './index';

/**
 * Tests specific to the wasm backend. The name of these tests must start with 'wasm' so that they are always included in the test runner. See env.specFilter in 'setup_test.ts' for details.
 */
describeWithFlags('wasm read/write', ALL_ENVS, () => {
  it('write and read values', async () => {
    const x = tf.tensor1d([1, 2, 3]);
    test_util.expectArraysClose([1, 2, 3], await x.data());
  });

  it('allocate repetitively and confirm reuse of heap space', () => {
    const backend = tf.backend() as BackendWasm;
    const size = 100;
    // Allocate for the first time, record the memory offset and dispose.
    const t1 = tf.zeros([size]);
    const memOffset1 = backend.getMemoryOffset(t1.dataId);
    t1.dispose();

    // Allocate again and make sure the offset is the same (memory was reused).
    const t2 = tf.zeros([size]);
    const memOffset2 = backend.getMemoryOffset(t2.dataId);
    // This should fail in case of a memory leak.
    expect(memOffset1).toBe(memOffset2);
  });

  it('allocates buffers with byteOffsets', async () => {
    const data = [-0.5, 0.5, 3.14];
    const buffer = new ArrayBuffer(32);
    const view = new Float32Array(buffer, 8, data.length);
    // Write values to buffer.
    for (let i = 0; i < data.length; ++i) {
      view[i] = data[i];
    }
    const t = tf.tensor(view);
    // Tensor values should match.
    test_util.expectArraysClose(await t.data(), view);
  });
});

describeWithFlags('wasm init', BROWSER_ENVS, () => {
  beforeEach(() => {
    registerBackend('wasm-test', async () => {
      const {wasm} = await init();
      return new BackendWasm(wasm);
    }, 100);
    // Silences backend registration warnings.
    spyOn(console, 'warn');
    spyOn(console, 'log');
  });

  afterEach(() => {
    resetWasmPath();
    removeBackend('wasm-test');
  });

  it('backend init fails when the path is invalid', async () => {
    setWasmPath('invalid/path');
    let wasmPath: string;
    const realFetch = fetch;
    spyOn(self, 'fetch').and.callFake((path: string) => {
      wasmPath = path;
      return realFetch(path);
    });
    expect(await tf.setBackend('wasm-test')).toBe(false);
    expect(wasmPath).toBe('invalid/path');
  });

  it('backend init fails when setWasmPaths is called with an invalid prefix', async () => {
    setWasmPaths({
      'tfjs-backend-wasm.wasm': 'invalid/path',
      'tfjs-backend-wasm-simd.wasm': 'invalid/path',
      'tfjs-backend-wasm-threaded-simd.wasm': 'invalid/path'
    });
    let wasmPathPrefix: string;
    const realFetch = fetch;
    spyOn(self, 'fetch').and.callFake((path: string) => {
      wasmPathPrefix = path;
      return realFetch(path);
    });
    expect(await tf.setBackend('wasm-test')).toBe(false);
    expect(wasmPathPrefix).toBe('invalid/path');
  });
});
open-source-used-in-cisco-meeting-server-forty-three-it('setWasmPaths throws error when called without specifying a path for `tfjs-backend-wasm.wasm', the binary')

async () => {

setWasmPaths({
  'tfjs-backend-wasm.wasm': '/base/wasm-out/tfjs-backend-wasm.wasm'
});

).toThrow();

); // it('backend init works when the path is valid and use platform fetch')

async () => {

const usePlatformFetch = true;

const validPrefix = '/base/wasm-out/tfjs-backend-wasm-threads-simd.wasm';

setWasmPaths(validPrefix, usePlatformFetch);

let wasmPath: string;

spyOn(utility, 'fetch').and.callFake((path: string) => {

wasmPath = path;

return realFetch(path);

});

); // it('backend init works when the path is valid and using platform fetch')

async () => {

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const validPrefix = '/base/wasm-out/tfjs-backend-wasm-threads-simd.wasm';

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setWasmPaths(validPrefix, usePlatformFetch);

let wasmPath: string;

spyOn(utility, 'fetch').and.callFake((path: string) => {

wasmPath = path;

return realFetch(path);

});

);
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=============================================================================

*/

import {KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';
import {Fill, FillAttrs} from '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';

export function fill(args: {attrs: FillAttrs, backend: BackendWasm}) {
  const {attrs: {shape, value, dtype}, backend} = args;
  const out = backend.makeOutput(shape, dtype);
  const outVals = backend.typedArrayFromHeap(out);
  outVals.fill(value as number);
  return out;
}

export const fillConfig: KernelConfig = {
  kernelName: Fill,
  backendName: 'wasm',
  kernelFunc: fill as {} as KernelFunc,
};

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 *=============================================================================
 */

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Fill.js.map

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

{"version":3,"file":"FusedBatchNorm.js","sourceRoot":null,"sources":[null],"mappings":null,"names":null}
IMPORT shared functionality from tfjs-backend-cpu without triggering side effects:
import {concatImpl as concatImplCPU} from '@tensorflow/tfjs-backend-cpu/dist/shared';
import {sliceImpl as sliceImplCPU} from '@tensorflow/tfjs-backend-cpu/dist/shared';
import {rangeImpl as rangeImplCPU} from '@tensorflow/tfjs-backend-cpu/dist/shared';
export {concatImplCPU, rangeImplCPU, sliceImplCPU};

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

```typescript
import {backend_util, FusedConv2D, FusedConv2DAttrs, FusedConv2DInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {FusableActivation} from './types';

let wasmFusedConv2d:
    (xId: number, batchSize: number, inputHeight: number, inputWidth: number,
     filterId: number, filterHeight: number, filterWidth: number,
     biasId: number, padTop: number, padRight: number, padBottom: number,
     padLeft: number, isSamePad: number, dilationHeight: number,
     dilationWidth: number, strideHeight: number, strideWidth: number,
     inputChannels: number, outputChannels: number, activation: number,
     preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>
        void;

function setup(backend: BackendWasm) {
  wasmFusedConv2d = backend.wasm.cwrap(FusedConv2D, null /* void */, 
    'number', // xId: number
    'number',  // batchSize
    'number',  // inputHeight: number
    'number',  // inputWidth: number
    'number',  // filterId: number
    'number',  // filterHeight: number
    'number',  // filterWidth: number
    'number',  // biasId: number
    'number',  // padTop: number
    'number',  // padBottom: number
    'number',  // padLeft: number
    'number',  // dilationHeight: number
    'number',  // dilationWidth: number
    'number',  // strideHeight: number
    'number',  // strideWidth: number
    'number',  // inputChannels: number
    'number',  // outputChannels: number
    'number',  // activation: number
    'number',  // preluActivationWeightsId: number
    'number',  // leakyreluAlpha: number
    'number',  // outId: number
  );
}

function fusedConv2d(args: {
  inputs: FusedConv2DInputs,
  backend: BackendWasm,
  attrs: FusedConv2DAttrs
}) {
  const {inputs, backend, attrs} = args;
  const {strides, pad, dilations, dataFormat, dimRoundingMode, activation, leakyreluAlpha} = attrs;
  const convInfo = backend_util.computeConv2DInfo((inputs[0] as Tensor4D).shape, (inputs[1] as Tensor4D).shape, strides, pad, dimRoundingMode, activation, leakyreluAlpha);
  const filterId = convInfo.filterId;
  const biasId = 0;
  if (bias != null) {
    const biasData = backend.datadMap.get(filterId).id;
    const filterId = backend.datadMap.get(filterId).id;
  }
  const outputChannels = convInfo.outputChannels;
  if (outputChannels != 0) {
    let biasId = 0;
  }
```

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throw new Error(`FusedConv2D only supports rank-1 bias but got ` +
`rank 
${biasData.shape.length}).`);
  } if (biasData.shape[0] !== outputChannels) {
    throw new Error(`FusedConv2D bias shape (${biasData.shape}) does not ` +
      `match the number of output channels (${outputChannels}`).`);
  }
  const filterHeight = convInfo.filterHeight;
  const filterWidth = convInfo.filterWidth;
  const padTop = convInfo.padInfo.top;
  const padRight = convInfo.padInfo.right;
  const padBottom = convInfo.padInfo.bottom;
  const padLeft = convInfo.padInfo.left;
  const dilationHeight = convInfo.dilationHeight;
  const dilationWidth = convInfo.dilationWidth;
  const strideHeight = convInfo.strideHeight;
  const strideWidth = convInfo.strideWidth;
  const inputChannels = convInfo.inChannels;
  const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;
  const batchSize = convInfo.batchSize;
  const inHeight = convInfo.inHeight;
  const inWidth = convInfo.inWidth;
  if (dataFormat !== 'NHWC') {
    throw new Error(`wasm backend FusedConv2D does not support 
` +
      `dataFormat:'` +
      `${dataFormat}'. Please use 'NHWC'.`);
  }
  const out = backend.makeOutput(convInfo.outShape, 'float32');
  const outId = backend.dataIdMap.get(out.dataId).id;
  const preluActivationWeightsId = preluActivationWeights == null ?
    0 : backend.dataIdMap.get(preluActivationWeights.dataId).id;
  const xId = backend.dataIdMap.get(preluActivationWeights.dataId).id;
  const xDataId = wasmFusedConv2d(xId, batchSize, inHeight, inWidth, filterId, filterHeight, filterWidth,
    biasId, padTop, padRight, padBottom, padLeft, isSamePad,
    dilationHeight, dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels,
    fusedActivation, preluActivationWeightsId, leakyreluAlpha || 0, outId);
  const outHeader = backend.outHeaderMap.get(out.dataId);
  return out;
}

export const fusedConv2DConfig: KernelConfig = {
  kernelName: FusedConv2D,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: fusedConv2D as {} as KernelFunc
};
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/OneHot.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Identity.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Cumsum.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/register_all_kernels.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/SplitV.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Neg.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/OnesLike.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/ZerosLike.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Neg.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Select.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Prod.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Prod.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Step.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/NonMaxSuppressionV4.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Pack.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/base.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Equal.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/flags_wasm.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Floor.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Range.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Conv2DBackpropInput.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Cumsum.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Sqrt.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/OnesLike.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/flags_wasm.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Conv2DBackpropInput.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Prod.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Step.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/base.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Fill.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Range.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Neg.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Reverse.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/
No license file was found, but licenses were detected in source scan.

```javascript
/**
 * @license
 * Copyright 2019 Google LLC. All Rights Reserved.
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 * you may not use this file except in compliance with the License.
 * You may obtain a copy of the License at
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 * http://www.apache.org/licenses/LICENSE-2.0
 *
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 * distributed under the License is distributed on an "AS IS"
 * BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
 * See the License for the specific language governing permissions and
 * limitations under the License.
 */
```

---

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import {KernelConfig, KernelFunc, Tile, TileAttrs, TileInputs} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {CppDType} from './types';

let wasmTile: (xId: number, xShape: Uint8Array, xShapeSize: number, newShape: Uint8Array, newShapeSize: number, dtypes: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmTile = backend.wasm.cwrap(Tile, null /* void */, ['number',  // x_id
    'array',   // x_shape
    'number',  // x_shape.length
    'array',   // new_shape
    'number',  // new_shape.length
    'number']  // dtype
  );
}

function tile({inputs, backend, attrs}) {  
  const {x} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  const {reps} = attrs;

  const newShape: number[] = new Array(x.shape.length);
  for (let i = 0; i < newShape.length; i++) {
    newShape[i] = x.shape[i] * reps[i];
  }
  const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);
  const newShapeBytes = new Uint8Array(new Int32Array(newShape).buffer);

  const out = backend.makeOutput(newShape, x.dtype);
  const outId = backend.dataIdMap.get(out.dataId).id;
  wasmTile(xId, xShapeBytes, x.shape.length, newShapeBytes, newShape.length,
    CppDType[out.dtype], outId);
  return out;
}

export const tileConfig: KernelConfig = {
  kernelName: Tile,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: tile as {} as KernelFunc
};
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BASIS, * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied. * See the License for the specific language governing permissions and * limitations under the License. *

```

import { KernelConfig, Ceil } from '@tensorflow/tfjs-core';

import { createUnaryKernelConfig } from './unary_kernel';

export const ceilConfig: KernelConfig = createUnaryKernelConfig(Ceil);
```

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.

```

import { KernelConfig, Ceil } from '@tensorflow/tfjs-core';

import { createUnaryKernelConfig } from './unary_kernel';

export const ceilConfig: KernelConfig = createUnaryKernelConfig(Ceil);
```

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.

```

import { KernelConfig, Ceil } from '@tensorflow/tfjs-core';

import { createUnaryKernelConfig } from './unary_kernel';

export const ceilConfig: KernelConfig = createUnaryKernelConfig(Ceil);
```
import {KernelConfig, KernelFunc, Reverse, ReverseAttrs, ReverseInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {identity} from './Identity';
import {reshape} from './Reshape';

let wasmReverse: (xId: number, axes: Uint8Array, axesLength: number, outShape: Uint8Array, outShapeLength: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmReverse = backend.wasm.cwrap(Reverse, null, [
    'number',  // x_id
    'array',   // axes
    'number',  // axes_length
    'array',   // out_shape
    'number',  // out_shape_length
    'number'   // out_id
  ]);}

export function reverse(args: {inputs: ReverseInputs, backend: BackendWasm, attrs: ReverseAttrs}): TensorInfo {
  const {inputs, backend, attrs} = args;
  const {x} = inputs;
  const {dims} = attrs;

  const axes = util.parseAxisParam(dims, x.shape);

  if (x.shape.length === 0) {
    return identity({inputs: {x}, backend});
  }

  const out = backend.makeOutput(x.shape, x.dtype);
  const xId = backend.dataIdMap.get(x.dataId).id;
  const outId = backend.dataIdMap.get(out.dataId).id;

  const axesBytes = new Uint8Array(new Int32Array(axes).buffer);
  const outShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);

  wasmReverse(xId, axesBytes, axes.length, outShapeBytes, x.shape.length, outId);

  const reshaped = reshape({inputs: {x: out}, attrs: {shape: x.shape}, backend});

  backend.disposeData(out.dataId);
  return reshaped;
}

export const reverseConfig: KernelConfig = {
  kernelName: Reverse,
  backendName: 'wasm',
  kernelFunc: reverse as {} as KernelFunc,
  setupFunc: setup
};

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"version":3,"file":"Exp.js","sourceRoot":null,"sources":[]}
import {Exp, KernelConfig} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';

export const expConfig: KernelConfig = createUnaryKernelConfig(Exp, 'float32');

const supportsFullBroadcast = false;
export const greaterConfig: KernelConfig =
  createBinaryKernelConfig(Greater, supportsFullBroadcast, 'bool');
No license file was found, but licenses were detected in source scan.

```javascript
import {BackendWasm} from '../backend_wasm';

// Analogous to `struct Result` in `non_max_suppression_impl.h`.
interface Result {
  pSelectedIndices: number;
  selectedSize: number;
  pSelectedScores: number;
  pValidOutputs: number;
}
/**
 * Parse the result of the c++ method, which has the shape equivalent to `Result`.
 * @export
 */
export function parseResultStruct(
    backend: BackendWasm, resOffset: number): Result {
  const result = new Int32Array(backend.wasm.HEAPU8.buffer, resOffset, 4);
  const pSelectedIndices = result[0];
  const selectedSize = result[1];
  const pSelectedScores = result[2];
  const pValidOutputs = result[3];
  // Since the result was allocated on the heap, we have to delete it.
  backend.wasm._free(resOffset);
  return {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs};
}
```

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.

```javascript
import {Abs, KernelConfig} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';

export const absConfig: KernelConfig = createUnaryKernelConfig(Abs);
```

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.

```javascript
import {Abs, KernelConfig} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';

export const absConfig: KernelConfig = createUnaryKernelConfig(Abs);
```
Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backendwasm/dist/kernels/Abs.js.map
No license file was found, but licenses were detected in source scan.
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s"],"names":[],"mappings":"AAAA;;;;;;;;;;;;;;;GAeG;AAEH,OAAO,EAAC,YAAY,EAAE,mBAAmB,EAA6F,IAAI,
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import {backend_util, Conv2DBackpropInput, Conv2DBackpropInputAttrs, Conv2DBackpropInputInputs, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmConv2DBackpropInput: (dyId: number, filterId: number, batchSize: number, filterHeight: number, filterWidth: number, inHeight: number, inWidth: number, inChannels: number, outHeight: number, outWidth: number, outChannels: number, strideHeight: number, strideWidth: number, topPad: number, leftPad: number, fltS0: number, fltS1: number, fltS2: number, xBatchStride: number, xColStride: number, xChannelStride: number, yBatchStride: number, yRowStride: number, yColStride: number, yChannelStride: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmConv2DBackpropInput = backend.wasm.cwrap(Conv2DBackpropInput, null, [
    'number',  // dyId
    'number',  // filterId
    'number',  // batchSize
    'number',  // filterHeight
    'number',  // filterWidth
    'number',  // inHeight
    'number',  // inWidth
    'number',  // inChannels
    'number',  // outHeight
    'number',  // outWidth
    'number',  // outChannels
    'number',  // strideHeight
    'number',  // strideWidth
    'number',  // topPad
    'number',  // leftPad
    'number',  // fltS0
    'number',  // fltS1
    'number',  // fltS2
    'number',  // xBatchStride
    'number',  // xColStride
    'number',  // xChannelStride
    'number',  // yBatchStride
    'number',  // yRowStride
    'number',  // yColStride
    'number',  // yChannelStride
    'number',  // outId
  ]);
}

function conv2DBackpropInput(args: {
  backend: BackendWasm,
  inputs: Conv2DBackpropInputInputs,
  attrs: Conv2DBackpropInputAttrs
}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {dy, filter} = inputs;
  const {strides, pad, dataFormat, dimRoundingMode, inputShape} = attrs;

  const dilations = 1;

  const $dataFormat = backend_util.convertConv2DDataFormat(dataFormat);
  const convInfo = backend_util.computeConv2DInfo(inputShape, filter.shape as [number, number, number, number], strides, dilations, pad, dimRoundingMode, false /* depthwise */, $dataFormat);
  const {batchSize, filterHeight, filterWidth, inChannels, inHeight, inWidth, outChannels, outHeight, outWidth, strideHeight, strideWidth} = convInfo;
  const topPad = filterHeight - 1 - convInfo.padInfo.top;
  const leftPad = filterWidth - 1 - convInfo.padInfo.left;
  const isChannelsLast = convInfo.dataFormat === 'channelsLast';
  const dxStrides = util.computeStrides(convInfo.inShape);
  const dyStrides = util.computeStrides(dy.shape);
  const [fltS0, fltS1, fltS2] = util.computeStrides(filter.shape);
  const xBatchStride = dxStrides[0];
  const xColStride = isChannelsLast ? dxStrides[1] : dxStrides[2];
  const xChannelStride = isChannelsLast ? dxStrides[1] : dxStrides[2];
  const yBatchStride = dyStrides[0];
  const yRowStride = isChannelsLast ? dyStrides[1] : dyStrides[2];
  const yColStride = isChannelsLast ? dyStrides[1] : dyStrides[2];
  const yChannelStride = isChannelsLast ? 1 : dyStrides[1];
  const outId = backend.makeOutput(convInfo.inShape, 'float32');
  const outId = backend.dataIdMap.get(out.dataId).id;
  const dyId = backend.dataIdMap.get(dy.dataId).id;
  const filterId = backend.dataIdMap.get(filter.dataId).id;
  const wasmConv2DBackpropInput = backend.wasm.cwrap(Conv2DBackpropInput, null, [
    'number',  // dyId
    'number',  // filterId
    'number',  // batchSize
    'number',  // filterHeight
    'number',  // filterWidth
    'number',  // inHeight
    'number',  // inWidth
    'number',  // inChannels
    'number',  // outHeight
    'number',  // outWidth
    'number',  // outChannels
    'number',  // strideHeight
    'number',  // strideWidth
    'number',  // topPad
    'number',  // leftPad
    'number',  // fltS0
    'number',  // fltS1
    'number',  // fltS2
    'number',  // xBatchStride
    'number',  // xColStride
    'number',  // xChannelStride
    'number',  // yBatchStride
    'number',  // yRowStride
    'number',  // yColStride
    'number',  // yChannelStride
    'number',  // outId
  ]);

  wasmConv2DBackpropInput(dyId, filterId, batchSize, filterHeight, filterWidth, inHeight, inWidth, inChannels, outHeight, outWidth, outChannels, strideHeight, strideWidth, topPad, leftPad, fltS0, fltS1, fltS2, xBatchStride, xRowStride, xColStride, xChannelStride, yBatchStride, yRowStride, yColStride, yChannelStride, outId);

  return out;
}

export const conv2DBackpropInputConfig: KernelConfig = {
  kernelName: 'Conv2DBackpropInput',
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: conv2DBackpropInput as {} as KernelFunc
};

Found in path(s):
  * /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Conv2DBackpropInput.js.map
No license file was found, but licenses were detected in source scan.

```
```

---

The image contains a code snippet from a file named `ArgMax.js` which is part of the Cisco Meeting Server (formerly Acano Server) 3.4. The code snippet includes the source code for the `ArgMax` kernel, which is part of the TensorFlow.js library. The code is written in TypeScript and includes comments explaining the licensing terms and the license file. The code snippet also includes a function for setting up the kernel and performing the `argmax` operation, which involves data permutation and handling of various input and output parameters. The code is structured to work with tensors and data arrays in the context of machine learning and data processing.

---

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 *
 *=============================================================================
 */

import {ArgMax, ArgMaxAttrs, ArgMaxInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {permuteAxesAndTranspose} from './kernel_utils';
import {CppDType} from './types';

let wasmFunc: (xId: number, dtype: number, outerSize: number, innerSize: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmFunc = backend.wasm.cwrap(ArgMax, null /* void */, [
    'number',  // x_id
    'number',  // dtype
    'number',  // outer_size
    'number',  // inner_size
    'number'   // out_id
  ]);}

function argmax(args: {inputs: ArgMaxInputs, backend: BackendWasm, attrs: ArgMaxAttrs}) {
  const {backend, inputs, attrs} = args;
  const {axis} = attrs as {} as ArgMaxAttrs;
  const {x} = inputs as {} as ArgMaxInputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  let inputId = xId;
  let input = x;

  const {transposed, axes, inputWasTransposed} = permuteAxesAndTranspose(x, axis, backend);
  if (inputWasTransposed) {
    const transposedId = backend.dataIdMap.get(transposed.dataId).id;
    if (transposedId !== xId) {
      // transpose was not a no-op. We will need to dispose of this input once we are done.
      input = transposed;
      inputId = transposedId;
    }
    input = transposed;
    inputId = transposedId;
  }
  const outShape = input.shape.slice(0, -1);
  const outerSize = util.sizeFromShape(outShape);
  const innerSize = input.shape[axes[0]];
  wasmFunc(inputId, outId);
  const outputId = backend.dataIdMap.get(out.dataId).id;
  const outerSize = util.sizeFromShape(out.shape);
```

---

The code snippet is an example of how TensorFlow.js handles data permutation and tensor operations, particularly in the context of machine learning and data processing. It demonstrates the use of the `permuteAxesAndTranspose` function to handle data reordering and the `wasmFunc` to perform the `argmax` operation using a WebAssembly backend.
CpDDType[input.dtype], outerSize, innerSize, outId);\n  if (inputWasTransposed) {
    // dispose of the transposed tensor.
    backend.disposeData(transposed.dataId);\n  }\n  return out;
\nexport const argMaxConfig: KernelConfig = {
  kernelName: ArgMax,\n  backendName: 'wasm',\n  kernelFunc: argmax as {} as KernelFunc,\n  setupFunc: setup\n};

Found in path(s):
* /opt/cola/permissions/1234600203_1638277742.68/0/tfjs-backend-wasm-dist/kernels/ArgMax.js.map

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Found in path(s):
* /opt/cola/permissions/1234600203_1638277742.68/0/tfjs-backend-wasm-dist/kernels/SpaceToBatchND.ts
* /opt/cola/permissions/1234600203_1638277742.68/0/tfjs-backend-wasm-dist/kernels/BatchToSpaceND.js

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 */

import {_FusedMatMul, _FusedMatMulAttrs, _FusedMatMulInputs, KernelConfig, KernelFunc} from
  '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {FusableActivation} from
  './types';

let wasmFusedMatMul:
  (aId: number,
   aShape: Uint8Array,
   aShapeSize: number,
   bId: number,
   bShape: Uint8Array,
   bShapeSize: number,
   transposeA: boolean,
   transposeB: boolean,
   activation: number,
   biasId: number,
   preluActivationWeightsId: number,
   leakyreluAlpha: number,
   outId: number) =>
  void;

function setup(backend: BackendWasm) {
  wasmFusedMatMul = backend.wasm.cwrap(_FusedMatMul,
    null /* void */, [
      'number',  // a_id
      'array',   // a_shape
      'number',  // a_shape.length
      'number',  // b_id
      'array',   // b_shape
      'number',  // b_shape.length
      'number',  // transpose_a
      'number',  // transpose_b
      'number',  // activation
      'number',  // biasId
      'number',  // prelu_activation_weights_id
      'number',  // leakyrelu_alpha
      'number',  // out_id
    ]);
}

function fusedBatchMatMul(args: {
  inputs:
    _FusedMatMulInputs,
  backend: BackendWasm,
  attrs: _FusedMatMulAttrs
}) {
  const {inputs, backend,
    attrs} = args;
  const {a, b, bias, preluActivationWeights} = inputs;

  if (a.dtype !== 'float32' || b.dtype !==
    'float32') {
    throw new Error(
      `_FusedMatMul for non float32 tensors not yet supported.`);
  }

  const {transposeA, transposeB, activation, leakyreluAlpha} = attrs;
  const aId =
backend.dataIdMap.get(a.dataId).id;
  const bId = backend.dataIdMap.get(b.dataId).id;

  let biasId = 0;
  if (bias != null) {
    const biasData = backend.dataIdMap.get(bias.dataId);
    if (biasData.shape.length !== 1) {
      throw new Error(_FusedMatMul only supports rank-1 bias but got `rank
      $\{biasData.shape.length\}`, biasId = biasData.id);}
    const batchDim = a.shape[0];
  }

  const out = backend.makeOutput([batchDim, leftDim, rightDim], a.dtype);
  const outId = backend.dataIdMap.get(out.dataId).id;

  const aShapeBytes = new Uint8Array(new Int32Array(a.shape).buffer);
  const bShapeBytes = new Uint8Array(new Int32Array(b.shape).buffer);

  wasmFusedMatMul(aId, aShapeBytes, a.shape.length, bId, bShapeBytes, b.shape.length, transposeA, transposeB, fusedActivation, biasId, preluActivationWeights == null ? 0 : backend.dataIdMap.get(preluActivationWeights.dataId).id, leakyreluAlpha || 0, outId);

  return out;
}

export const fusedMatMulConfig: KernelConfig = {
  kernelName: _FusedMatMul,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: fusedBatchMatMul as {} as KernelFunc
};

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/_FusedMatMul.js.map

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 */

// Register the wasm backend.
import './index';

// tslint:disable-next-line: no-imports-from-dist
import {setTestEnvs} from '@tensorflow/tfjs-core/dist/jasmine_util';
import jasmine from 'jasmine';

Error.stackTraceLimit = Infinity;

process.on('unhandledRejection', e => {
  throw e;
});

setTestEnvs([{name: 'wasm-node', backendName: 'wasm', isDataSync: true}]);

const runner = new jasmine({});
runner.loadConfig({spec_files: ['src/**/*_test.ts'], random: false});

if (process.env.JASMINE_SEED) {
  runner.seed(process.env.JASMINE_SEED);
}

runner.execute();

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/test_node.js.map
const inputRank = input.shape.length;

const [outShape, reduceShape] = backend_util.computeOutAndReduceShapes(input.shape, axes);

const reduceSize = util.sizeFromShape(reduceShape);

const out = backend.makeOutput(outShape, input.dtype);

if (util.sizeFromShape(input.shape) !== 0) {
  const outId = backend.dataIdMap.get(out.dataId).id;

  wasmMin(inputId, CppDType[x.dtype], reduceSize, outId);
}

if (inputWasTransposed) {
  backend.disposeData(transposed.dataId);
}

if (keepDims) {
  const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);
  out.shape = newShape;
}

return out;

export const minConfig: KernelConfig = {
  kernelName: 'wasm',
  setupFunc: setup,
  kernelFunc: min as {} as KernelFunc
};
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```
{"version":3,"file":"Tanh.js","sourceRoot":"","sources":["./src/kernels/Tanh.ts"],"names":[]},"mappings":"AAAA:;;;;;;;;;;;;;GAeG;AACH,OAAO,EAAe,IAAI,EAAC,MAAM,uBAAuB,CAAC;AAEzD,OAAO,EAAC,uBAAuB,EAAC,MAAM,gBAAgB,CAAC;AACvD,MAAM,CAAC,MAAM,UAAM,GAAiB,UAAM,CAAC,IAAI,CAAC,CAAC","sourcesContent":"/**
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 */

import {KernelConfig, Tanh} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';
export const tanhConfig: KernelConfig = createUnaryKernelConfig(Tanh);
```

Found in path(s):

```
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-dist/kernels/Tanh.js.map

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 */

/**
 * @deprecated Use `setWasmPaths` instead.
 * @param path wasm file path or url
 * @param usePlatformFetch optional boolean to use platform fetch to download
 * the wasm file, default to false.
 */
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

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```javascript
// Short-circuit zero-sized tensors.
if (util.sizeFromShape(out.shape) === 0) {
  return out;
}

wasmFunc(xId, CppDType[x.dtype], outId);
```

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/unary_kernel.js.map
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```javascript
import {CropAndResize, CropAndResizeAttrs, CropAndResizeInputs, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-core';

import {cast} from './Cast';

// Must match enum in CropAndResize.cc
enum InterpolationMethod {
  bilinear = 0,
  nearest = 1
}

let wasmCropAndResize: (imagesId: number, boxesId: number, boxIndId: number, numBoxes: number, imagesShape: Uint8Array, cropHeight: number, cropWidth: number, method: number, extrapolationValue: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmCropAndResize = backend.wasm.cwrap(CropAndResize, null /*void*/, [
    'number',  // imagesId
    'number',  // boxesId
    'number',  // boxIndId
    'number',  // numBoxes
    'array',   // images shape
    'number',  // cropHeight
    'number',  // cropWidth
    'number',  // method
    'number',  // extrapolationValue
    'number'   // out id
  ]);}

function cropAndResize(args: {
  backend: BackendWasm,
  inputs: CropAndResizeInputs,
```
attrs: CropAndResizeAttrs
): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {method, extrapolationValue, cropSize} = attrs;
  const {image, boxes, boxInd} = inputs;
  const numBoxes = boxes.shape[0];
  const {cropHeight, cropWidth} = cropSize as [number, number];
  const outShape = [numBoxes, cropHeight, cropWidth, image.shape[3]];
  let imagesData = backend.dataIdMap.get(image.dataId);
  let castedData = cast({x: image, attrs: {dtype: 'float32'}});
  imagesData = backend.dataIdMap.get(castedData.dataId);
  const boxesId = backend.dataIdMap.get(boxes.dataId).
  const boxIndId = backend.dataIdMap.get(boxInd.dataId);
  const out = backend.makeOutput(outShape, 'float32');
  const imagesShapeBytes = new Uint8Array(new Int32Array(image.shape).buffer);
  wasmCropAndResize(imagesId, boxesId, boxIndId, numBoxes, imagesShapeBytes, cropHeight, cropWidth, method as InterpolationMethod, extrapolationValue, outId);

  return out;
}
import {parseResultStruct} from './NonMaxSuppression_util';

let wasmFunc: (boxesId: number, scoresId: number, maxOutputSize: number,
    iouThreshold: number, scoreThreshold: number) => number;

function setup(backend: BackendWasm): void {
  wasmFunc = backend.wasm.cwrap(
      NonMaxSuppressionV3,
      'number',  // Result*
      
        'number',  // boxesId
        'number',  // scoresId
        'number',  // maxOutputSize
        'number',  // iouThreshold
        'number',  // scoreThreshold
    );
}

function kernelFunc(args: {
  backend: BackendWasm,
  inputs: NonMaxSuppressionV3Inputs,
  attrs: NonMaxSuppressionV3Attrs
}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {iouThreshold, maxOutputSize, scoreThreshold} = attrs;
  const {boxes, scores} = inputs;

  const boxesId = backend.dataIdMap.get(boxes.dataId).id;
  const scoresId = backend.dataIdMap.get(scores.dataId).id;

  const resOffset = wasmFunc(boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold);

  const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} = parseResultStruct(
    backend, resOffset);

  // Since we are not using scores for V3, we have to delete it from the heap.
  backend.wasm._free(pSelectedScores);
  backend.wasm._free(pValidOutputs);

  const selectedIndicesTensor =
      backend.makeOutput([selectedSize], 'int32', pSelectedIndices);
  return selectedIndicesTensor;
}

export const nonMaxSuppressionV3Config: KernelConfig = {
  kernelName: NonMaxSuppressionV3,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: kernelFunc as {} as KernelFunc,
};

//backen_wasm\n\nimport {parseResultStruct} from './NonMaxSuppression_util';\n\nlet wasmFunc: (in boxesId: number, scoresId: number, maxOutputSize: number,\n    in iouThreshold: number, scoreThreshold: number) => number;
\nfunction setup(backend: BackendWasm): void {
  wasmFunc = backend.wasm.cwrap(\n  NonMaxSuppressionV3, \n  'number', \n  Result* \n  boxesId 'number', \n  scoresId 'number', \n  maxOutputSize 'number', \n  iouThreshold 'number', \n  scoreThreshold 'number', \n
function kernelFunc(args: {
  backend: BackendWasm,
  inputs: NonMaxSuppressionV3Inputs,
  attrs: NonMaxSuppressionV3Attrs
}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {iouThreshold, maxOutputSize, scoreThreshold} = attrs;
  const {boxes, scores} = inputs;

  const boxesId =
      backend.dataIdMap.get(boxes.dataId).id;
  const scoresId = backend.dataIdMap.get(scores.dataId).id;

  const resOffset =
      wasmFunc(boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold);

  const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} =
      parseResultStruct(backend, resOffset);

  // Since we are not using scores for V3, we have to delete it from the heap.

  backend.wasm._free(pSelectedScores);
  backend.wasm._free(pValidOutputs);

  const selectedIndicesTensor =
      backend.makeOutput([selectedSize], 'int32', pSelectedIndices);

  return selectedIndicesTensor;
}

export const nonMaxSuppressionV3Config: KernelConfig = {
  kernelName: NonMaxSuppressionV3,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: kernelFunc as {} as KernelFunc,
};
```

import {KernelConfig, KernelFunc, TensorInfo, Transpose, TransposeAttrs, TransposeInputs} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {identity} from './Identity';
import {CppDType} from './types';

let wasmTranspose: (xId: number, xShape: Uint8Array, xShapeLength: number, dtype: CppDType, outId: number, perm: Uint8Array, permLength: number) => void;

function setup(backend: BackendWasm) {
  wasmTranspose = backend.wasm.cwrap(Transpose, null /* void */, [  
    'number', // xId
    'array',  // x.shape
    'number', // x.shape.length
    'number', // dtype
    'number', // outId
    'array',  // perm
    'number', // perm.length
  ]);}

export function transpose(args: {inputs: TransposeInputs, backend: BackendWasm, attrs: TransposeAttrs}: TensorInfo {
  const {inputs, backend, attrs} = args;

  const reducedShape = removeOneSizeDims(inputs.x.shape, attrs.perm);

  if (reducedShape.length === 1) {
    return identity({inputs, backend});
  }

  const outShape = computeOutShape(inputs.x.shape, attrs.perm);

  const x = {dataId: inputs.x.dataId, shape: reducedShape, dtype: inputs.x.dtype};

  const out = backend.makeOutput(outShape, x.dtype);
  const xId = backend.dataIdMap.get(x.dataId).id;
  const outId = backend.dataIdMap.get(out.dataId).id;

  const permBytes = new Uint8Array(new Int32Array(attrs.perm).buffer);
  const xShapeBytes = new Uint8Array(new Int32Array(inputs.x.shape).buffer);

  wasmTranspose(xId, xShapeBytes, x.shape.length, CppDType[inputs.x.dtype], outId, permBytes, perm.length);

  return out;
}
```

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-backendwasm/dist/kernels/Transpose.js.map
No license file was found, but licenses were detected in source scan.
{"version":3,"file":"NonMaxSuppressionV4.js","sourceRoot":"","sources":["../../src/kernels/NonMaxSuppressionV4
.ts"],"names":[],"mappings":"AAAA;;;;;;;;;;;;;;;GAeG;AAEH,OAAO,EAA2B,mBAAmB,EAAkE,MAAM,uBAAuB
,CAAC;AAIrJ,OAAO,EAAC,iBAAiB,EAAC,MAAM,0BAA0B,CAAC;AAE3D,IAAI,QAGsC,CAAC;AAE3C,SA
AS,KAAK,CAAC,OAAoB;IACjC,QAAQ,GAAG,OAAO,CAAC,IAAI,CAAC,KAAK,CACzB,mBAAmB,EACnB,
QAAQ,EAAG,UAAU;IACrB;QACE,QAAQ;QACR,QAAQ;QACR,QAAQ;QACR,QAAQ;QACR,QAAQ;QACR,
MAAM;KACP,CAAC,CAAC;AACT,CAAC;AAED,SAAS,mBAAmB,CAAC,IAI5B;IACC,MAAM,EAAC,OAAO
,EAAE,MAAM,EAAE,KAAK,EAAC,GAAG,IAAI,CAAC;IACtC,MAAM,EAAC,YAAY,EAAE,aAAa,EAAE,cA
Ac,EAAE,kBAAkB,EAAC,GACnE,KAAK,CAAC;IACV,MAAM,EAAC,KAAK,EAAE,MAAM,EAAC,GAAG,M
AAM,CAAC;IAE/B,MAAM,OAAO,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,KAAK,CAAC,MAAM,C
AAC,CAAC,EAAE,CAAC;IACvD,MAAM,QAAQ,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,MAAM,C
AAC,MAAM,CAAC,CAAC,EAAE,CAAC;IAEzD,MAAM,SAAS,GAAG,QAAQ,CACtB,OAAO,EAAE,QAAQ,E
AAE,aAAa,EAAE,YAAY,EAAE,cAAc,EAC9D,kBAAkB,CAAC,CAAC;IAExB,MAAM,EAAC,gBAAgB,EAAE,
YAAY,EAAE,eAAe,EAAE,aAAa,EAAC,GAClE,iBAAiB,CAAC,OAAO,EAAE,SAAS,CAAC,CAAC;IAE1C,4E
AA4E;IAC5E,OAAO,CAAC,IAAI,CAAC,KAAK,CAAC,eAAe,CAAC,CAAC;IAEpC,MAAM,qBAAqB,GACvB,
OAAO,CAAC,UAAU,CAAC,CAAC,YAAY,CAAC,EAAE,OAAO,EAAE,gBAAgB,CAAC,CAAC;IAElE,MAAM
,kBAAkB,GAAG,OAAO,CAAC,UAAU,CAAC,EAAE,EAAE,OAAO,EAAE,aAAa,CAAC,CAAC;IAE1E,OAAO,
CAAC,qBAAqB,EAAE,kBAAkB,CAAC,CAAC;AACrD,CAAC;AAED,MAAM,CAAC,MAAM,yBAAyB,GAAiB
;IACrD,UAAU,EAAE,mBAAmB;IAC/B,WAAW,EAAE,MAAM;IACnB,SAAS,EAAE,KAAK;IAChB,UAAU,EA
AE,mBAAuC;CACpD,CAAC","sourcesContent":["/**\n * @license\n * Copyright 2020 Google LLC. All Rights
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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

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const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} =
parseResultStruct(backend, resOffset); // Since we are not using scores for V4, we have to delete it from the heap.

const selectedIndicesTensor =
backend.makeOutput([selectedSize], 'int32', pSelectedIndices);

const validOutputsTensor =
backend.makeOutput([], 'int32', pValidOutputs);

return [selectedIndicesTensor, validOutputsTensor];

export const nonMaxSuppressionV4Config: KernelConfig = {
  kernelName: NonMaxSuppressionV4,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: nonMaxSuppressionV4 as {} as KernelFunc,
};

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/NonMaxSuppressionV4.js.map

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 *
 *=============================================================================

// This enum must align with the enum defined in cc/backend.h.
export enum CppDType {
  float32 = 0,
  int32 = 1,
  bool = 2,
  string = 3,
  complex64 = 4
}

// Must match enum in cc/fusable_activations.h.
export enum FusableActivation {
  linear = 0,
  relu = 1,
  relu6 = 2,
  prelu = 3,
  leakyrelu = 4,
  sigmoid = 5,
  elu = 6
}

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 *=============================================================================

// This enum must align with the enum defined in cc/backend.h.
export enum CppDType {
  float32 = 0,
  int32 = 1,
  bool = 2,
  string = 3,
  complex64 = 4
}

// Must match enum in cc/fusable_activations.h.
export enum FusableActivation {
  linear = 0,
  relu = 1,
  relu6 = 2,
  prelu = 3,
  leakyrelu = 4,
  sigmoid = 5,
  elu = 6
}

```javascript
import {_FusedMatMul, _FusedMatMulAttrs, _FusedMatMulInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {FusableActivation} from './types';

let wasmFusedMatMul:
    (aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,
     bShape: Uint8Array, bShapeSize: number, transposeA: boolean,
     transposeB: boolean, activation: number,
     biasId: number, preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>
     void;

function setup(backend: BackendWasm) {
  wasmFusedMatMul = backend.wasm.cwrap(_FusedMatMul,
      null /* void */, 
    ['number',  // a_id
     'array',   // a_shape
     'number',  // a_shape.length
     'number',  // b_id
     'array',   // b_shape
     'number',  // b_shape.length
     'number',  // transpose_a
     'number',  // transpose_b
     'number',  // activation
     'number',  // biasId
     'number',  // preluActivationWeights
     'number',  // leakyreluAlpha
     'number',  // out_id
    ]);
}

function fusedBatchMatMul(args: {
  inputs: _FusedMatMulInputs,
  backend: BackendWasm,
  attrs: _FusedMatMulAttrs
}) {
  const {inputs, backend,
    attrs} = args;
  const {a, b, bias, preluActivationWeights} = inputs;
  if (a.dtype !== 'float32' || b.dtype !== 'float32') {
    throw new Error('fusedBatchMatMul for non-float32 tensors not yet supported.');}

  const {transposeA, transposeB, activation, leakyreluAlpha} = attrs;
  const aId =
```
```javascript
const biasId = backend.dataIdMap.get(bias.dataId).id;

let biasId = 0;
if (bias != null) {
  const biasData = backend.dataIdMap.get(bias.dataId);
  if (biasData.shape.length !== 1) {
    throw new Error('FusedMatMul only supports rank-1 bias but got ' + rank $\{biasData.shape.length\}.');
  }
  biasId = biasData.id;
}

const preluActivationWeightsId = preluActivationWeights == null ? 0 : backend.dataIdMap.get(preluActivationWeights.dataId).id;

const fusedActivation = FusableActivation[activation as {} as keyof typeof FusableActivation];
if (fusedActivation == null) {
  throw new Error('activation not yet supported for FusedConv2D ' + in the wasm backend.');
}

const batchDim = a.shape[0];
const out = backend.makeOutput([batchDim, leftDim, rightDim], a.dtype);
const outId = backend.dataIdMap.get(out.dataId).id;
const aShapeBytes = new Uint8Array(new Int32Array(a.shape).buffer);
const bShapeBytes = new Uint8Array(new Int32Array(b.shape).buffer);

wasmFusedMatMul(aId, aShapeBytes, a.shape.length, bId, bShapeBytes, b.shape.length, transposeA, transposeB, fusedActivation, biasId, preluActivationWeightsId, leakyreluAlpha || 0, outId);
return out;
}

export const fusedMatMulConfig: KernelConfig = {
  kernelName: _FusedMatMul,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: fusedBatchMatMul as {} as KernelFunc
};

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=============================================================================

import {DataType, KernelConfig, TensorInfo, UnaryInputs, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {CppDType} from './types';

export function createUnaryKernelConfig(kernelName: string, outType?: DataType): KernelConfig {
  let wasmFunc: (xId: number, dtype: number, outId: number) => void;

  function setupFunc(backend: BackendWasm): void {
    wasmFunc = backend.wasm.cwrap(kernelName, null /* void */, [
      'number',  // x_id
      'number',  // dtype
      'number',  // out_id
    ]);  
  }

  function kernelFunc(args: {backend: BackendWasm, inputs: UnaryInputs}):
    TensorInfo {
    const {backend, inputs: {x}} = args;
    const xId = backend.dataIdMap.get(x.dataId).id;
    const out = backend.makeOutput(x.shape, x.dtype);
    const outId = backend.dataIdMap.get(out.dataId).id;
    const out = backend.dataIdMap.get(out.dataId).id;
    const out = backend.dataIdMap.get(out.dataId).id;

    // Short-circuit zero-sized tensors:
    if (util.sizeFromShape(out.shape) === 0) {
      return out;
    }

    wasmFunc(xId, CppDType[x.dtype], outId);
    return out;
  }

  return {kernelName, backendName: 'wasm',
  setupFunc: setupFunc, kernelFunc: createBatchMatMul as {} as KernelFunc
};

const absConfig: KernelConfig = createUnaryKernelConfig(Abs);

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 *
=============================================================================

import {Abs, KernelConfig} from '@tensorflow/tfjs-core';

const absConfig = createUnaryKernelConfig(Abs);

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*/

import {backend_util, BinaryInputs, DataType, KernelConfig, TensorInfo, util} from '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';
import {CppDType} from '@types';

export

function createBinaryKernelConfig(
    kernelName: string, supportsFullBroadcast: boolean,
    dtype?: DataType): KernelConfig {
  let wasmFunc:
      (aId: number, aShape: Uint8Array, aShapeLen: number, bId:
       number, bShape: Uint8Array, bShapeLen: number, dtype: number, outId: number) =>
          void;

  function setupFunc(backend: BackendWasm): void {
    wasmFunc = backend.wasm.cwrap(kernelName, null /* void */,
        ['number', // a_id
         'array', // a_shape
         'number', // a_shape.length
         'number', // b_id
         'array', // b_shape
         'number', // b_shape.length
         'number', // dtype
         'number'] // out_id
      );

  function kernelFunc(args: {backend: BackendWasm, inputs: BinaryInputs}): TensorInfo {
    const {backend, inputs} = args;
    const {a, b} = inputs;
    const aId = backend.dataIdMap.get(a.dataId).id;
    const bId = backend.dataIdMap.get(b.dataId).id;

    const outputType = dtype != null ? dtype : a.dtype;
    const newShape = backend_util.assertAndGetBroadcastShape(a.shape, b.shape);
    const out = backend.makeOutput(newShape, outputType);

    // Short-circuit zero-sized tensors.
    if (util.sizeFromShape(newShape) === 0) {
      return out;
    }

    const aShapeBytes = new Uint8Array(new Int32Array(a.shape).buffer);
    const bShapeBytes = new Uint8Array(new Int32Array(b.shape).buffer);
    const outId = backend.dataIdMap.get(out.dataId).id;

    const kernelFunc = () => wasmFunc(aId, aShapeBytes, a.shape.length, bId, bShapeBytes, b.shape.length,
        CppDType[a.dtype], outId);

    // Currently only some float operations support full broadcast.
    if (supportsFullBroadcast && a.dtype === 'float32') {
      kernelFunc();
      return out;
    }

    const aBroadcastDims = backend_util.assertAndGetBroadcastShape(a.shape, b.shape);
    const bBroadcastDims = backend_util.assertAndGetBroadcastShape(b.shape, newShape);

    const loopsOverAllOfA = aBroadcastDims.every((v, i) => v === i);
    const loopsOverAllOfB = bBroadcastDims.every((v, i) => v === i);
    if (loopsOverAllOfA && loopsOverAllOfB) {
      kernelFunc();
      return out;
    } else {
      throw new Error('Broadcasting along outer dims is not yet supported for ' +
          `${a.dtype} ${kernelName}.`);
    }
  }

  return {kernelName, backendName: 'wasm', setupFunc, kernelFunc};
}

const supportsFullBroadcast = true;

export const addConfig: KernelConfig =

createBinaryKernelConfig(Add, supportsFullBroadcast);

const AddN = AddN;

const addn = AddN;

const supportsFullBroadcast = true;

export const addnConfig: KernelConfig =

createBinaryKernelConfig(AddN, supportsFullBroadcast);
function removeOneSizeDims(shape, perm) {
    const newShape = shape.filter(num => num !== 1);
    const newPerm = perm.filter(index => shape[index] !== 1);
    return shape.length - newPerm.length === 0 ? [newShape, newPerm] : undefined;
}

function removeOneSizeDims(shape, perm) {
    const newShape = shape.map((num, index) => num !== 1 ? num : 1);
    const newPerm = perm.map((index, i) => shape[index] !== 1 ? i : perm.indexOf(index));
    return newShape.length - newPerm.length === 0 ? [newShape, newPerm] : undefined;
}

export const transposeConfig: KernelConfig = {
    kernelName: Transpose,
    backendName: 'wasm',
    kernelFunc: transpose as {} as KernelFunc,
    setupFunc: setup,
};

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 */

import {KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';

function permuteAxesAndTranspose(x, perm) {
    return x.shape.length === perm.length ? [x, perm] : undefined;
}

export function permuteAxesAndTranspose(x, perm) {
    const newPerm = perm.map(index => x.shape.indexOf(index));
    return newPerm.length === x.shape.length ? [x, newPerm] : undefined;
}

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 */

import {All, AllAttrs, AllInputs, backend_util, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {permuteAxesAndTranspose} from './kernel_utils';

let wasmAll: (xId: number, reduceSize: number, outId: number) => void;

function setup(backend: BackendWasm): void {
    wasmAll = backend.wasm.cwrap(All, null /*void*/, ['number, number, number']);
}

function all(args: {backend: BackendWasm, inputs: AllInputs, attrs: AllAttrs}):
    TensorInfo {
    const {backend, inputs, attrs} = args;
    const {axis, keepDims} = attrs;
    const {x} = inputs;
    const xId = backend.dataIdMap.get(x.dataId).id;
    const inputId = xId;
    const input = x;

    const {transposed, axes, originalAxes, inputWasTransposed} =
        permuteAxesAndTranspose(x, axis, backend);

    if (inputWasTransposed) {
        const transposedId = backend.dataIdMap.get(transposed.dataId).id;
        if (transposedId !== xId) {
            inputId = transposedId;
            input = transposed;
        }
    }

    const xId = backend.dataIdMap.get(x.dataId).id;
    let inputData = xId;
    let input = x;

    const transposed = backend.util.permuteAxesAndTranspose(x, xId);
    const xId = backend.dataIdMap.get(transposed.dataId).id;
    if (transposedId !== xId) {
        inputId = transposedId;
        input = transposed;
    }

    return {transposed, originalAxes, axes, inputWasTransposed};
}
util.sizeFromShape(reduceShape);

const out = backend.makeOutput(outShape, x.dtype);
if (util.sizeFromShape(input.shape) !== 0) {
  const outId = backend.getDataIdMap.get(out.dataId).id;
  wasmAll(inputId, reduceSize, outId);
}

if (inputWasTransposed) {
  const outId = backend.getDataIdMap.get(out.dataId).id;
  wasmAll(inputId, reduceSize, outId);
}

// dispose of the transposed tensor.
backend.disposeData(transposed.dataId);

if (keepDims) {
  const newShape = backend.expandShapeToKeepDim(out.shape, originalAxes);
  out.shape = newShape;
}

return out;

export const allConfig: KernelConfig = {
  kernelName: All,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: all as {} as KernelFunc
};

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 */

import {Any, AnyAttrs, AnyInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {permuteAxesAndTranspose} from './kernel_utils';

let wasmAny: (xId: number, reduceSize: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmAny = backend.wasm.cwrap(Any, null /*void*/, ['number', 'number', 'number']);
}

function any(args: {backend: BackendWasm, inputs: AnyInputs, attrs: AnyAttrs}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {axis, keepDims} = attrs;
  const {x} = inputs;
  const xId = backend.getDataIdMap.get(x.dataId).id;
  let inputId = xId;
  let input = x;

  const {transposed, axes, originalAxes, inputWasTransposed} =
      permuteAxesAndTranspose(x, axis, backend);

  if (inputWasTransposed) {
    const transposedId = backend.getDataIdMap.get(transposed.dataId).id;
    input = transposed;
    inputId = transposedId;
  }

  const inputRank = input.shape.length;
  backend_util.assertAxesAreInnerMostDims('any', axes, inputRank);
  const [outShape, reduceShape] =
    backend_util.computeOutAndReduceShapes(input.shape, axes);
  const reduceSize = util.sizeFromShape(reduceShape);

  const out = backend.makeOutput(outShape, x.dtype);
  if (util.sizeFromShape(input.shape) !== 0) {
    const outId = backend.getDataIdMap.get(out.dataId).id;
    wasmAny(inputId, reduceSize, outId);
  }

  // dispose of the transposed tensor.
  backend.disposeData(transposed.dataId);

  if (keepDims) {
    const newShape =
      backend_util.expandShapeToKeepDim(out.shape, originalAxes);
    out.shape = newShape;
  }

  return out;
}

export const anyConfig: KernelConfig = {
  kernelName: Any,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: any as {} as KernelFunc
};

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 */

import {ArgMax, ArgMaxAttrs, ArgMaxInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {permuteAxesAndTranspose} from './kernel_utils';

let wasmFunc: (xId: number, dtype: number, outerSize: number, innerSize: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmFunc = backend.wasm.cwrap(ArgMax, null /*void*/, ['number', 'number', 'number', 'number', 'number']);
}

function argmax(args: {inputs: ArgMaxInputs, backend: BackendWasm, attrs: ArgMaxAttrs}) {
  const {backend, inputs, attrs} = args;
  const {axis} = attrs;
  const {x} = inputs;
  const xId = backend.getDataIdMap.get(x.dataId).id;
  let inputId = xId;
  let input = x;

  const inputRank = input.shape[length];
  backend_util.assertAxesAreInnerMostDims('argmax', axes, inputRank);
  const [outShape, reduceShape] =
    backend_util.computeOutAndReduceShapes(input.shape, axes);
  const reduceSize = util.sizeFromShape(reduceShape);

  const out = backend.makeOutput(outShape, x.dtype);
  if (util.sizeFromShape(input.shape) !== 0) {
    const outId = backend.getDataIdMap.get(out.dataId).id;
    wasmFunc(inputId, reduceSize, outputId);
  }

  // dispose of the transposed tensor.
  backend.disposeData(transposed.dataId);

  if (keepDims) {
    const newShape =
      backend_util.expandShapeToKeepDim(out.shape, originalAxes);
    out.shape = newShape;
  }

  return out;
}

export const argmaxConfig: KernelConfig = {
  kernelName: ArgMax,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: argmax as {} as KernelFunc
};

=============================================================================

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backend.dataIdMap.get(x.dataId).id;
  let inputId = xId;
  let input = x;

  const {transposed, axes, inputWasTransposed} =
      permuteAxesAndTranspose(x, axes, backend);
  if (inputWasTransposed) {
    const transposedId = backend.dataIdMap.get(transposed.dataId).id;
    if (transposedId !== xId) {
      // transpose was not a no-op. We will need to dispose of this
      // once we are done.
      input = transposed;
      inputId = transposedId;
    }
  }

  const outShape = input.shape.slice(0, -1);
  const out = backend.makeOutput(outShape, 'int32');
  const outId = backend.dataIdMap.get(out.dataId).id;

  const outerSize = util.sizeFromShape(out.shape);
  const innerSize = input.shape[axes[0]];
  wasmFunc(inputId, CppDType[input.dtype], outerSize, innerSize, outId);

  if (inputWasTransposed) {
    // dispose of the transposed tensor.
    backend.disposeData(transposed.dataId);
  }

  return out;
}

export const argMaxConfig: KernelConfig = {
  kernelName: ArgMax,
  backendName: 'wasm',
  kernelFunc: argmax as {} as KernelFunc,
  setupFunc: setup
};

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 */

import {AvgPool, AvgPoolAttrs, AvgPoolInputs, backend_util, KernelConfig, KernelFunc, Tensor4D} from
    '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';

let wasmAvgPool: (
    xId: number, batchSize: number, inputHeight: number, inputWidth: number,
    filterHeight: number, filterWidth: number, padTop: number, padRight: number,
    padBottom: number, padLeft: number, strideHeight: number,
    strideWidth: number, channels: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmAvgPool = backend.wasm.cwrap(AvgPool, null /* void */, 
      [ 'number',  // xId
        'number',  // batchSize
        'number',  // inputHeight
        'number',  // inputWidth
        'number',  // filterHeight
        'number',  // filterWidth
        'number',  // padTop
        'number',  // padRight
        'number',  // padBottom
        'number',  // padLeft
        'number',  // strideHeight
        'number',  // strideWidth
        'number',  // channels
        'number',  // outId
      ],
      'void',
      [ 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number' ]);
}

function avgPool(
    args: {inputs: AvgPoolInputs, backend: BackendWasm, attrs: AvgPoolAttrs}) {
  const {inputs, attrs, backend} = args;

  const x = inputs.x as Tensor4D;
  const xId = backend.dataIdMap.get(x.dataId).id;

  const {filterSize, strides, pad, dimRoundingMode} = attrs;
  const convInfo = backend_util.computePool2DInfo(
      x.shape, filterSize, strides, 1 /* dilations */, pad, dimRoundingMode);

  const filterHeight = convInfo.filterHeight;
  const filterWidth = convInfo.filterWidth;
  const padTop = convInfo.padTop;
  const padRight = convInfo.padRight;
  const padBottom = convInfo.padBottom;
  const padLeft = convInfo.padLeft;
  const strideHeight = convInfo.strideHeight;
  const strideWidth = convInfo.strideWidth;
  const channels = convInfo.channels;

  if (convInfo.dataFormat !== 'channelsLast') {
    throw new Error(`wasm backend does not support dataFormat:'` +
        `${convInfo.dataFormat}'. Please use 'channelsLast'.`);
  }

  if (convInfo.dilationWidth !== 1 || convInfo.dilationHeight !== 1) {
    throw new Error(`was backend only supports average pooling with dilation = [1, 1], ` +
        `got $[{convInfo.dilationHeight}, ${convInfo.dilationWidth}].`);
  }

  const outId = backend.dataIdMap.get(out.dataId).id;
  const out = wasmAvgPool(xId, x.shape[0], x.shape[1], x.shape[2],
      filterHeight, filterWidth, padTop, padRight, padBottom, padLeft, strideHeight, strideWidth, channels,
      outId);
  if (convInfo.dilationHeight !== 1 || convInfo.dilationWidth !== 1) {
    throw new Error(`was backend only supports pooling with dilation = [1, 1], ` +
        `got $[{convInfo.dilationHeight}, ${convInfo.dilationWidth}].`);
  }

  return out;
}

export const avgPoolConfig: KernelConfig = {
  kernelName: AvgPool,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: avgPool as {} as KernelFunc
};

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 */

const backend = new BackendWasm();
const wasmFunc = backend.wasm.cwrap(FUNC_NAME, void, 
    [ 'number',  // xId
      'number',  // batchSize
      'number',  // inputHeight
      'number',  // inputWidth
      'number',  // filterHeight
      'number',  // filterWidth
      'number',  // padTop
      'number',  // padRight
      'number',  // padBottom
      'number',  // padLeft
      'number',  // strideHeight
      'number',  // strideWidth
      'number',  // channels
      'number'   // outId
    ],
    'void',
    [ 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number' ]);
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=============================================================================
*/

import {KernelConfig, KernelFunc, Reshape, ReshapeAttrs, ReshapeInputs, util} from '@tensorflow/tfjs-core';

export function reshape(args: {inputs: ReshapeInputs, attrs: ReshapeAttrs, backend: BackendWasm}) {
  const {inputs, attrs} = args;
  const xSize = util.sizeFromShape(x.shape);
  const $shape = util.inferFromImplicitShape(shape, xSize);
  util.assert($shape === new shape: $shape, old shape: $(x.shape). New shape and old shape must have the same number of elements.);
  // Backend needs to track refCount for the dataId for reshape op
  args.backend.incRef(x.dataId);
  return {
    dataId: x.dataId, shape: $shape, dtype: x.dtype};
}

export const reshapeConfig: KernelConfig = {
  kernelName: Reshape,
  backendName: 'wasm',
  kernelFunc: reshape as {} as KernelFunc
};

=============================================================================
*/

import {BatchMatMul, BatchMatMulAttrs, BatchMatMulInputs, KernelConfig, KernelFunc, util} from
  '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {reshape} from './Reshape';

let wasmBatchMatMul: (
  aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,
  bShape: Uint8Array, bShapeSize: number, transposeA: boolean, transposeB: boolean, outId: number) =>
  void;

function setup(backend: BackendWasm) {
  wasmBatchMatMul = backend.wasm.cwrap(BatchMatMul, null /* void */, [
    'number',  // a_id
    'array',   // a_shape
    'number',  // a_shape.length
    'number',  // b_id
    'array',   // b_shape
    'number',  // b_shape.length
    'number',  // transpose_a
    'number',  // transpose_b
    'number'   // out_id
  ]);}

function batchMatMul(args: {
  inputs: BatchMatMulInputs,
  backend: BackendWasm,
  attrs: BatchMatMulAttrs
}) {
  const {inputs, backend, attrs} = args;
  const {a, b} = inputs;

  const transposeA = attrs.transposeA;
  const transposeB = attrs.transposeB;

  if (a.dtype !== 'float32' || b.dtype !== 'float32') {
    throw new Error(`BatchMatMul for non non-float32 tensors not yet supported.`);
  }

  const aRank = a.shape.length;
  const bRank = b.shape.length;

  const innerShapeA = transposeA ? a.shape[aRank - 2] : a.shape[aRank - 1];
  const innerShapeB = transposeB ? b.shape[bRank - 2] : b.shape[bRank - 1];

  const outerShapeA = a.shape.slice(0, -2);
  const outerShapeB = b.shape.slice(0, -2);

  const batchDimA = util.sizeFromShape(outerShapeA);
  const batchDimB = util.sizeFromShape(outerShapeB);

  const batchDimsCompatible =
      batchDimA === batchDimB || batchDimA === 1 || batchDimB === 1;

  util.assert(aRank >= 2 && bRank >= 2 && batchDimsCompatible,
      () => `Error in matMul: the input batch dimensions must either be the
      same or at least one input batch dimension must be 1. Got input batch
      dimensions: a: [${outerShapeA}], b: [${outerShapeB}].`);

  const outShape = outShapeOuterDims =
outShapeOuterDims.concat([a.shape.slice(0, -2), b.shape.slice(0, -2)]);

  util.assert(outShape = outShapeOuterDims,
      () => `Error in matMul: the output batch dimensions:
      [${outerShapeA}], [${outerShapeB}]. Expected output
      shape: [${a.shape}], [${b.shape}].`);

  const a3dShape = transposeA ? a.shape.slice(0, -2) : a.shape;
  const b3dShape = transposeB ? b.shape.slice(0, -2) : b.shape;

  const outShapeA = transposeA ? b.shape[bRank - 1] : a.shape[aRank - 1];
  const outShapeB = transposeB ? a.shape[aRank - 2] : b.shape[bRank - 2];

  const outShapeOuterDimsA = util.sizeFromShape(outShapeOuterDimsA);
  const outShapeOuterDimsB = util.sizeFromShape(outShapeOuterDimsB);
  util.assert(outShapeOuterDimsA = outShapeOuterDimsB,
      () => `Error in matMul: the output batch dimensions:
      [${outerShapeA}], [${outerShapeB}]. Expected output
      shape: [${a.shape}], [${b.shape}].`);

  const a = inputs.a;
  const b = inputs.b;

  util.assert(a.dataId = backend.dataIdMap.get(a3dShape).id,
      () => `Error in matMul: the output batch dimensions:
      [${outerShapeA}], [${outerShapeB}]. Expected output
      shape: [${a.shape}], [${b.shape}].`);

  const b3dId = backend.dataIdMap.get(b3dShape).id;
  util.assert(b3dId = backend.dataIdMap.get(b3dShape).id,
      () => `Error in matMul: the output batch dimensions:
      [${outerShapeA}], [${outerShapeB}]. Expected output
      shape: [${a.shape}], [${b.shape}].`);

  const leftDim

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  const leftDim = Math.max(batchDimA, batchDimB);
  const out = backend.makeOutput([leftDim, rightDim],
                                 a3d.dtype);
  const outId = backend.dataIdMap.get(out.dataId).id;
  const aShapeBytes = new Uint8Array(new Int32Array(a3d.shape).buffer);
  const bShapeBytes = new Uint8Array(new Int32Array(b3d.shape).buffer);
  wasmBatchMatMul(a3dId, aShapeBytes, a3d.shape.length, b3dId,
                  bShapeBytes, b3d.shape.length, transposeA, transposeB, outId);
  backend.disposeData(a3d.dataId);
  backend.disposeData(b3d.dataId);
  out.shape = outShape;
  return out;
}

export const batchMatMulConfig:
  KernelConfig = {
    kernelName: BatchMatMul,
    backendName: 'wasm',
    setupFunc: setup,
    kernelFunc: batchMatMul as {} as KernelFunc
  };

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 */

import { backend_util, util } from '@tensorflow/tfjs-core';
export function concatImpl(inputs, outShape, dtype, simplyConcat) {
  const outVals = util.getArrayFromDType(dtype, util.sizeFromShape(outShape));
  if (simplyConcat &amp; dtype !== 'string') {
    // Use built-in TypedArray.set() method for speed.
    let offset = 0;
    inputs.forEach(input => {
      const size = util.sizeFromShape(input.shape);
      outVals.set(input.vals, offset);
      offset += size;
    });
  } else {
    let colOffset = 0;
    inputs.forEach(input => {
      const decodedData = dtype === 'string' ?
        backend_util.fromUint8ToStringArray(input.vals) :
        input.vals;
      let tIdx = 0;
      for (let row = 0; row < input.shape[0]; ++row) {
        const resIdx = row * outShape[1] + colOffset;
        for (let col = 0; col < input.shape[1]; ++col) {
          outVals[resIdx + col] = decodedData[tIdx++];
        }
        colOffset += input.shape[1];
      }
    });
  }
  return outVals;
}
```javascript
import { util } from '@tensorflow/tfjs-core';

export function rangeImpl(start, stop, step, dtype) {
  const sameStartStop = start === stop;
  const increasingRangeNegativeStep = start < stop && step < 0;
  const decreasingRangePositiveStep = stop < start && step > 0;
  if (sameStartStop || increasingRangeNegativeStep ||
      decreasingRangePositiveStep) {
    return util.makeZerosTypedArray(0, dtype);
  }
  const numElements = Math.abs(Math.ceil((stop - start) / step));
  const values = util.makeZerosTypedArray(numElements, dtype);

  if (stop < start && step === 1) {
    // Auto adjust the step's sign if it hasn't been set
    // (or was set to 1)
```

---

*An import from @tensorflow/tfjs-core*/export function rangeImpl(start, stop, step, dtype) {\n  const sameStartStop = start === stop;\n  const increasingRangeNegativeStep = start < stop && step < 0;\n  const decreasingRangePositiveStep = stop < start && step > 0;\n  if (sameStartStop || increasingRangeNegativeStep ||
```


```javascript
    step = -1;
    }
    values[0] = start;
    for (let i = 1; i < values.length; i++) {
        values[i] = values[i - 1] + step;
    }
    return values;
} //
```

Source mapping URL: data:application/json;base64,eyJ2ZXJzaW9uIjozLCJmaWxlIjoiUmFuZ2VfaW1wb3J0c0ZvblwiLCJ2aWV3IjoiMjI0IiwiZF9hdCI6MTY3fQ==
```javascript
import {backend_util, KernelConfig, KernelFunc, Slice, slice_util, SliceInputs, TypedArray, util} from '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';
import {sliceImplCPU} from '../kernel_utils/shared';

export function slice(
    args: {inputs: SliceInputs, attrs: SliceAttrs, backend: BackendWasm}) {
  const {inputs: {x}, attrs: {begin, size}, backend} = args;

  const [begin_, size_] = slice_util.parseSliceParams(x, begin, size);

  const isContinous = slice_util.isSliceContinous(x.shape, begin_, size_);
  const xVals = backend.readSync(x.dataId);
  const out = backend.makeOutput(size_, x.dtype);
  const xStrides = util.computeStrides(x.shape);
  const outData = backend.dataIdMap.get(out.dataId);

  if (isContinous) {
    const flatOffset = slice_util.computeFlatOffset(begin_, xStrides);

    if (x.dtype === 'string') {
      outData.stringBytes = (xVals as Uint8Array).slice(flatOffset, flatOffset + util.sizeFromShape(size_));
    } else {
      const outVals = backend.typedArrayFromHeap(out);
      outVals.set((xVals as TypedArray).subarray(flatOffset, flatOffset + util.sizeFromShape(size_)));
    }

    return out;
  }

  if (x.dtype === 'string') {
    const res = sliceImplCPU(xVals, begin_, size_, x.shape, x.dtype);
    outData.stringBytes = res as Uint8Array;
    return out;
  }

  const outVals = backend.typedArrayFromHeap(out);
  const rank = x.shape.length;
  if (rank === 2) {
    slice2d(xVals as TypedArray, xStrides[0], outVals, begin_ as [number, number], size_ as [number, number]);
  } else if (rank === 3) {
    slice3d(xVals as TypedArray, xStrides[0], xStrides[1], outVals, begin_ as [number, number, number], size_ as [number, number, number]);
  } else if (rank === 4) {
    slice4d(xVals as TypedArray, xStrides[0], xStrides[1], xStrides[2], outVals, begin_ as [number, number, number, number], size_ as [number, number, number, number]);
  } else {
    const res = sliceImplCPU(xVals, begin_, size_, x.shape, x.dtype);
    return new ArrayLike(backend, TypedArray, x.shape);  // Create a new array of the same shape as x
    return out;
  }

  return out;
}

function slice2d(
    xVals: backend_util.TypedArray, xStride: number,
    outVals: backend_util.TypedArray, begin: [number, number],
    size: [number, number]): void {


```
number, xStride2: number,
outVals: backend_util.TypedArray, begin: [number, number, number],
size: [number, number, number]): void {
  const beginI = begin[0];
  const beginJ = begin[1];
  const beginK = begin[2];
  const endI = beginI + size[0];
  const endJ = beginJ + size[1];
  const endK = beginK + size[2];
  for (let i = beginI; i < endI; i++) {
    for (let j = beginJ; j < endJ; j++) {
      const xOffset = i * xStride1 + j * xStride2 + beginK;
      outVals.set(xVals.subarray(xOffset, xOffset + size[2]), outOffset);
      outOffset += size[2];
    }
  }
}

function slice4d(
    xVals: backend_util.TypedArray, xStride1: number, xStride2: number,
    xStride3: number, outVals: backend_util.TypedArray, begin: [number, number, number, number],
    size: [number, number, number, number]): void {
  const beginI = begin[0];
  const beginJ = begin[1];
  const beginK = begin[2];
  const beginL = begin[3];
  for (let i = beginI; i < endI; i++) {
    for (let j = beginJ; j < endJ; j++) {
      for (let k = beginK; k < endK; k++) {
        const xOffset = i * xStride1 + j * xStride2 + k * xStride3 + beginL;
        outVals.set(xVals.subarray(xOffset, xOffset + size[3]), outOffset);
        outOffset += size[3];
      }
    }
  }
}

export const sliceConfig: KernelConfig = {
  kernelName: Slice,
  backendName: 'wasm',
  kernelFunc: slice as {} as KernelFunc,
};

export const batchToSpaceNDConfig: KernelConfig = {
  kernelName: BatchToSpaceND,
  backendName: 'wasm',
  kernelFunc: batchToSpaceND as {} as KernelFunc,
};

export function
TensorInfo {
    const {inputs: [x], attr: [dtype], backend} = args;
    const out = backend.makeOutput(x.shape, dtype);
    const inVals = backendtypedArrayFromHeap(x);
    const outVals = backendtypedArrayFromHeap(out);
    outVals.set(inVals);
    return out;
}

export const castConfig: KernelConfig = {
    kernelName: Cast,
    backendName: 'wasm',
    kernelFunc: cast as {} as KernelFunc,
}

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 */
import {KernelConfig, Ceil} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from '../unary_kernel';

export const ceilConfig: KernelConfig = createUnaryKernelConfig(Ceil);

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 */

import {ClipByValue, ClipByValueAttrs, ClipByValueInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmClip: (xId: number, min: number, max: number, outId: number) => void;

function setup(backend: BackendWasm) {
    wasmClip = backend.wasm.cwrap(ClipByValue, null /* void */, [
        'number',  // x_id
        'number',  // min
        'number',  // max
        'number'   // out_id
    ]);
    backend.setFunction(setup(backend));
}

function clip(args: {
    inputs: ClipByValueInputs,
    backend: BackendWasm,
    attrs: ClipByValueAttrs
}) {
    const {inputs, backend, attrs} = args;
    const {x} = inputs;
    const {clipValueMin, clipValueMax} = attrs;
    const xId = backend.dataIdMap.get(x.dataId).id;
    const out = backend.makeOutput(x.shape, x.dtype);
    const outId = backend.dataIdMap.get(out.dataId).id;
    wasmClip(xId, clipValueMin, clipValueMax, outId);
    return out;
}

export const clipByValueConfig: KernelConfig = {
    kernelName: ClipByValue,
    backendName: 'wasm',
    setupFunc: setup,
    kernelFunc: clip as {} as KernelFunc
}

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 */

import {backend_util, Concat, ConcatAttrs, ConcatInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';
import {concatImplCPU} from '../kernel_utils/shared';
import {identity} from './Identity';
import {reshape} from './Reshape';

export function concat(
    args: {inputs: ConcatInputs, backend: BackendWasm}) {
    const {inputs, backend} = args;
    const axis = util.parseAxisParam(args.attrs.axis, inputs[0].shape)[0];
    const $inputs = inputs.filter(t => util.sizeFromShape(t.shape) > 0);
    if ($inputs.length === 1) {
        return identity({inputs: {x: $inputs[0]}, backend});
    }
    const out = backend.makeOutput(inputs.map(t => t.shape).length > 0);
    const inShape = util.sizeFromShape(outShape).length === 1) {
        return identity({inputs: {x: $inputs[0]}, backend});
    }
    const out = backend.makeOutput(outShape, inputs[0].dtype);
    if (util.sizeFromShape(outShape) === 0) {
        return out;
    }
    const shapes =
$inputs.map(t => t.shape);
 backend_util.assertParamsConsistent(shapes, axis);
 if ($inputs[0].dtype === 'string') {
   // Any concat of n-dimensional tensors across any axis can be reduced to
   // a concatenation of two-dimensional tensors across the axis 1, finally reshaping
   // the result to have the proper shape.
   const inputs2D = $inputs.map(t => {
     const innerSize = util.sizeFromShape(t.shape.slice(axis));
     const shape = [-1, innerSize];
     return reshape({ inputs: { x: t }, backend, attrs: { shape } });
   });
   let sumInnerDims = 0;
   const innerDims = $inputs.map(input => {
     const innerDim = util.sizeFromShape(input.shape.slice(axis));
     sumInnerDims += innerDim;
     return innerDim;
   });
   const inVals = $inputs.map(input => backend.typedArrayFromHeap(input));
   const outVals = backend.typedArrayFromHeap(out);
   for (let b = 0; b < batchDim; b++) {
     let outOffset = b * sumInnerDims;
     for (let i = 0; i < inVals.length; i++) {
       const innerDim = innerDims[i];
       const inOffset = b * innerDim;
       const vals = inVals[i].subarray(inOffset, inOffset + innerDim);
       outVals.set(vals, outOffset);
       outOffset += innerDim;
     }
   }
   return out;
 }

 const batchDim = util.sizeFromShape($inputs[0].shape.slice(0, axis));
 let sumInnerDims = 0;
 const innerDims = $inputs.map(t => t.shape.slice(axis));
 let sumInnerDims = $inputs.map(t => t.shape.slice(axis));
 backend_util.computeConv2DInfo($inputs.map(t => t.shape), (filter as Tensor4D).shape, strides, dilations, pad, dimRoundingMode, dataFormat, true, $inputs.map(t => t.shape), (filter as Tensor4D).shape, strides, dilations, pad, dimRoundingMode, false,
const filterHeight = convInfo.filterHeight;
const filterWidth = convInfo.filterWidth;
const padTop = convInfo.padInfo.top;
const padRight = convInfo.padInfo.right;
const padBottom = convInfo.padInfo.bottom;
const padLeft = convInfo.padInfo.left;
const dilationHeight = convInfo.dilationHeight;
const dilationWidth = convInfo.dilationWidth;
const strideHeight = convInfo.strideHeight;
const strideWidth = convInfo.strideWidth;
const inputChannels = convInfo.inChannels;
const outputChannels = convInfo.outChannels;
const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;
if (convInfo.dataFormat !== 'channelsLast') {
  throw new Error('wasm backend Conv2D does not support dataFormat: ' + $(convInfo.dataFormat). Please use 'channelsLast.');}
const out = backend.makeOutput(convInfo.outShape, 'float32');
const outId = backend.dataIdMap.get(out.dataId).id;
wasmConv2d(xId, x.shape[0], x.shape[1], x.shape[2], filterId, filterHeight, filterWidth, padTop, padRight, padBottom, padLeft, isSamePad, dilationHeight, dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels, outId); return out;

export const conv2DConfig: KernelConfig = {
  kernelName: Conv2D,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: conv2d as {} as KernelFunc
};

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 */

import {backend_util, Conv2DBackpropInput, Conv2DBackpropInputAttrs, Conv2DBackpropInputInputs, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmConv2DBackpropInput: (dyId: number, filterId: number, batchSize: number, filterHeight: number, filterWidth: number, inHeight: number, inWidth: number, inChannels: number, outHeight: number, outWidth: number, outChannels: number, strideHeight: number, strideWidth: number, topPad: number, leftPad: number, fltS0: number, fltS1: number, fltS2: number, xBatchStride: number, xRowStride: number, xColStride: number, xChannelStride: number, yBatchStride: number, yRowStride: number, yColStride: number, yChannelStride: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmConv2DBackpropInput = backend.wasm.cwrap(Conv2DBackpropInput, null, ['number', // dyId: number, filterId: number, batchSize: number, filterHeight: number, filterWidth: number, inHeight: number, inWidth: number, inChannels: number, outHeight: number, outWidth: number, outChannels: number, strideHeight: number, strideWidth: number, topPad: number, leftPad: number, fltS0: number, fltS1: number, fltS2: number, xBatchStride: number, xRowStride: number, xColStride: number, xChannelStride: number, yBatchStride: number, yRowStride: number, yColStride: number, yChannelStride: number, outId: number]);
}

function conv2DBackpropInput(args: {
  backend: BackendWasm,
  inputs: Conv2DBackpropInputInputs,
  attrs: Conv2DBackpropInputAttrs
}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {dy, filter} = inputs;
  const {strides, pad, dataFormat, dimRoundingMode, inputShape} = attrs;
  const dilations = 1;
  const dataFormat = backend_util.convertConv2DDataFormat(dataFormat);
  const convInfo = backend_util.computeConv2DInfo(dyInputShape, filter.shape as [number, number, number, number], strides, dilations, pad, dimRoundingMode, false /* depthwise */, dataFormat);
  const {batchSize, filterHeight, filterWidth, inChannels, inHeight, inWidth, outChannels, outHeight, outWidth, strideHeight, strideWidth} = convInfo;
  const topPad = filterHeight - 1 - convInfo.padInfo.top;
  const leftPad = filterWidth - 1 - convInfo.padInfo.left;
  const isChannelsLast = convInfo.dataFormat === 'channelsLast';
  const dxStrides = util.computeStrides(convInfo.inShape);
  const dyStrides = util.computeStrides(dy.shape);
  const [fltS0, fltS1, fltS2] = util.computeStrides(filter.shape);
  const xBatchStride = dxStrides[0];
  const xRowStride =

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extrapolationValue, cropSize = attrs;
const {image, boxes, boxInd} = inputs;
const numBoxes = boxes.shape[0];
const [cropHeight, cropWidth] = cropSize as [number, number];
const outShape = [numBoxes, cropHeight, cropWidth, image.shape[3]];
let imagesData = backend.dataIdMap.get(image.dataId);
if (image.dtype !== 'float32') {
  const castedData = cast([backend, inputs: {x: image}, attrs: {dtype: 'float32'}]);
  imagesData = backend.dataIdMap.get(castedData.dataId);
}
const imagesId = imagesData.id;
const boxesId = backend.dataIdMap.get(boxes.dataId).id;
const boxIndId = backend.dataIdMap.get(boxInd.dataId).id;
const out = backend.makeOutput(outShape, 'float32');
const outId = backend.dataIdMap.get(out.dataId).id;
const imagesShapeBytes = new Uint8Array(new Int32Array(image.shape).buffer);
wasmCropAndResize(imagesId, boxesId, boxIndId, numBoxes, imagesShapeBytes, cropHeight, cropWidth, InterpolationMethod[method as {} as keyof typeof InterpolationMethod], extrapolationValue, outId);
if (castedData != null) {
  backend.disposeData(castedData.dataId);
}
return out;
}

const cropAndResizeConfig: KernelConfig = {
  kernelName: CropAndResize,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: cropAndResize as {} as KernelFunc
};

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 */

import {backend_util, KernelConfig, KernelFunc, Cumsum, CumsumAttrs, CumsumInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {CppDType} from './types';

import {transpose} from './Transpose';

let wasmCumsum: (xId: number, exclusive: number, reverse: number, finalDim: number, outId: number, dtype: CppDType) => void;

function setup(backend: BackendWasm) {
  wasmCumsum = backend.wasm.cwrap(Cumsum, null /* void */, [
    'number', // x_id
    'number', // exclusive
    'number', // reverse
    'number', // final_dim
    'number', // out_id
    'number'  // dtype
  ]);
}

export function cumsum(
  args: {inputs: CumsumInputs, backend: BackendWasm, attrs: CumsumAttrs}):
TensorInfo {
  const {inputs, backend, attrs} = args;
  const {x} = inputs;
  const {axis, exclusive, reverse} = attrs;
  const xRank = x.shape.length;

  util.assert(x.dtype === 'float32' || x.dtype === 'int32', () => `cumsum does not support ${x.dtype} tensors in the WASM backend`);
  // permute required axis to inner most axis
  const permutation = backend_util.getAxesPermutation([axis], xRank);
  let permutedX = x;
  if (permutation !== null) {
    permutedX = transpose({inputs: {x}, attrs: {perm: permutation}, backend});
  }
  const permutedAxis = backend_util.getInnerMostAxes(1, xRank)[0];
  backend_util.assertAxesAreInnerMostDims('cumsum', [permutedAxis], xRank);
  const permutedOut = backend.makeOutput(permutedX.shape, permutedX.dtype);
  const finalDim = permutedX.shape[permutedAxis];
  const permutedXId = backend.dataIdMap.get(permutedX.dataId).id;
  const permutedOutId = backend.dataIdMap.get(permutedOut.dataId).id;
  wasmCumsum(permutedXId, exclusive ? 1 : 0, reverse ? 1 : 0, finalDim, permutedOutId, CppDType[x.dtype] as number);
  // transpose data back if permutedOut let out = permutedOut;
  if (permutation !== null) {
    const undoPermutation = backend_util.getUndoAxesPermutation([axis], xRank);
    permutedX = transpose({inputs: [x], attrs: {perm: permutation, backend}});
    backend.disposeAxesAreInnerMostDims('cumsum', [permutedAxis], xRank);
    const permutedAxes = [...permutedAxis];
    permutedAxes[permutedAxis] = undoPermutation[permutedAxis];
    permutedAxes[0] = undoPermutation[0];
  }
  // permute required axis to inner most axis
  const permutation = backend_util.getAxesPermutation([axis], xRank);
  let permutedX = x;
  if (permutation !== null) {
    permutedX = transpose({inputs: [x], attrs: {perm: undoPermutation, backend}});
    backend.disposeData(permutedOut.dataId);
    backend.disposeData(permutedX.dataId);
    return out;
  }
  return out;
}

export const cumsumConfig: KernelConfig = {
  kernelName: Cumsum,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: cumsum as {} as KernelFunc
};

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 */
```javascript
depthwiseConv2d(args: {
  inputs: DepthwiseConv2dNativeInputs,
  backend: BackendWasm,
  attrs: DepthwiseConv2dNativeAttrs
}) {
  const {inputs, attr, backend} = args;
  const {x, filter, inputs} = args;
  const xId = backend.dataIdMap.get(x.dataId).id;
  const filterId = backend.dataIdMap.get(filter.dataId).id;
  const {strides, dilations, pad, dimRoundingMode} = attr;
  const sDilations = dilations === null ? [1, 1] : dilations;
  const convInfo = backend_util.computeConv2DInfo(
    x as Tensor4D).shape,
    (filter as Tensor4D).shape,
    strides,
    (sDilations as number | [number, number]),
    pad, dimRoundingMode
    true /* depthwise */);

  const filterHeight = convInfo.filterHeight;
  const filterWidth = convInfo.filterWidth;
  const padTop = convInfo.padInfo.top;
  const padRight = convInfo.padInfo.right;
  const padBottom = convInfo.padInfo.bottom;
  const padLeft = convInfo.padInfo.left;
  const dilationHeight = convInfo.dilationHeight;
  const dilationWidth = convInfo.dilationWidth;
  const strideHeight = convInfo.strideHeight;
  const strideWidth = convInfo.strideWidth;
  const inputChannels = convInfo.inChannels;
  const outputChannels = convInfo.outChannels;
  const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;

  if (convInfo.dataFormat !== 'channelsLast') {
    throw new Error('wasm backend DepthwiseConv2dNative does not support dataFormat:' +
      '{convInfo.dataFormat}'. Please use 'channelsLast'.
    )
  }

  const out = backend.makeOutput(convInfo.outShape, 'float32');
  const outId = backend.dataIdMap.get(out.dataId).id;
  wasmDepthwiseConv2d(
    xId, x.shape[0], x.shape[1], x.shape[2], filterId, filterHeight,
    filterWidth, padTop, padRight, padBottom, padLeft, isSamePad,
    dilationHeight, dilationWidth, strideHeight, strideWidth,
    inputChannels, outputChannels, outId);
  return out;
}

export const depthwiseConv2dNativeConfig:
  KernelConfig = {
    kernelName: DepthwiseConv2dNative,
    backendName: 'wasm',
    setupFunc: setup,
    kernelFunc: depthwiseConv2d as {} as KernelFunc
  };
```

---

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---

*An import [Elu, KernelConfig] from '@tensorflow/tfjs-core';

*An import [createUnaryKernelConfig] from

'./unary_kernel';

*An export const eluConfig: KernelConfig = createUnaryKernelConfig(Elu);

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---

*An import [Equal, KernelConfig] from '@tensorflow/tfjs-core';

*An import [createBinaryKernelConfig] from

'./binary_kernel';

*An const supportsFullBroadcast = false;

*An export const equalConfig: KernelConfig = createBinaryKernelConfig(Equal, supportsFullBroadcast, 'bool');

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---

*An import [Exp, KernelConfig] from '@tensorflow/tfjs-core';

*An import [createUnaryKernelConfig] from

'./unary_kernel';

*An export const expConfig: KernelConfig = createUnaryKernelConfig(Exp, 'float32');

```
KernelConfig = {
  kernelName: FlipLeftRight,
  backendName: 'wasm',
  kernelFunc: flipLeftRight as {}
};

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 */

import {Floor, KernelConfig} from '@tensorflow/tfjs-core';

export const floorConfig: KernelConfig = createUnaryKernelConfig(Floor);

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 */

import {FloorDiv, KernelConfig} from '@tensorflow/tfjs-core';

export const floorDivConfig: KernelConfig = createBinaryKernelConfig(FloorDiv);

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 */

import {FusedBatchNorm, FusedBatchNormAttrs, FusedBatchNormInputs, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';

export const fusedBatchNormConfig: KernelConfig = {
  kernelName: FusedBatchNorm,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: fusedBatchNorm as {} as KernelFunc
};
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*/

import {backend_util, FusedConv2D, FusedConv2DAttrs, FusedConv2DInputs, KernelConfig, KernelFunc,
Tensor4D} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {FusableActivation} from './types';\nlet wasmFusedConv2d:\n    (xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n     filterId: number, filterHeight: number, filterWidth: number,\n     biasId: number,\n     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     leakyreluAlpha: number, outId: number) =>\n    new void(void);\n
function setup(backend: BackendWasm) {
  wasmFusedConv2d = backend.wasm.cwrap(FusedConv2D, null /* void */, [\n    'number',  // xId
    'number',  // batchSize
    'number',  // inputHeight
    'number',  // inputWidth
    'number',  // filterId
    'number',  // filterHeight
    'number',  // filterWidth
    'number',  // biasId
    'number',  // padTop
    'number',  // padRight
    'number',  // padBottom
    'number',  // padLeft
    'number',  // isSamePad
    'number',  // dilationHeight
    'number',  // dilationWidth
    'number',  // strideHeight
    'number',  // strideWidth
    'number',  // inputChannels
    'number',  // outputChannels
    'number',  // activation
    'number',  // leakyreluAlpha
    'number',  // outId
  ]);\n}

function fusedConv2d(args: {
  inputs: FusedConv2DInputs,
  backend: BackendWasm,
  attrs: FusedConv2DAttrs
}){
  const {inputs, attrs, backend} = args;
  const {x, filter, bias, preluActivationWeights} = inputs;

  const {strides, pad, dilations, dataFormat, dimRoundingMode, activation, leakyreluAlpha} = attrs;
  const convInfo = backend_util.computeConv2DInfo(x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations, dataFormat, dimRoundingMode);

  const fusedActivation = FusableActivation[activation as {} as keyof typeof FusableActivation];
  if (fusedActivation == null) {
    throw new Error(`${activation} activation not yet supported for FusedConv2D in the wasm backend.`);
  }

  const xId = backend.dataIdMap.get(x.dataId).id;
  const filterId = backend.dataIdMap.get(filter.dataId).id;
  const biasId = 0;
  const outputChannels = convInfo.outChannels;

  const outputShape = [outputChannels, convInfo.outHeight, convInfo.outWidth];

  if (bias != null) {
    const biasData = backend.dataIdMap.get(bias.dataId);
    if (biasData.shape.length !== 1) {
      throw new Error(`FusedConv2D only supports rank-1 bias but got ${biasData.shape.length} rank`);
    }
    if (biasData.shape[0] !== outputChannels) {
      throw new Error(`FusedConv2D bias shape (${biasData.shape}) does not match the number of output channels`);
    }
  }

  const filterHeight = convInfo.filterHeight;
  const filterWidth = convInfo.filterWidth;
  const padTop = convInfo.padTop;
  const padRight = convInfo.padRight;
  const padBottom = convInfo.padBottom;
  const padLeft = convInfo.padLeft;
  const dilationHeight = convInfo.dilationHeight;
  const dilationWidth = convInfo.dilationWidth;
  const strideHeight = convInfo.strideHeight;
  const strideWidth = convInfo.strideWidth;
  const inputChannels = convInfo.inChannels;
  const isSamePad = convInfo.pads[0];

  const out = backend.makeOutput(outputShape, 'float32');
  const outId = backend.dataIdMap.get(out.dataId).id;
  const preluActivationWeightsId = preluActivationWeights == null ? 0 : backend.dataIdMap.get(preluActivationWeights.dataId).id;

  wasmFusedConv2d(xId, batchSize, inHeight, inWidth, filterId, filterHeight, filterWidth, biasId, padTop, padRight, padBottom, isSamePad, dilationHeight, dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels, fusedActivation, preluActivationWeightsId, leakyreluAlpha, outId);

  return out;
}

export const fusedConv2DConfig: KernelConfig = {
  kernelName: FusedConv2D,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc:
fusedConv2d as {} as KernelFunc

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 */

import {backend_util, FusedDepthwiseConv2D, FusedDepthwiseConv2DAttrs, FusedDepthwiseConv2DInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {FusableActivation} from './types';

let wasmFusedDepthwiseConv2d:
    (xId: number, batchSize: number, inputHeight: number, inputWidth: number,
filterId: number, filterHeight: number, filterWidth: number,
biasId: number, padTop: number, padRight: number, padBottom: number,
padLeft: number, isSamePad: number, dilationHeight: number,

...
import {GatherNd, GatherNdInputs, KernelConfig, TensorInfo} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {CppDType} from './types';

let wasmGatherNd: (xId: number, dtype: CppDType, indicesId: number, numSlices: number, sliceRank: number, sliceSize: number, strides: Uint8Array, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmGatherNd = backend.wasm.cwrap(GatherNd, null /*void*/, 
    'number',  // xId
    'number',  // dtype
    'array',   // xStrides
    'number',  // stridesSize
    'number',  // indicesId
    'number',  // batchSize
    'array',   // outStrides
    'number'   // outId
  );
}

function gatherNd(args: {backend: BackendWasm, inputs: GatherNdInputs, params: number, indices: number}): TensorInfo {
  const {backend, inputs, params, indices} = args;
  const {x, indices} = inputs;
  const {numSlices, sliceSize, strides, outId} = inputs;
  const xData = backend.dataIdMap.get(x.dataId);
  const xId = xData.id;
  const indicesData = backend.dataIdMap.get(indices.dataId);
  const indicesId = indicesData.id;

  const stridesBytes = new Uint8Array(new Int32Array(strides).buffer);

  const outId = backend.dataIdMap.get(outId.dataId).id;
  wasmGatherNd(xId, CppDType[params.dtype], indicesId, numSlices, sliceSize, stridesBytes, outId);

  return outId;
}

export const gatherNdConfig: KernelConfig = {
  kernelName: GatherNd,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: gatherNd
};
parsedAxis = util.parseAxisParam(axis, x.shape)[0];
const indicesVals = backend.readSync(indices.dataId) as 
TypedArray;
const axisDim = x.shape[parsedAxis];
for (let i = 0; i < indicesVals.length; ++i) {
  const index = indicesVals[i];
  util.assert(index <= axisDim - 1 && index >= 0, `GatherV2: the index value ${index} is not in [0, ${axisDim - 1}]`);
}

const shapeInfo = backend_util.segment_util.collectGatherOpShapeInfo(x as Tensor, indices as Tensor, parsedAxis, batchDims);

const flattenX = reshape(x as Tensor, shapeInfo.batchSize, shapeInfo.dimSize, shapeInfo.sliceSize);
const flattenIndex = reshape(indices as Tensor, shapeInfo.batchSize, shapeInfo.sliceSize);

const flattenOutputShape = [shapeInfo.batchSize, shapeInfo.outputShape, indices.size / shapeInfo.batchSize, shapeInfo.sliceSize];

const out = backend.makeOutput(flattenOutputShape, x.dtype);
if (util.sizeFromShape(x.shape) === 0) {
  return out;
}

const stridesSize = flattenX.shape.length - 1;

const xData = backend.dataIdMap.get(flattenX.dataId);
const xId = xData.id;

const indicesData = backend.dataIdMap.get(flattenIndex.dataId);
const indicesId = indicesData.id;

const outId = backend.dataIdMap.get(out.dataId).id;

const xStridesBytes = new Uint8Array(new Int32Array(util.computeStrides(flattenX.shape)).buffer);
const outStridesBytes = new Uint8Array(new Int32Array(util.computeStrides(flattenOutputShape)).buffer);

wasmGather(xId, CppDType[x.dtype], xStridesBytes, stridesSize, indicesId, shapeInfo.batchSize, outStridesBytes, outId);

backend.disposeData(flattenX.dataId);
backend.disposeData(flattenInput.dataId);

// reshape out.shape = [shapeInfo.outputShape, indices.size / shapeInfo.batchSize, shapeInfo.sliceSize];

export const gatherV2Config: KernelConfig = {
  kernelName: GatherV2,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: gatherV2 as {} as KernelFunc
};

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 */

const supportsFullBroadcast = false;
export const greaterEqualConfig: KernelConfig = createBinaryKernelConfig(GreaterEqual, supportsFullBroadcast, 'bool');

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 */

const supportsFullBroadcast = false;
export const greaterConfig: KernelConfig = createBinaryKernelConfig(Greater, supportsFullBroadcast, 'bool');
import {KernelConfig, KernelFunc, LeakyRelu, LeakyReluAttrs, LeakyReluInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {CppDType} from './types';

let wasmFunc: (xId: number, dtype: number, leakyreluAlpha: number, outId: number) => void;

function setupFunc(backend: BackendWasm): void {
  wasmFunc = backend.wasm.cwrap(LeakyRelu, null /* void */, ['number', // x_id
    'number', // dtype
    'number', // leakyrelu_alpha
    'number', // out_id
  ]);)
}

export function leakyRelu(args: LeakyReluInputs, attrs: LeakyReluAttrs, backend: BackendWasm): TensorInfo {
  const {inputs: {x}, attrs: {alpha}, backend} = args;

  const xId = backend.dataIdMap.get(x.dataId).id;
  // According to TF API, LeakyRelu returns float32 when input is either float32 or int32.
  const out = backend.makeOutput(x.shape, 'float32');

  if (util.sizeFromShape(x.shape) !== 0) {
    const outId = backend.dataIdMap.get(out.dataId).id;
    wasmFunc(xId, CppDType[x.dtype], alpha, outId);
  }

  return out;
}

export const leakyReluConfig: KernelConfig = {
  kernelName: LeakyRelu,
  backendName: 'wasm',
  setupFunc,
  kernelFunc: leakyRelu as {} as KernelFunc,
};

import {KernelConfig, Less} from '@tensorflow/tfjs-core';

import {createBinaryKernelConfig} from './binary_kernel';
const supportsFullBroadcast = false;
export const lessConfig: KernelConfig = createBinaryKernelConfig(Less, supportsFullBroadcast, 'bool');

import {KernelConfig, LessEqual} from '@tensorflow/tfjs-core';

import {createBinaryKernelConfig} from './binary_kernel';
const supportsFullBroadcast = false;
export const lessEqualConfig: KernelConfig = createBinaryKernelConfig(LessEqual, supportsFullBroadcast, 'bool');

import {KernelConfig, Log} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';
export const logConfig: KernelConfig = createUnaryKernelConfig(Log);
import {KernelConfig, LogicalAnd} from '@tensorflow/tfjs-core';

import {createBinaryKernelConfig} from './binary_kernel';

const supportsFullBroadcast = false;

export const logicalAndConfig: KernelConfig = createBinaryKernelConfig(LogicalAnd, supportsFullBroadcast, 'bool',
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 */

import {backend_util, KernelConfig, KernelFunc, Max, MaxAttrs, MaxInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {permuteAxesAndTranspose} from './kernel_utils';
import {CppDType} from './types';

let wasmMax: (xId: number, dtype: number, reduceSize: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmMax = backend.wasm.cwrap(Max, null /*void*/, [
    'number',  // x_id
    'number',  // dtype
    'number',  // reduce_size
    'number',  // out_id
  ]);}

function max(args: {backend: BackendWasm, inputs: MaxInputs, attrs: MaxAttrs}):
    TensorInfo {
  const {backend, inputs, attrs} = args;

  const {reductionIndices: axis, keepDims} = attrs;
  const {x} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  let inputId = xId;
  let input = x;

  const {transposed, axes, originalAxes, inputWasTransposed} =
      permuteAxesAndTranspose(x, axis, backend);

  if (inputWasTransposed) {
    const transposedId = backend.dataIdMap.get(transposed.dataId).id;
    input = transposed;
    inputId = transposedId;
  }

  const inputRank = input.shape.length;
  backend_util.assertAxesAreInnerMostDims('max', axes, inputRank);

  const [outShape, reduceShape] =
      backend_util.computeOutAndReduceShapes(input.shape, axes);
  const reduceSize = util.sizeFromShape(reduceShape);

  const out = backend.makeOutput(outShape, x.dtype);
  if (util.sizeFromShape(input.shape) !== 0) {
    const outId = backend.dataIdMap.get(out.dataId).id;
    wasmMax(inputId, CppDType[x.dtype], reduceSize, outId);
  }

  if (inputWasTransposed) {
    // dispose of the transposed tensor.
    backend.disposeData(transposed.dataId);
  }

  if (keepDims) {
    // reshape
    const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);
    out.shape = newShape;
  }

  return out;
}

export const maxConfig: KernelConfig = {
  kernelName: Max,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: max as {} as KernelFunc
};

import {KernelConfig, Maximum} from '@tensorflow/tfjs-core';

import {createBinaryKernelConfig} from './binary_kernel';

const supportsFullBroadcast = false;

export const maximumConfig: KernelConfig = createBinaryKernelConfig(Maximum, supportsFullBroadcast);

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 */
import {backend_util, KernelConfig, KernelFunc, MaxPool, MaxPoolAttrs, MaxPoolInputs, Tensor4D, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmMaxPool = backend.wasm.cwrap(MaxPool, null /* void */, [
    'number',  // xId
    'number',  // batchSize
    'number',  // inputHeight
    'number',  // inputWidth
    'number',  // filterHeight
    'number',  // filterWidth
    'number',  // padTop
    'number',  // padRight
    'number',  // padBottom
    'number',  // padLeft
    'number',  // dilationHeight
    'number',  // dilationWidth
    'number',  // strideHeight
    'number',  // strideWidth
    'number',  // inputChannels
    'number',  // outputChannels
    'number',  // outputId
] /*function setup(backend: BackendWasm) { 
  wasmMaxPool = backend.wasm.cwrap(MaxPool, null /* void */, [
    'number',  // xId
    'number',  // batchSize
    'number',  // inputHeight
    'number',  // inputWidth
    'number',  // filterHeight
    'number',  // filterWidth
    'number',  // padTop
    'number',  // padRight
    'number',  // padBottom
    'number',  // padLeft
    'number',  // dilationHeight
    'number',  // dilationWidth
    'number',  // strideHeight
    'number',  // strideWidth
    'number',  // inputChannels
    'number',  // outputChannels
    'number',  // outputId
  ]); 
}*/

export const maxPoolConfig: KernelConfig = {
  kernelName: MaxPool,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: wasmMaxPool
};

*/

import {backend_util, KernelConfig, KernelFunc, Mean, MeanAttrs, MeanInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';
import {cast} from './Cast';

import {permuteAxesAndTranspose} from './kernel_utils';

let wasmMean = backend.wasm.cwrap(Mean, null /*void*/, ['number', 'number', 'number']);

function setup(backend: BackendWasm): void {
  wasmMean = backend.wasm.cwrap(Mean, null /* void */, ['number', 'number', 'number']);
}

export function mean(
    args:
    {backend: BackendWasm, inputs: MeanInputs, attrs: MeanAttrs}:
    TensorInfo {
  const {backend, inputs, attrs} = args;
  const {axis, keepDims} = attrs;
  const x = inputs.x as Tensor4D;
  const xId = backend.dataIdMap.get(x.dataId).id;
  return backend.makeOutput(x.shape, 'float32');
};
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 *
=============================================================================

import {backend_util, KernelConfig, KernelFunc, Min, MinAttrs, MinInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {permuteAxesAndTranspose} from './kernel_utils';
import {CppDType} from './types';

let wasmMin: (xId: number, dtype: number, reduceSize: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmMin = backend.wasm.cwrap(Min, null /*void*/, 
    ['number',  // x_id
     'number',  // dtype
     'number',  // reduce_size
     'number',  // out_id
   ]);
}

function min(args: {backend: BackendWasm, inputs: MinInputs, attrs: MinAttrs}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {axis, keepDims} = attrs;
  const {x} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  let inputId = xId;
  let input = x;

  const {transposed, axes, originalAxes, inputWasTransposed} = permuteAxesAndTranspose(x, axis, backend);

  if (inputWasTransposed) {
    const transposedId = backend.dataIdMap.get(transposed.dataId).id;
    if (transposedId !== xId) {
      // transpose was not a no-op. We will need to dispose of this input.
      input = transposed;
      inputId = transposedId;
    }
  }

  reductionAxes = backend_util.getInnerMostAxes
    (reductionAxes.length, input.shape.length);
  const [outShape, reduceShape] = backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);

  const reduceSize = util.sizeFromShape(reduceShape);
  let castedInput = input;
  if (input.dtype !== 'float32') {
    castedInput = cast({backend, inputs: {x: input}, attrs: {dtype: 'float32'}});
    inputId = backend.dataIdMap.get(castedInput.dataId).id;
  }

  const out = backend.makeOutput(outShape, 'float32');
  if (util.sizeFromShape(input.shape) !== 0) {
    const outId = backend.dataIdMap.get(out.dataId).id;
    wasmMin(inputId, CppDType[x.dtype], reduceSize, outId);
  }

  if (inputWasTransposed) {
    // dispose of the transposed tensor.
    backend.disposeData(transposed.dataId);
  }

  if (keepDims) {
    // reshape
    const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);
    out.shape = newShape;
  }

  return out;
}

export const minConfig: KernelConfig = {
  kernelName: Min,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: min as {} as KernelFunc
};

*/

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 *
=============================================================================

*/

import {backend_util, KernelConfig, KernelFunc, Min, MinAttrs, MinInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {permuteAxesAndTranspose} from './kernel_utils';
import {CppDType} from './types';

let wasmMin: (xId: number, dtype: number, reduceSize: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmMin = backend.wasm.cwrap(Min, null /*void*/, 
    ['number',  // x_id
     'number',  // dtype
     'number',  // reduce_size
     'number',  // out_id
   ]);
}

function min(args: {backend: BackendWasm, inputs: MinInputs, attrs: MinAttrs}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {axis, keepDims} = attrs;
  const {x} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  let inputId = xId;
  let input = x;

  const {transposed, axes, originalAxes, inputWasTransposed} = permuteAxesAndTranspose(x, axis, backend);

  if (inputWasTransposed) {
    const transposedId = backend.dataIdMap.get(transposed.dataId).id;
    if (transposedId !== xId) {
      // transpose was not a no-op. We will need to dispose of this input.
      input = transposed;
      inputId = transposedId;
    }
  }

  reductionAxes = backend_util.getInnerMostAxes
    (reductionAxes.length, input.shape.length);
  const [outShape, reduceShape] = backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);

  const reduceSize = util.sizeFromShape(reduceShape);
  let castedInput = input;
  if (input.dtype !== 'float32') {
    castedInput = cast({backend, inputs: {x: input}, attrs: {dtype: 'float32'}});
    inputId = backend.dataIdMap.get(castedInput.dataId).id;
  }

  const out = backend.makeOutput(outShape, 'float32');
  if (util.sizeFromShape(input.shape) !== 0) {
    const outId = backend.dataIdMap.get(out.dataId).id;
    wasmMin(inputId, CppDType[x.dtype], reduceSize, outId);
  }

  if (inputWasTransposed) {
    // dispose of the transposed tensor.
    backend.disposeData(transposed.dataId);
  }

  if (keepDims) {
    // reshape
    const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);
    out.shape = newShape;
  }

  return out;
}

export const minConfig: KernelConfig = {
  kernelName: Min,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: min as {} as KernelFunc
};

*/

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=============================================================================
*/

import {KernelConfig, Minimum} from '@tensorflow/tfjs-core';

import {createBinaryKernelConfig} from './binary_kernel';

const supportsFullBroadcast = false;
export const minimumConfig: KernelConfig =
createBinaryKernelConfig(Minimum, supportsFullBroadcast);

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=============================================================================
*/

import {KernelConfig, MirrorPad, MirrorPadAttrs, MirrorPadInputs} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {CppDType} from './types';

// Must match enum in MirrorPad.cc
enum MirrorPaddingMode {
  reflect = 0,
  symmetric = 1
}

let wasmMirrorPad: (
  xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype: number,
  prePaddingsBytes: Uint8Array, postPaddingsBytes: Uint8Array, mode: number,
  outId: number) => void;

function setup(backend: BackendWasm) {
  wasmMirrorPad = backend.wasm.cwrap(MirrorPad, null /* void */, [
    'number', // xId
    'array',  // x.shape
    'number',  // x.shape.length
    'number',  // x.dtype
    'array',  // pre-paddings
    'array',  // post-paddings
    'number',  // mode
    'number',  // outId
  ]);
}

function mirrorPad(args: {
  inputs: MirrorPadInputs,
  backend: BackendWasm,
  attrs: MirrorPadAttrs
}) {
  const {inputs: {x}, backend, attrs: {paddings, mode}} = args;

  const outShape = paddings.map(
      (p, i) => p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);
  const xId = backend.dataIdMap.get(x.dataId).id;
  const out = backend.makeOutput(outShape, x.dtype);
  const outId = backend.dataIdMap.get(out.dataId).id;
  const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);

  const prePaddingsFlat = paddings.map(padTuple => padTuple[0]);
  const postPaddingsFlat = paddings.map(padTuple => padTuple[1]);
  const prePaddingsBytes = new Uint8Array(new Int32Array(prePaddingsFlat).buffer);
  const postPaddingsBytes = new Uint8Array(new Int32Array(postPaddingsFlat).buffer);
  const xId, xShapeBytes, x.shape.length, CppDType[x.dtype], prePaddingsBytes,\n  MirrorPaddingMode[mode], outId);\n  return out;

export const mirrorPadConfig: KernelConfig = {
  kernelName: MirrorPad,
  backendName: 'wasm',
  kernelFunc: mirrorPad as {} as KernelFunc,
  setupFunc: setup
};

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=============================================================================
*/

import {KernelConfig, Multiply} from '@tensorflow/tfjs-core';

import {createBinaryKernelConfig} from './binary_kernel';

const supportsFullBroadcast = true;
export const multiplyConfig: KernelConfig =
createBinaryKernelConfig(Multiply, supportsFullBroadcast);

*/
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=============================================================================

*/

import {KernelConfig, KernelFunc, NonMaxSuppressionV4, NonMaxSuppressionV4Attrs,
NonMaxSuppressionV4Inputs, TensorInfo} from '@tensorflow/tfjs-core';

import {parseResultStruct} from './NonMaxSuppression_util';

let wasmFunc: (boxesId: number, scoresId: number, maxOutputSize: number, iouThreshold: number, scoreThreshold: number, padToMaxOutputSize: boolean) => number;

function setup(backend: BackendWasm): void {
  wasmFunc = backend.wasm.cwrap(NonMaxSuppressionV4, 'number',
      [boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold, padToMaxOutputSize]);
}

function nonMaxSuppressionV4(args: {
  backend: BackendWasm,
  inputs: NonMaxSuppressionV4Inputs,
  attrs: NonMaxSuppressionV4Attrs
}): TensorInfo[] {
  const {backend, inputs, attrs} = args;
  const {iouThreshold, maxOutputSize, scoreThreshold, padToMaxOutputSize} = attrs;
  const {boxes, scores} = inputs;
  const boxesId = backend.dataIdMap.get(boxes.dataId).id;
  const scoresId = backend.dataIdMap.get(scores.dataId).id;
  const resOffset = wasmFunc(boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold, padToMaxOutputSize);
  const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} = parseResultStruct(backend, resOffset);

  // Since we are not using scores for V4, we have to delete it from the heap.
  backend.wasm._free(pSelectedScores);

  const selectedIndicesTensor = backend.makeOutput([selectedSize], 'int32', pSelectedIndices);
  const validOutputsTensor = backend.makeOutput([pValidOutputs], 'int32', pValidOutputs);
  return [selectedIndicesTensor, validOutputsTensor];
}

export const nonMaxSuppressionV4Config: KernelConfig = {
  kernelName: NonMaxSuppressionV4,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: nonMaxSuppressionV4
};

=============================================================================

*/

import {KernelConfig, KernelFunc, NonMaxSuppressionV5, NonMaxSuppressionV5Attrs,
NonMaxSupressionV5Inputs, TensorInfo} from '@tensorflow/tfjs-core';

import {parseResultStruct} from './NonMaxSuppression_util';

let wasmFunc: (boxesId: number, scoresId: number, maxOutputSize: number, iouThreshold: number, scoreThreshold: number, softNmsSigma: number) => number;

function setup(backend: BackendWasm): void {
  wasmFunc = backend.wasm.cwrap(NonMaxSuppressionV5, 'number',
      [boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold, softNmsSigma]);
}

function kernelFunc(args: {
  backend: BackendWasm,
  inputs: NonMaxSupressionV5Inputs,
  attrs: NonMaxSupressionV5Attrs
}): TensorInfo[] {
  const {backend, inputs, attrs} = args;
  const {iouThreshold, maxOutputSize, scoreThreshold, softNmsSigma} = attrs;
  const {boxes, scores} = inputs;
  const boxesId = backend.dataIdMap.get(boxes.dataId).id;
  const scoresId = backend.dataIdMap.get(scores.dataId).id;
  const resOffset = wasmFunc(boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold, softNmsSigma);
  const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} = parseResultStruct(backend, resOffset);

  // 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\n const selectedScoresTensor =\n backend.makeOutput([selectedSize], 'float32', pSelectedScores);\n\n return [selectedIndicesTensor, selectedScoresTensor];

export const nonMaxSuppressionV5Config: KernelConfig = {
  kernelName: NonMaxSuppressionV5,
  backendName: 'wasm',
  setupFunc: setup,
  kernelfunc: kernelfunc as {} as KernelFunc,
};

type {\n  kernelName: string,
  backendName: string,
  setupFunc: Function,
  kernelfunc: Function,
  \n  \n  export const nonMaxSuppressionV5Config: KernelConfig = {
  kernelName: NonMaxSuppressionV5,
  backendName: 'wasm',
  setupFunc: setup,
  kernelfunc: kernelfunc as {} as KernelFunc,
};

export const nonMaxSuppressionV5Config: KernelConfig = {
  kernelName: NonMaxSuppressionV5,
  backendName: 'wasm',
  setupFunc: setup,
  kernelfunc: kernelfunc as {} as KernelFunc,
};

export const nonMaxSuppressionV5Config: KernelConfig = {
  kernelName: NonMaxSuppressionV5,
  backendName: 'wasm',
  setupFunc: setup,
  kernelfunc: kernelfunc as {} as KernelFunc,
};

export const nonMaxSuppressionV5Config: KernelConfig = {
  kernelName: NonMaxSuppressionV5,
  backendName: 'wasm',
  setupFunc: setup,
  kernelfunc: kernelfunc as {} as KernelFunc,
};

export const nonMaxSuppressionV5Config: KernelConfig = {
  kernelName: NonMaxSuppressionV5,
  backendName: 'wasm',
  setupFunc: setup,
  kernelfunc: kernelfunc as {} as KernelFunc,
};

export const nonMaxSuppressionV5Config: KernelConfig = {
  kernelName: NonMaxSuppressionV5,
  backendName: 'wasm',
  setupFunc: setup,
  kernelfunc: kernelfunc as {} as KernelFunc,
};

export const nonMaxSuppressionV5Config: KernelConfig = {
  kernelName: NonMaxSuppressionV5,
  backendName: 'wasm',
  setupFunc: setup,
  kernelfunc: kernelfunc as {} as KernelFunc,
};

export const nonMaxSuppressionV5Config: KernelConfig = {
  kernelName: NonMaxSuppressionV5,
  backendName: 'wasm',
  setupFunc: setup,
  kernelfunc: kernelfunc as {} as KernelFunc,
};

export const nonMaxSuppressionV5Config: KernelConfig = {
  kernelName: NonMaxSuppressionV5,
  backendName: 'wasm',
  setupFunc: setup,
  kernelfunc: kernelfunc as {} as KernelFunc,
};

export const nonMaxSuppressionV5Config: KernelConfig = {
  kernelName: NonMaxSuppressionV5,
  backendName: 'wasm',
  setupFunc: setup,
  kernelfunc: kernelfunc as {} as KernelFunc,
};

export const nonMaxSuppressionV5Config: KernelConfig = {
  kernelName: NonMaxSuppressionV5,
  backendName: 'wasm',
  setupFunc: setup,
  kernelfunc: kernelfunc as {} as KernelFunc,
};

export const nonMaxSuppressionV5Config: KernelConfig = {
  kernelName: NonMaxSuppressionV5,
  backendName: 'wasm',
  setupFunc: setup,
  kernelfunc: kernelfunc as {} as KernelFunc,
};

export const nonMaxSuppressionV5Config: KernelConfig = {
  kernelName: NonMaxSuppressionV5,
  backendName: 'wasm',
  setupFunc: setup,
  kernelfunc: kernelfunc as {} as KernelFunc,
};

export const nonMaxSuppressionV5Config: KernelConfig = {
  kernelName: NonMaxSuppressionV5,
  backendName: 'wasm',
  setupFunc: setup,
  kernelfunc: kernelfunc as {} as KernelFunc,
};

export const nonMaxSuppressionV5Config: KernelConfig = {
  kernelName: NonMaxSuppressionV5,
  backendName: 'wasm',
  setupFunc: setup,
  kernelfunc: kernelfunc as {} as KernelFunc,
};

export const nonMaxSuppressionV5Config: KernelConfig = {
  kernelName: NonMaxSuppressionV5,
  backendName: 'wasm',
  setupFunc: setup,
  kernelfunc: kernelfunc as {} as KernelFunc,
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 */

import {KernelConfig, Pow} from '@tensorflow/tfjs-core';

import {createBinaryKernelConfig} from './binary_kernel';

const supportsFullBroadcast = false;
export const powConfig: KernelConfig = createBinaryKernelConfig(Pow, supportsFullBroadcast);

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 */

import {KernelConfig, KernelFunc, Prelu, PreluInputs} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {cast} from './Cast';

function setup(backend: BackendWasm) {
  wasmPrelu = backend.wasm.cwrap(Prelu, null /* void */, 
    ['number',  // x_id
     'number',  // weights_id
     'number']   // out_id
  );
}

function prelu(args: {inputs: PreluInputs, backend: BackendWasm}) {
  const {inputs, backend} = args;
  const {x, alpha} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  const weightsId = backend.dataIdMap.get(alpha.dataId).id;

  let inputId = xId;
  let castedInput = x;
  if (input.dtype !== 'float32') {
    castedInput = cast({backend, inputs: {x}, attrs: {dtype: 'float32'}});
    inputId = backend.dataIdMap.get(castedInput.dataId).id;
  }

  const out = backend.makeOutput(x.shape, 'float32');
  const outId = backend.dataIdMap.get(out.dataId).id;
  wasmPrelu(inputId, weightsId, outId);

  if (input.dtype !== 'float32') {
    backend.disposeData(castedInput.dataId);
  }
  return out;
}

export const preluConfig: KernelConfig = {
  kernelName: Prelu,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: prelu as {} as KernelFunc
};

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 */

import {backend_util, KernelConfig, KernelFunc, Prod, ProdAttrs, ProdInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {permuteAxesAndTranspose} from './kernel_utils';

import {CppDType} from './types';

function setup(backend: BackendWasm): void {
  wasmProd = backend.wasm.cwrap(Prod, null /*void*/, 
    ['number',
     'number',
     'number',
     'number']
  );
}

function prod(args: {
  backend: BackendWasm,
  inputs: ProdInputs,
  attrs: ProdAttrs
}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {axis, keepDims} = attrs;
  const {x} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  let inputId = xId;
  let castedInput = x;
  if (input.dtype !== 'float32') {
    castedInput = cast({backend, inputs: {x}, attrs: {dtype: 'float32'}});
    inputId = backend.dataIdMap.get(castedInput.dataId).id;
  }

  const out = backend.makeOutput(x.shape, 'float32');
  const outId = backend.dataIdMap.get(out.dataId).id;
  wasmProd(inputId, weightsId, outId);

  if (input.dtype !== 'float32') {
    backend.disposeData(castedInput.dataId);
  }
  return out;
}

export const prodConfig: KernelConfig = {
  kernelName: Prod,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: prod as {} as KernelFunc
};

---

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backend.dataIdMap.get(transposed.dataId).id; 
if (transposedId !== xId) { 
  // transpose was not a no-op. We will need to dispose of this
  // once we are done.
  input = transposed;
  inputId = xId;
  reductionAxes = backend_util.getInnerMostAxes(reductionAxes.length, input.shape.length);
  backend_util.assertAxesAreInnerMostDims('prod', reductionAxes, input.shape.length);
  const [outShape, reduceShape] = backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);
  const reduceSize = util.sizeFromShape(reduceShape);
  const out = backend.makeOutput(outShape, input.dtype);
  if (util.sizeFromShape(input.shape) !== 0) {
    const outId = backend.dataIdMap.get(out.dataId).id;
    wasmProd(inputId, reduceSize, CppDType[out.dtype], outId);
  }
  if (inputWasTransposed) {
    // dispose of the transposed tensor.
    backend.disposeData(transposed.dataId);
  }
  if (keepDims) {
    // reshape
    const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);
    out.shape = newShape;
  }
}

return out;

export const prodConfig: KernelConfig = {
  kernelName: Prod,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: prod as {} as KernelFunc
};

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 */

import {KernelConfig, KernelFunc, Range, RangeAttrs, TensorInfo} from '@tensorflow/tfjs-core';

const supportsFullBroadcast = true;
export const realDivConfig: KernelConfig = createBinaryKernelConfig(RealDiv, supportsFullBroadcast);

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 */

import {KernelConfig, RealDiv} from '@tensorflow/tfjs-core';

const supportsFullBroadcast = true;
export const relayConfig: KernelConfig = createUnaryKernelConfig(Relay);

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 */

import {KernelConfig, Relu} from '@tensorflow/tfjs-core';

const supportsFullBroadcast = true;
export const reluConfig: KernelConfig = createUnaryKernelConfig(Relu);

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=============================================================================

*/

import {KernelConfig, Relu6} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';

export const relu6Config: KernelConfig = createUnaryKernelConfig(Relu6);

/*=============================================================================

*/

import {KernelConfig, KernelFunc, ResizeBilinear, ResizeBilinearAttrs, ResizeBilinearInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {cast} from './Cast';

let wasmResizeBilinear: (xId: number, batch: number, oldHeight: number, oldWidth: number, numChannels: number, newHeight: number, newWidth: number, alignCorners: number, halfPixelCenters: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmResizeBilinear = backend.wasm.cwrap(ResizeBilinear, null /*void*/, 
    'number',  // xId
    'number',  // batch
    'number',  // oldHeight
    'number',  // oldWidth
    'number',  // numChannels
    'number',  // newHeight
    'number',  // newWidth
    'number',  // alignCorners
    'number',  // halfPixelCenters
    'number'   // outId
  );
}

function resizeBilinear(args: {
  backend: BackendWasm,
  inputs: ResizeBilinearInputs,
  attrs: ResizeBilinearAttrs
}): TensorInfo {
  const {backend, inputs, attrs} = args;

  const {images} = inputs;
  const {alignCorners, halfPixelCenters, size} = attrs;
  const [newHeight, newWidth] = size;

  const [batch, oldHeight, oldWidth, numChannels] = images.shape;
  const outShape = [batch, newHeight, newWidth, numChannels];

  let xData = backend.dataIdMap.get(images.dataId);
  let castedData;
  if (xData.dtype !== 'float32') {
    castedData =
      cast({backend, inputs: {x: images}, attrs: {dtype: 'float32'}});
    xData = backend.dataIdMap.get(castedData.dataId);
  }
  const xId = xData.id;

  const out = backend.makeOutput(outShape, 'float32');
  if (util.sizeFromShape(images.shape) === 0) {
    return out;
  }

  const outId = backend.dataIdMap.get(out.dataId).id;

  wasmResizeBilinear(
      xId, batch, oldHeight,
      oldWidth, numChannels, newHeight,
      newWidth, alignCorners ? 1 : 0, halfPixelCenters ? 1 : 0, outId);

  if (castedData != null) {
    backend.disposeData(castedData.dataId);
  }

  return out;
}

export const resizeBilinearConfig: KernelConfig = {
  kernelName: ResizeBilinear,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: resizeBilinear as {} as KernelFunc
};

/*=============================================================================

*/

import {KernelConfig, KernelFunc, Reverse, ReverseAttrs, ReverseInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {identity} from './Identity';
import {reshape} from './Reshape';

let wasmReverse: (xId: number, axes: Uint8Array, axesLength: number, outShape: Uint8Array, outShapeLength: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmReverse = backend.wasm.cwrap(Reverse, null /*void*/, 
    'number',  // xId
    'array',  // axes
    'number',  // axesLength
    'array',  // outShape
    'number',  // outShapeLength
    'number'
  );
}

function reverseArgs(args: {
  // @license
  backend: BackendWasm,
  inputs: ReverseInputs,
  attrs: ReverseAttrs
}: any) {

  const {backend, inputs, attrs} = args;

  const {data} = inputs;
  const {axes} = attrs;

  return {
    data: data.dataId,
    axes: axes
  };
}

function reverse(dataId: number, axes: number, outDataId: number) {
  wasmReverse(dataId, axes, axes.length, outShape, outShapeLength, outDataId);
}

function reverseConfig() {
  return {
    kernelName: Reverse,
    backendName: 'wasm',
    setupFunc: setup,
    kernelFunc: reverse as {} as KernelFunc
  };
}

/*=============================================================================

*/

import {KernelConfig, KernelFunc, Relu6} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';

export const relu6Config: KernelConfig = createUnaryKernelConfig(Relu6);

/*=============================================================================

*/

import {KernelConfig, Relu6} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';

export const relu6Config: KernelConfig = createUnaryKernelConfig(Relu6);

/*=============================================================================

*/
// out_id
]

 TensorInfo

 const [inputs, backend, attr] = args;

 const [x] = inputs;

 const [dims] = attr;

 const axes = util.parseAxisParam(dims, x.shape);

 if (x.shape.length === 0) {

 return identity({inputs: [x], backend});

 outId = backend.makeOutput(x.shape, x.dtype);

 const xId = backend.dataIdMap.get(x.dataId);

 const outId = backend.dataIdMap.get(out.dataId);

 const axesBytes = new Uint8Array(new Int32Array(axes).buffer);

 wasmReverse(xId, axesBytes, axes.length, outShapeBytes, x.shape.length, outId);

 const reshaped = reshape({inputs: [x, out], attrs: {shape: x.shape, backend}});

 backend.disposeData(out.dataId);

 return reshaped;
}

export const reverseConfig: KernelConfig = {

 kernelName: Reverse,

 backendName: 'wasm',

 kernelFunc: reverse as {} as KernelFunc,

 setupFunc: setup
};

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 */

import {KernelConfig, KernelFunc, CreateUnaryKernelConfig} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';

export const roundConfig: KernelConfig = createUnaryKernelConfig(Round);

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 */

import {KernelConfig, KernelFunc, RotateWithOffset} from '@tensorflow/tfjs-core';

import {CreateUnaryKernelConfig, rotateWithOffset} from './unary_kernel';

export const roundConfig: KernelConfig = createUnaryKernelConfig(Round);

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import {KernelConfig, KernelFunc, RotateWithOffset} from '@tensorflow/tfjs-core';

import {CreateUnaryKernelConfig, rotateWithOffset} from './unary_kernel';

export const roundConfig: KernelConfig = createUnaryKernelConfig(Round);
```javascript
const tId = backend.dataIdMap.get(t.dataId).id;
const eId = backend.dataIdMap.get(e.dataId).id;
const out = backend.makeOutput(t.shape, t.dtype);
const outId = backend.dataIdMap.get(out.dataId).id;

const cRank = condition.shape.length;
const tRank = t.shape.length;
const offset = cRank === 0 || cRank > 1 || tRank === 1 ? 1 : 0;

const conditionId = backend.dataIdMap.get(condition.dataId).id;
wasmSelect(conditionId, tId, eId, offset, outId);
return out;
}

export const selectConfig: KernelConfig = {
  kernelName: Select,
  backendName: 'wasm',
  kernelFunc: select as {} as KernelFunc,
  setupFunc: setup
};

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 */

import {KernelConfig, Sigmoid, SigmoidInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmFunc: (xId: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmFunc = backend.wasm.cwrap(Sigmoid, null /* void */, ['number', 'number']);
}

function sigmoid(args: {backend: BackendWasm, inputs: SigmoidInputs}):
  TensorInfo {
  const {backend, inputs: {x}} = args;
  const xId = backend.dataIdMap.get(x.dataId).id;
  const out = backend.makeOutput(x.shape, x.dtype);
  const outId = backend.dataIdMap.get(out.dataId).id;

  const channels = out.shape[0];
  const batch = util.sizeFromShape(out.shape) / channels;

  // Short-circuit zero-sized tensors.
  if (util.sizeFromShape(out.shape) === 0) {
    return out;
  }

  wasmFunc(xId, outId, channels, batch);
  return out;
}

export const sigmoidConfig: KernelConfig = {
  kernelName: 'Sigmoid',
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: sigmoid as {} as KernelFunc
};

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 */

import {KernelConfig, KernelFunc, Softmax, SoftmaxAttrs, SoftmaxInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmFunc: (xId: number, outId: number, channels: number, batch: number) => void;

function setup(backend: BackendWasm): void {
  wasmFunc = backend.wasm.cwrap(Softmax, null /* void */, ['number', 'number', 'number', 'number']);
}

function softmax(args: {backend: BackendWasm, inputs: SoftmaxInputs, attrs: SoftmaxAttrs}):
  TensorInfo {
  const {backend, inputs: {logits}, attrs: {dim}} = args;
  const xId = backend.dataIdMap.get(logits.dataId).id;
  const out = backend.makeOutput(logits.shape, logits.shape[dim]);

  const outId = backend.dataIdMap.get(out.dataId).id;
  const channels = logits.shape[dim];

  // Short-circuit zero-sized tensors.
  if (util.sizeFromShape(logits.shape) === 0) {
    return out;
  }

  wasmFunc(xId, outId, channels, batch);
  return out;
}

export const softmaxConfig: KernelConfig = {
  kernelName: 'Softmax',
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: softmax as {} as KernelFunc
};

```
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```javascript
util.sizeFromShape(out.shape) === 0) {
    return out;
  }

  wasmFunc(xId, outId, channels, batch);
  return
```
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=============================================================================

import {KernelConfig, KernelFunc, slice_util, StridedSlice, StridedSliceAttrs, StridedSliceInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';
import {reshape} from './Reshape';
import {slice} from './Slice';

let wasmStridedSlice: (
    xId: number, xStridesBytes: Uint8Array, xRank: number,
    beginBytes: Uint8Array, endBytes: Uint8Array, stridesBytes: Uint8Array,
    outShapeBytes: Uint8Array, outStridesBytes: Uint8Array,
    outShapeLength: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmStridedSlice = backend.wasm.cwrap(StridedSlice, null /*void*/, [
    'number',  // xId
    'array',   // xStrides
    'number',  // xRank
    'array',   // begin
    'array',   // end
    'array',   // strides
    'array',   // outShape
    'array',   // outStrides
    'number',  // outShapeLength
    'number'   // outId
  ]);
}

export function stridedSlice(args: {
  backend: BackendWasm,
  inputs: StridedSliceInputs,
  attrs: StridedSliceAttrs
}): TensorInfo {
  const {backend, inputs, attrs} = args;

  const {x} = inputs;

  const {
    begin,
    end,
    strides,
    beginMask,
    endMask,
    ellipsisMask,
    newAxisMask,
    shrinkAxisMask
  } = attrs;

  const {
    finalShapeSparse,
    finalShape,
    isIdentity,
    sliceDim0,
    isSimpleSlice,
    begin: $begin,
    end: $end,
    strides: $strides
  } =
      slice_util.sliceInfo(
          x.shape, begin, end, strides, beginMask, endMask, ellipsisMask,
          newAxisMask, shrinkAxisMask);

  let result;

  if (isIdentity) {
    // Optimization #1, slice is a no-op plus reshape
    result = reshape({inputs: {x},
        backend, attrs: {shape: finalShape}});
  } else if (sliceDim0 || isSimpleSlice) {
    // Optimization #2, slice is
    // memory contiguous (only occurs in dim 0)
    util.assert(
        x.shape.length >= 1,
        () => `Input must have
        rank at least 1, got: ${x.shape.length}`);

    const size = slice_util.computeOutShape($begin, $end, $strides);

    // To tolerate begin[0] > end[0] (a 0-output slice), we min(begin, end).
    const sliced = slice({inputs: {x},
        backend, attrs: {begin: $begin, size}});
    result =
        reshape({inputs: {x: sliced}, backend, attrs: {shape: finalShape}});
    backend.disposeData(sliced.dataId);
  } else {
    const out =
        backend.makeOutput(finalShapeSparse, 'float32');

    const xId = backend.dataIdMap.get(x.dataId).id;
    const xStridesBytes =
        new Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);
    const beginBytes = new Uint8Array($begin);
    const endBytes = new Uint8Array($end);
    const stridesBytes = new Uint8Array($strides);

    const outputShapeBytes =
        new Uint8Array(util.computeStrides(finalShapeSparse)).buffer;
    const outId =
        backend.dataIdMap.get(out.dataId).id;

    result = reshape({inputs: {x: out}, backend, attrs: {shape: finalShape}});

    backend.disposeData(outputShapeBytes.dataId);

    return result;
  }
}

export const stridedSliceConfig: KernelConfig = {
  kernelName: StridedSlice,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: stridedSlice as {} as KernelFunc
};

=============================================================================

import {KernelConfig, KernelFunc, slice_util, StridedSlice, StridedSliceAttrs, StridedSliceInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {createBinaryKernelConfig} from './binary_kernel';
const supportsFullBroadcast = true;
export const subConfig: KernelConfig =

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=============================================================================
createBinaryKernelConfig(Sub, supportsFullBroadcast);"/n","/**
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 */

import {KernelConfig, Tan} from '@tensorflow/tfjs-core';
import {createUnaryKernelConfig} from './unary_kernel';
export const tanConfig: KernelConfig = createUnaryKernelConfig(Tan);

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 */

import {KernelConfig, Tanh} from '@tensorflow/tfjs-core';
import {createUnaryKernelConfig} from './unary_kernel';
export const tanhConfig: KernelConfig = createUnaryKernelConfig(Tanh);

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 */
```typescript
import {KernelConfig, KernelFunc, Tile, TileAttrs, TileInputs} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';
import {CppDType} from './types';

let wasmTile: (xId: number, xShape: Uint8Array, xShapeSize: number, newShape: Uint8Array, newShapeSize: number, dtype: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmTile = backend.wasm.cwrap(Tile, null /* void */, [
    'number',  // x_id
    'array',   // x_shape
    'number',  // x_shape.length
    'array',   // new_shape
    'number',  // new_shape.length
    'number',  // out_id
  ]);}

function tile(inputs: TileInputs, backend: BackendWasm, attrs: TileAttrs) {
  const {x} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  const {reps} = attrs;

  const newShape: number[] = new Array(x.shape.length);
  for (let i = 0; i < newShape.length; i++) {
    newShape[i] = x.shape[i] * reps[i];
  }
  const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);
  const newShapeBytes = new Uint8Array(new Int32Array(newShape).buffer);

  const out = backend.makeOutput(newShape, x.dtype);
  const outId = backend.dataIdMap.get(out.dataId).id;
  wasmTile(xId, xShapeBytes, x.shape.length, newShapeBytes, newShape.length, CppDType[out.dtype], outId);
  return out;
}

export const tileConfig: KernelConfig = {
  kernelName: Tile,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: tile as {} as KernelFunc,
};
```

```typescript
import {KernelConfig, KernelFunc, TensorInfo, TopK, TopKAttrs, TopKInputs} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';
import {CppDType} from './types';

let wasmTopK: (xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype: CppDType, k: number, sorted: boolean, outValuesId: number, outIndicesId: number) => void;

function setup(backend: BackendWasm) {
  wasmTopK = backend.wasm.cwrap(TopK, null /* void */, [
    'number',  // xId
    'array',   // x.shape
    'number',  // x.shape.length
    'number',  // x.dtype
    'number',  // k
    'bool',    // sorted
    'number',  // outValuesId
    'number',  // outIndicesId
  ]);}

export const topk = (inputs: TopKInputs, backend: BackendWasm, attrs: TopKAttrs) => {
  const {x} = inputs;
  const {k, sorted} = attrs;

  const xId = backend.dataIdMap.get(x.dataId).id;
  const xShapeBytes = backend.makeOutput(x.shape).buffer;
  const outputShape = new Uint8Array(new Int32Array(x.shape).buffer);

  const outValuesId = backend.dataIdMap.get(outValuesId.dataId).id;
  const outValues = backend.makeOutput(outputShape, x.dtype);
  const outIndices = backend.dataIdMap.get(outIndicesId.dataId).id;
  const wasmTopK = backend.wasm.cwrap(TopK, null /* void */, [
    'number',  // xId
    'array',   // x.shape
    'number',  // x.dtype
    'number',  // k
    'bool',    // sorted
    'number',  // outValuesId
    'number',  // outIndicesId
  ], ['wasmTopK', xId, xShapeBytes, x.dtype, k, sorted, outValuesId, outIndicesId]);

  outputShape[outShape.length - 1] = k;
  const outputValues = backend.makeOutput(outputShape, x.dtype);
  const outputValuesId = backend.dataIdMap.get(outputValuesId.dataId).id;
  const outputIndices = backend.dataIdMap.get(outputIndicesId.dataId).id;

  return [outputValues, outputIndices];
}

export const topKConfig: KernelConfig = {
  kernelName: TopK,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: topk as {} as KernelFunc,
};
```
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=============================================================================

import {KernelConfig, KernelFunc, TensorInfo, Transform, TransformAttrs, TransformInputs, util} from '@tensorflow/tfjs-core';

function setup(backend: BackendWasm): void {
  wasmTransform = backend.wasm.cwrap(Transform,
      null /*void*/, 
      ['number',  // imageId
       'number',  // transformsId
       'bool',    // isBatchTransform
       'number',  // batch
       'number',  // outHeight
       'number',  // outWidth
       'number',  // numChannels
       'number',  // imageWidth
       'number',  // imageHeight
       'array',   // strides
       'number',  // stridesLength
       'number',  // interpolationModeId
       'number',  // fillModeId
       'number',  // fillValue
       'number'   // outId
      ]);}

function transform(
    args: {backend: BackendWasm, inputs: TransformInputs, attrs: TransformAttrs}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {image, transforms} = inputs;
  const {interpolation, fillMode, fillValue, outputShape} = attrs;
  const [batch, imageHeight, imageWidth, numChannels] = image.shape;
  const [outHeight, outWidth] = outputShape != null ? outputShape : [imageHeight, imageWidth];
  const outShape = [batch, outHeight, outWidth, numChannels] as [number, number, number, number];
  const strides = new Uint8Array(new Int32Array(util.computeStrides(image.shape)).buffer);
  const out = backend.makeOutput(outShape, image.dtype);
  const outId = backend.dataIdMap.get(out.dataId).id;
  const imageData = backend.dataIdMap.get(image.dataId);
  const imageId = imageData.id;
  const transformsData = backend.dataIdMap.get(transforms.dataId);
  const transformsId = transformsData.id;
  let interpolationModeId = interpolation === 'nearest' ? 1 : 2;
  let fillModeId;
  switch (fillMode) {
    case 'constant':
      fillModeId = 1;
      break;
    case 'reflect':
      fillModeId = 2;
      break;
    case 'wrap':
      fillModeId = 3;
      break;
    case 'nearest':
      fillModeId = 4;
      break;
    default:
      fillModeId = 0;
      break;
  }
  wasmTransform(imageId, transformsId, (transforms.shape[0] > 1), batch, outHeight, outWidth, numChannels, imageWidth, imageHeight, strides, image.shape.length - 1, interpolationModeId, fillModeId, fillValue, outId);
  return out;
}

export const transformConfig: KernelConfig = {
  kernelName: Transform,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: transform as {} as KernelFunc
};

/*=============================================================================

*/

import {KernelConfig, KernelFunc, TensorInfo, Unpack, UnpackAttrs, UnpackInputs} from '@tensorflow/tfjs-core';

function unpack(
    args: {inputs: UnpackInputs, backend: BackendWasm, attrs: UnpackAttrs}): TensorInfo {
  const {inputs, backend, attrs} = args;
  const value = inputs;\n  const axis = attrs.axis;
  const numOutputs = value.shape.length - 1;
  const outs: TensorInfo[] = new Array(numOutputs);
  const outIndex = 0;
  while (i < rank - 1) {
    const out = backend.makeOutput(outShape, value.dtype);
    const outId = backend.dataIdMap.get(out.dataId).id;
    const image = backend.dataIdMap.get(image.dataId);
    const imageId = image.dataId;
    const transforms = backend.dataIdMap.get(transforms.dataId);
    const transformsId = transforms.dataId;
    const interpolationModeId = interpolation === 'nearest' ? 1 : 2;
    let fillModeId;
    switch (fillMode) {
      case 'constant':
        fillModeId = 1;
        break;
      case 'reflect':
        fillModeId = 2;
        break;
      case 'wrap':
        fillModeId = 3;
        break;
      case 'nearest':
        fillModeId = 4;
        break;
      default:
        fillModeId = 0;
        break;
    }
    wasmTransform(imageId, transformsId, (transforms.shape[0] > 1), batch, outHeight, outWidth, numChannels, imageWidth, imageHeight, strides, value.shape.length - 1, interpolationModeId, fillModeId, fillValue, outId);
    return out;
  }
Array(numOutputs));
  const begin = new Array(rank).fill(0);
  const size = value.shape.slice();
  size[axis] = 1;
  for (let i = 0; i < outs.length; i++) {
    begin[axis] = i;
    outs[i] = slice({inputs: [x, value], attrs: [begin, size], backend});
  }
  return outs.map((({dataId, dtype}) => ({dataId, dtype, shape: outShape})));
}

export const unpackConfig: KernelConfig = {
  kernelName: Unpack,
  backendName: 'wasm',
  kernelFunc: unpack as {} as KernelFunc,
};

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 */

import {KernelConfig, KernelFunc, ZerosLike, ZerosLikeInputs} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

function zerosLike(args: {inputs: ZerosLikeInputs, backend: BackendWasm}) {
  const {inputs: {x}, backend} = args;
  const out = backend.makeOutput(x.shape, x.dtype);
  const outVals = backend.typedArrayFromHeap(out);
  outVals.fill(0);
  return out;
}

export const zerosLikeConfig: KernelConfig = {
  kernelName: ZerosLike,
  backendName: 'wasm',
  kernelFunc: zerosLike as {} as KernelFunc,
};

We explicitly import the modular kernels so they get registered in the global registry when we compile the library. A modular build would replace the contents of this file and import only the kernels that are needed.

```javascript
import {KernelConfig, registerKernel} from '@tensorflow/tfjs-core';
import {fusedMatMulConfig} from './kernels/_FusedMatMul';
import {absConfig} from './kernels/Abs';
import {addConfig} from './kernels/Add';
import {addNConfig} from './kernels/AddN';
import {allConfig} from './kernels/All';
import {anyConfig} from './kernels/Any';
import {argMaxConfig} from './kernels/ArgMax';
import {avgPoolConfig} from './kernels/AvgPool';
import {batchMatMulConfig} from './kernels/BatchMatMul';
import {batchToSpaceNDConfig} from './kernels/BatchToSpaceND';
import {castConfig} from './kernels/Cast';
import {ceilConfig} from './kernels/Ceil';
import {clipByValueConfig} from './kernels/ClipByValue';
import {concatConfig} from './kernels/Concat';
import {conv2DConfig} from './kernels/Conv2D';
import {conv2DBackpropInputConfig} from './kernels/Conv2DBackpropInput';
import {cosConfig} from './kernels/Cos';
import {coshConfig} from './kernels/Cosh';
import {cropAndResizeConfig} from './kernels/CropAndResize';
import {cumsumConfig} from './kernels/Cumsum';
import {depthToSpaceConfig} from './kernels/DepthToSpace';
import {depthwiseConv2dNativeConfig} from './kernels/DepthwiseConv2dNative';
import {eluConfig} from './kernels/Elu';
import {equalConfig} from './kernels/Equal';
import {expConfig} from './kernels/Exp';
import {expandDimsConfig} from './kernels/ExpandDims';
import {fillConfig} from './kernels/Fill';
import {flipLeftRightConfig} from './kernels/FlipLeftRight';
import {floorConfig} from './kernels/Floor';
import {floorDivConfig} from './kernels/FloorDiv';
import {fusedBatchNormConfig} from './kernels/FusedBatchNorm';
import {fusedConv2DConfig} from './kernels/FusedConv2D';
import {fusedDepthwiseConv2DConfig} from './kernels/FusedDepthwiseConv2D';
import {gatherNdConfig} from './kernels/GatherNd';
import {gatherV2Config} from './kernels/GatherV2';
import {greaterConfig} from './kernels/Greater';
import {greaterEqualConfig} from './kernels/GreaterEqual';
import {identityConfig} from './kernels/Identity';
```
[leakyReluConfig] from './kernels/LeakyRelu';
import {lessConfig} from './kernels/Less';
import {lessEqualConfig} from './kernels/LessEqual';
import {logConfig} from './kernels/Log';
import {logicalAndConfig} from './kernels/LogicalAnd';
import {maxConfig} from './kernels/Max';
import {maximumConfig} from './kernels/Maximum';
import {meanConfig} from './kernels/Mean';
import {minConfig} from './kernels/Min';
import {minimumConfig} from './kernels/Minimum';
import {mirrorPadConfig} from './kernels/MirrorPad';
import {multiplyConfig} from './kernels/Multiply';
import {negConfig} from './kernels/Neg';
import {nonMaxSuppressionV3Config} from './kernels/NonMaxSuppressionV3';
import {nonMaxSuppressionV4Config} from './kernels/NonMaxSuppressionV4';
import {nonMaxSuppressionV5Config} from './kernels/NonMaxSuppressionV5';
import {notEqualConfig} from './kernels/NotEqual';
import {oneHotConfig} from './kernels/OneHot';
import {onesLikeConfig} from './kernels/OnesLike';
import {padConfig} from './kernels/Pad';
import {padV2Config} from './kernels/PadV2';
import {prodConfig} from './kernels/Prod';
import {rangeConfig} from './kernels/Range';
import {realDivConfig} from './kernels/RealDiv';
import {reluConfig} from './kernels/Relu';
import {relu6Config} from './kernels/Relu6';
import {reshapeConfig} from './kernels/Reshape';
import {resizeBilinearConfig} from './kernels/ResizeBilinear';
import {reverseConfig} from './kernels/Reverse';
import {rotateWithOffsetConfig} from './kernels/RotateWithOffset';
import {roundConfig} from './kernels/Round';
import {rsqrtConfig} from './kernels/Rsqrt';
import {scatterNdConfig} from './kernels/ScatterNd';
import {signConfig} from './kernels/Sign';
import {sinConfig} from './kernels/Sin';
import {sliceConfig} from './kernels/Slice';
import {softmaxConfig} from './kernels/Softmax';
import {spaceToBatchNDConfig} from './kernels/SpaceToBatchND';
import {splitVConfig} from './kernels/SplitV';
import {sqrtConfig} from './kernels/Sqrt';
import {squareConfig} from './kernels/Square';
import {squareDifferenceConfig} from './kernels/SquareDifference';
import {stepConfig} from './kernels/Step';
import {stridedSliceConfig} from './kernels/StridedSlice';
import {subConfig} from './kernels/Sub';
import {sumConfig} from './kernels/Sum';
import {tanConfig} from './kernels/Tan';
import {tanhConfig} from './kernels/Tanh';
import {tileConfig} from './kernels/Tile';
import {topKConfig} from './kernels/TopK';
import {transformConfig} from './kernels/Transform';
import {transposeConfig} from './kernels/Transpose';
import {unpackConfig} from './kernels/Unpack';
import {zerosLikeConfig} from './kernels/ZerosLike';

// List all kernel configs here
const kernelConfigs: KernelConfig[] = [
  absConfig,
  addConfig,
  addNConfig,
  allConfig,
  anyConfig,
  argMaxConfig,
  avgPoolConfig,
  batchMatMulConfig,
  batchToSpaceNDConfig,
  castConfig,
  ceilConfig,
  clipByValueConfig,
  concatConfig,
  conv2DConfig,
  conv2DBackpropInputConfig,
  cosConfig,
  coshConfig,
  cropAndResizeConfig,
  cumsumConfig,
  depthToSpaceConfig,
  depthwiseConv2dNativeConfig,
  eluConfig,
  equalConfig,
  expConfig,
  expandDimsConfig,
  fillConfig,
  flipLeftRightConfig,
  floorConfig,
  floorDivConfig,
  fusedMatMulConfig,
  fusedBatchNormConfig,
  fusedConv2DConfig,
  fusedDepthwiseConv2DConfig,
  gatherNdConfig,
  gatherV2Config,
  greaterEqualConfig,
  identityConfig,
  leakyReluConfig,
  lessConfig,
  lessEqualConfig,
  logConfig,
  logicalAndConfig,
  maxConfig,
  maximumConfig,
  maxPoolConfig,
  meanConfig,
  minConfig,
  minimumConfig,
  mirrorPadConfig,
  multiplyConfig,
  negConfig,
  nonMaxSuppressionV3Config,
  nonMaxSuppressionV4Config,
  nonMaxSuppressionV5Config,
  notEqualConfig,
  onesLikeConfig,
  packConfig,
  padV2Config,
  powConfig,
  preluConfig,
  prodConfig,
  rangeConfig,
  realDivConfig,
  reluConfig,
  relu6Config,
  reshapeConfig,
  resizeBilinearConfig,
  reverseConfig,
  rotateWithOffsetConfig,
  rsqrtConfig,
  roundConfig,
  scatterNdConfig,
  selectConfig,
  sigmoidConfig,
  sinConfig,
  sliceConfig,
  softmaxConfig,
  spaceToBatchNDConfig,
  splitVConfig,
  sqrtConfig,
  squareConfig,
  squareDifferenceConfig,
  stepConfig,
  stridedSliceConfig,
  subConfig,
  sumConfig,
  tanConfig,
  tanhConfig,
  tileConfig,
  topKConfig,
  transformConfig,
  transposeConfig,
  unpackConfig,
  zerosLikeConfig
];

for (const kernelConfig of kernelConfigs) {
  registerKernel(kernelConfig);
}

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=============================================================================

import {env} from '@tensorflow/tfjs-core';

const ENV = env();

/**
 * True if SIMD is supported.
 */
// From: https://github.com/GoogleChromeLabs/wasm-feature-detect
ENV.registerFlag('WASM_HAS_SIMD_SUPPORT', async () => WebAssembly.validate(new Uint8Array([0, 97, 115, 109, 1, 0, 0, 1, 4, 1, 96, 0, 0, 3, 2, 1, 0, 10, 9, 1, 7, 0, 65, 0, 253, 15, 26, 11])));

/**
 * True if threads are supported.
 */
// From: https://github.com/GoogleChromeLabs/wasm-feature-detect
ENV.registerFlag('WASM_HAS_MULTITHREAD_SUPPORT', async () => {
  // TODO(annxingyuan): Enable node support once this is resolved
  // https://github.com/tensorflow/tfjs/issues/3830
  if (ENV.get('IS_NODE')) {
    return false;
  }

  try {
    // Test for transferability of SABs (needed for Firefox)
    new MessageChannel().port1.postMessage(new SharedArrayBuffer(1));
    return WebAssembly.validate(new Uint8Array([0, 97, 115, 109, 1, 0, 0, 1, 4, 1, 96, 0, 0, 3, 2, 1, 0, 10, 9, 1, 7, 0, 65, 0, 254, 16, 2, 0, 26, 11]));
  } catch (e) {
    return false;
  }
});

var WasmBackendModuleThreadedSimd = (function() {
  if (typeof __filename !== 'undefined') _scriptDir = _scriptDir || __filename;
  return function(WasmBackendModuleThreadedSimd) {
    WasmBackendModuleThreadedSimd = WasmBackendModuleThreadedSimd || {};

    function GROWABLE_HEAP_I8() { if (wasmMemory.buffer !== buffer) { updateGlobalBufferAndViews(wasmMemory.buffer) } return HEAP8 } function GROWABLE_HEAP_U8() { if (wasmMemory.buffer !== buffer) { updateGlobalBufferAndViews(wasmMemory.buffer) } return HEAPU8 } function GROWABLE_HEAP_I32() { if (wasmMemory.buffer !== buffer) { updateGlobalBufferAndViews(wasmMemory.buffer) } return HEAP32 } function GROWABLE_HEAP_U32() { if (wasmMemory.buffer !== buffer) { updateGlobalBufferAndViews(wasmMemory.buffer) } return HEAPU32 } function GROWABLE_HEAP_F64() { if (wasmMemory.buffer !== buffer) { updateGlobalBufferAndViews(wasmMemory.buffer) } return HEAPF64 } var Module = typeof WasmBackendModuleThreadedSimd !== 'undefined' ? WasmBackendModuleThreadedSimd : {};

    var quit_ = function(status, toThrow) {
      throw toThrow;
    }

    var _scriptDir = typeof document !== 'undefined' ? document.currentScript.src : undefined;
    if (typeof __filename !== 'undefined') _scriptDir = __filename;

    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 environmentIsWeb = typeof window !== 'undefined' && window.self !== null;
    var environmentIsNode = typeof process !== 'undefined' && process.versions !== null;
    var environmentIsWorker = typeof window === 'undefined' && environmentIsNode;
    var environmentIsShell = typeof process === 'undefined' && environmentIsNode;
    var environmentIsWeb = typeof window === 'undefined' && environmentIsNode;

    importScripts('function()

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ENVIROMENT_IS_PTHREAD=Module["ENVIRONMENT_IS_PTHREAD"]\[false;if\(\text{ENVIROMENT_IS_PTHREAD}=false;\)\]

\(\text{function }\)locateFile(path); var scriptDirectory="\"\"; return scriptDirectory+path; \(\text{return }\)scriptDirectory+path; var read_readAsync,readBinary,setWindowTitle; var nodeFS; var

\(\text{function }\)read_(); var readAsync, readBinary, setWindowTitle; var nodeFS; var

\(\text{function }\)locateFile(path); if(Module["locateFile"]){ return Module["locateFile"](path,scriptDirectory); } return scriptDirectory+path; \(\text{var }\)read_readAsync,readBinary,setWindowTitle; var nodeFS; var

\(\text{if }\)ENVIRONMENT_IS_NODE}{ scriptDirectory=require("path").dirname(scriptDirectory)+"\"\"; } else { scriptDirectory=\"\"; } \(\text{read }=\) function

shell_read(filename,binary); if(!nodeFS)nodeFS=require("fs"); if(!nodePath)nodePath=require("path"); var path=filename=normalizenodePath["normalize"](filename); return nodeFS["readFileSync"](filename,binary=null?"utf8"}); readBinary=function readBinary(filename)\{ var ret=\(\text{return }\)read((filename, true);\} if(ret.buffer)\{ return read(buffer); return

\(\text{if }\)process.argv.length>1\{ \text{thisProgram}=process.argv[1]; \text{replace}(/\\/g,\"\"\"\\"\"\) arguments_=process.argv.slice(2); \text{process}["on"]("uncaughtException",function(ex)\{ if(ex instanceof ExitStatus)\{ throw ex \}\); \text{process}["on"]("unhandledRejection",abort); \text{quit }=function(status)\{ \text{process}["exit"](status); \text{Module}["inspect"]\}=function()\{ return\} (\text{Emscripten Module object}()); \}

\(\text{var }\)nodeWorkerThreads; try{ nodeWorkerThreads=require("worker_threads")\} catch(e)\{ throw e; \}

\(\text{if }\)ENVIRONMENT_IS_SHELL\{ \text{read }=\) function shell_read(filename,binary)\{ return read(filename)\}; \text{readBinary}=function readBinary(filename)\{ var ret=read(); return ret.buffer?new Uint8Array(ret):ret\}; \text{readAsync}=function(url,onload,onerror)\{ var xhr=new XMLHttpRequest; xhr.open("GET",url,\text{false}); xhr.send(null); return xhr.responseText; \}

\(\text{if }\)ENVIRONMENT_IS_WEB\{ \text{scriptDirectory}=\"\"; \}

\(\text{if }\)ENVIRONMENT_IS_SHELL\{ \text{scriptDirectory}=document.currentScript.src\}; \text{if }\)typeof print!=="undefined"\{ \text{console.log}(); \text{console.warn}(); \}

\(\text{if }\)ENVIRONMENT_IS_WEB\{ \text{scriptDirectory}=\"\"; \}

\(\text{var }\)out=Module.print||console.log.bind(console); var err=Module.printErr||console.warn.bind(console); for(key in

\(\text{if }\)moduleOverrides\{ \text{console.log.bind(console)}(\text{for }\)key in moduleOverrides\{ \text{console.log.bind(console)}(\text{for }\)key in moduleOverrides\{ \text{console.log.bind(console)}(\text{for }\)key in moduleOverrides\{ \text{console.log.bind(console)}(\text{for }\)key in moduleOverrides\{ \text{console.log.bind(console)}(\text{for }\)key in moduleOverrides\{ \text{console.log.bind(console)}(\text{for }\)key in moduleOverrides\{ \text{console.log.bind(console)}(\text{for }\)key in moduleOverrides\{ \text{console.log.bind(console)}(\text{for }\)key in moduleOverrides\{ \text{console.log.bind(console)}(\text{for }\)key in moduleOverrides\{ \text{console.log.bind(console)}(\text{for }\)key in moduleOverrides\{ \text{console.log.bind(console)}(\text{for }\)key in moduleOverrides\{ \text{console.log.bind(console)}(\text{for }\)key in moduleOverrides\{ \text{console.log.bind(console)}(\text{for }\)key in moduleOverrides\{ \text{console.log.bind(console)}(\text{for }\)key in moduleOverrides\{ \text{console.log.bind(console)}(\text{for }\)key in moduleOverrides\{ \text{console.log.bind(console)}(\text{for }\)key in moduleOverrides\{ \text{console.log.bind(console)}(\text{for }\)key in moduleOverrides\{ \text{console.log.bind(console)}(\text{for }\)key in moduleOverrides\{ \text{console.log.bind(console)}(\text{for }\)key in moduleOverrides\{ \text{console.log.bind(console)}(\text{for }\)key in moduleOverrides\{ \text{console.log.bind(console)}(\text{for }\)key in moduleOverrid

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Module["thisProgram"]();if(Module["quit"])quit = Module["quit"];function warnOnce(text){if(!warnOnce.shown)warnOnce.shown={};if(!warnOnce.shown[text]){warnOnce.shown[text]=1;error(text)}
var Atomics_load=Atoms.load;var Atomics_store=Atoms.store;var Atomics_compareExchange=Atoms.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 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 call(iden,returnType,argv,opts){
var toC={\"string\":function(str){
var ret=0;if(str!=null&&str!="undefined"&&str!==0)
stackAlloc(len++)
return ret}]
array":function(arr){
var ret=stackAlloc(arr.length)
writeArrayToMemory(arr)
return ret}]
function convertReturnValue(ret){
if(returnType==="string")
return UTF8ToString(ret)
if(returnType==="boolean")
return Boolean(ret)
return func=getCFunc(ident);
var cArgs=[];
var stack=0;
if(args){
for(var i=0;i<args.length;i++){
var converter=toC[argvTypes[i]];
if(converter){
if(stack==0)stack=stackSave();
cArgs[i]=converter(args[i])
}
else{cArgs[i]=args[i]}
}
ret=func.apply(null,cArgs);
ret=convertReturnValue(ret);

}
}
function UTF8ArrayToString(heap,idx,maxBytesToRead){
var endIdx=idx+maxBytesToRead;
var str="";
while(!(idx>=endIdx)){
var u0=heap[idx++];
if(!u0)return
str+=String.fromCharCode(u0);
continue}
var u1=heap[idx++]&63;
if(u1&224)==192
str+=String.fromCharCode(u0&31)<<6|u1<<12|u2<<6
else if(u0&240)==224
u0=(u0&15)<<12|u1<<6|u2<<6
heap[idx++]
else if(u0&65536){
str+=String.fromCharCode(u0);
else{char=u0-65536;str+=String.fromCharCode(55296|char>>10,56320|char&1023)}
}
return str}
function UTF8ToString(heap,idx,maxBytesToRead){
var endIdx=idx+maxBytesToRead;
var str="";
while((idx<endIdx)){
var u0=heap[idx++];
if(u0)return
}
str+=String.fromCharCode(u0);
continue}
var u1=heap[idx++]&63;
if(u1&224)==192
str+=String.fromCharCode(u0&31)<<6|u1<<12
else if(u0&240)==224
u0=(u0&15)<<12|u1<<6
else if(u0&65536){
str+=String.fromCharCode(u0);
else{char=u0-65536;str+=String.fromCharCode(55296|char>>10,56320|char&1023)}
}
return str}
function stringToUTF8Array(str,heap,outIdx,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){
var u1=str.charCodeAt(i+1);
if(u1==0x10ff0000){
len+=4}
else if(u1==0x10ff0001){
len+=3}
else if(u1==0x10ff0002){
len+=2}
else if(u1==0x10ff0003){
len+=1}
}
else if(u>127){
len+=1}
}
return len}
function writeArrayToMemory(array,buffer){
GROWABLE_HEAP_U8().set(array,buffer)
}
function alignUp(x,multiple){
if(x%multiple>0){
x+=multiple-x%multiple
return x}
}

buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;

return
}}
}}


SED:14,EADDRINUSE:3,ECONNABORTED:13,ENETUNREACH:40,ETIMEDOUT:38,ETIMEDOUT:73,EHOSTDOW
TOOMANYREFS:141,EUSER:136,EDQUOT:19,ESTALE:72,ETIMEDOUT:138,ENOMEDIUM:14
5);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,mainTh
readWaitAddress,0);if(loadedAddr===mainThreadWaitAddress){--count;mainThreadWoken=1;if(count<=0)return
1}var ret=Atomics.notify(GROWABLE_HEAP_I32(),addr>>2,count);if(ret>=0)return
ret+mainThreadWoken;throw"Atomics.notify returned an unexpected value
"+ret}Module["_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
call to killThread()";GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var
pthread=PThread.pthreads[pthread_ptr];pthread.worker.terminate();PThread.freeThreadData(pthread);PThread.runni
gWorkers.splice(PThread.runningWorkers.indexOf(pthread.worker),1);pthread.worker. pthread=undefined;functio
ncancelThread(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
call to 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
call to 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(){},initRuntime:function(){var
headPrt=tb+152;GROWABLE_HEAP_U32()[headPrt>>2]=headPrt;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);Atoms.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:functi
on(){while(PThread. threadExitHandlers.length>0)PThread.removeExitHandlers.pop()();if(ENVIRONMENT IS_PTHREAD&
&_pthread_self()&&!_pthread
_tsd_run_dtor());runExitHandlersAndDeinitThread(function(tb,exitCode){Atoms.store(GROWABLE_HEAP_U
32(),tb+56>>2,1);Atoms.store(GROWABLE_HEAP_U32(),tb+60>>2,0);PThread.runExitHandlers();Atoms.stor
eg(GROWABLE HEAP_U32(),tb+56>>2,exitCode);Atoms.store(GROWABLE_HEAP_U32(),tb+56>>2,1);_emscript
en_futex_wake(tb+0,2147483647);__emscripten_thread_init(0,0),exitThread:exitCode){if(tb===_pthread
_self()){if(tb===_pthread_self()){if(tb===_pthread.runExitHandlersAndDeinitThread(tb,exitCode);if(ENVIRONMENT IS_PTHREAD
AD)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
var stackTop=stackSave();var
varargs=stackAlloc(12);GROWABLE_HEAP_I32[](varargs>>2]=eventTypeId;GROWABLE_HEAP_I32[](varargs
+4>>2]=eventId;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[](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(targetCanvas,width,height){targetCanvas=targetC
anvas?UTF8ToString(targetCanvas)\";_emscripten_set_offscreencanvas_size_on_target_thread_js(targetThrea
d,targetCanvas,width,height)\}function maybeCStringToJsString(cString){return
(cString>2?UTF8ToString(cString):cString)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_I
32[](canvas.canvasSharedPtr>>2]=width;GROWABLE_HEAP_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
canvas.height=height;if(autoResizeViewport)canvas.GLctxObject.GLctx.viewport(0,0,canvas.width,canvas.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
_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_calling_thread(target,width,height){var
canvas=findCanvasEventTarget(target);if(canvas){var
return
_emscripten_set_canvas_element_size_calling_thread(target,width,height)}else{return
_emscripten_set_canvas_element_size_calling_thread(target,width,height))}function
_emscripten_set_current_thread_status(newStatus){}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"));
}

  if (!GL.lastError) {
    GL.lastError = errorCode;
  }
  GLctx = GLctx || GL.currentContext && GL.currentContext.GLctx;
  GLctx.disjointTimerQueryExt = GLctx.getExtension("EXT_disjoint_timer_query");
  var exts = GLctx.getSupportedExtensions() || [];
  exts.forEach(function (ext) {
    if (ext.indexOf("lose_context") < 0 && ext.indexOf("debug") < 0) {
      if (typeof ext == "object") {
        ctx[ext + "Extension"] = ext;
      } else {
        ctx["" + ext] = ext;
      }
    }
  });
  if (typeof GLctx === "object") {
    GLctx = GLctx.GLctx;
  } else {
    GLctx = GL.currentContext && GL.currentContext.GLctx;
  }
  return 1
}

function createContext(canvas, webGLContextAttributes) {
  var ctx = canvas.getContext("webgl", webGLContextAttributes);
  if (!ctx) return 0;
  var handle = GL.registerContext(ctx, webGLContextAttributes);
  if (typeof webGLContextAttributes.enableExtensionsByDefault == "undefined" || webGLContextAttributes.enableExtensionsByDefault) {
    GL.initExtensions();
  }
  return handle;
}

function makeContextCurrent(contextHandle) {
  GL.currentContext = GL.contexts[contextHandle];
  Module.ctx = GLctx = GL.currentContext && GL.currentContext.GLctx;
  return !(contextHandle && !GLctx), getFunction(contextHandle);
}

function recordError(errorCode) {
  if (!GL.lastError) {
    GL.lastError = errorCode;
  }
  GLctx = GLctx || GL.currentContext && GL.currentContext.GLctx;
  GLctx.disjointTimerQueryExt = GLctx.getExtension("EXT_disjoint_timer_query");
  var exts = GLctx.getSupportedExtensions() || [];
  exts.forEach(function (ext) {
    if (ext.indexOf("lose_context") < 0 && ext.indexOf("debug") < 0) {
      ctx[ext + "Extension"] = ext;
    }
  });
  if (typeof GLctx === "object") {
    GLctx = GLctx.GLctx;
  } else {
    GLctx = GL.currentContext && GL.currentContext.GLctx;
  }
  return 1
}

  if (!GL.lastError) {
    GL.lastError = errorCode;
  }
  GLctx = GLctx || GL.currentContext && GL.currentContext.GLctx;
  GLctx.disjointTimerQueryExt = GLctx.getExtension("EXT_disjoint_timer_query");
  var exts = GLctx.getSupportedExtensions() || [];
  exts.forEach(function (ext) {
    if (ext.indexOf("lose_context") < 0 && ext.indexOf("debug") < 0) {
      ctx[ext + "Extension"] = ext;
    }
  });
  if (typeof GLctx === "object") {
    GLctx = GLctx.GLctx;
  } else {
    GLctx = GL.currentContext && GL.currentContext.GLctx;
  }
  return 1
}

function createContext(canvas, webGLContextAttributes) {
  var ctx = canvas.getContext("webgl", webGLContextAttributes);
  if (!ctx) return 0;
  var handle = GL.registerContext(ctx, webGLContextAttributes);
  if (typeof webGLContextAttributes.enableExtensionsByDefault == "undefined" || webGLContextAttributes.enableExtensionsByDefault) {
    GL.initExtensions();
  }
  return handle;
}

function makeContextCurrent(contextHandle) {
  GL.currentContext = GL.contexts[contextHandle];
  Module.ctx = GLctx = GL.currentContext && GL.currentContext.GLctx;
  return !(contextHandle && !GLctx), getFunction(contextHandle);
}

function recordError(errorCode) {
  if (!GL.lastError) {
    GL.lastError = errorCode;
  }
  GLctx = GLctx || GL.currentContext && GL.currentContext.GLctx;
  GLctx.disjointTimerQueryExt = GLctx.getExtension("EXT_disjoint_timer_query");
  var exts = GLctx.getSupportedExtensions() || [];
  exts.forEach(function (ext) {
    if (ext.indexOf("lose_context") < 0 && ext.indexOf("debug") < 0) {
      ctx[ext + "Extension"] = ext;
    }
  });
  if (typeof GLctx === "object") {
    GLctx = GLctx.GLctx;
  } else {
    GLctx = GL.currentContext && GL.currentContext.GLctx;
  }
  return 1
}
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) { stackSave(cArgs[i] = converter(args[i])); } else { cArgs[i] = args[i]; } } } var ret = func.apply(null, cArgs); ret = convertReturnValue(ret); if (stack === 0) { stackSave(); } cArgs = []; stack = 0; if (args) { for (var i = 0; i < args.length; i++) { var converter = toC[argTypes[i]]; if (converter) { if (stack === 0) { 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 numericRet = returnType !== "string" && numericArgs(argTypes, arguments, opts); if (numericRet && numericArgs) { 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) { if (u0 = heap[idx++] && !(u0 & 128)) { str += String.fromCharCode(u0); continue; } u1 = heap[idx++] & 63; if (u0 & 224) { str += String.fromCharCode((u0 & 31) << 6 | u1); continue; } u2 = heap[idx++] & 63; if (u0 & 240) { u0 = (u0 & 15) << 12 | u1 << 6 | u2; } else { if (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); } else 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++] = 192 | u >> 6 & 63; heap[outIdx++] = 128 | u & 63; } else if (u <= 1114111) { if (outIdx + 3 == endIdx) { break; } heap[outIdx++] = 240 | u >> 18; heap[outIdx++] = 192 | 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, HEAP16, HEAPU16, HEAP32, HEAPU32, HEAPF32, HEAPF64; function updateGlobalBufferAndViews(buf) { buffer = buf; Module['HEAP8'] = new Int8Array(buf); Module['HEAP16'] = new Int16Array(buf); Module['HEAPU16'] = new Uint16Array(buf); Module['HEAP32'] = new Int32Array(buf); Module['HEAPU32'] = new Uint32Array(buf); Module['HEAPF32'] = new Float32Array(buf); Module['HEAPF64'] = new Float64Array(buf); } var INITIAL_MEMORY = Module['INITIAL_MEMORY'] || 16777216; var wasmTable; var __ATPRERUN__ = []; var __ATTABLIENT = []; var __ATMAIN__ = [ ]; var __ATPOSTRUN__ = [ ]; var runtimeInitialized = false; __ATINIT__.push(function (func) { return null; }); function preRun() { if (Module['preRun']) { if (typeof Module['preRun'] == "function") { 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'](); } while (Module['postRun'].length) { addOnPostRun(Module['postRun'].shift()); } } callRuntimeCallbacks(__ATPOSTRUN__); }
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") {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\"]["\"\"];updateGlobalBufferAndViews(wasmMemory.buffer);wasmTable=Module["asm\"]["\"\"];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) {
if(!wasmBinaryFile) {throw\"wasm streaming compile failed: \"+reason; err\"falling back to ArrayBuffer instantiation\")
return instantiateArrayBuffer(receiveInstantiatedSource())})

function instantiateAsync() {
if(!wasmBinaryFile) {
return Promise.resolve().then(function() {
return getBinary(wasmBinaryFile)})
}

function createWasm() {
var var info={"\"\".asmLibraryArg Arg};

function receiveInstance(instance,module) {
var exports=instance.exports;Module["asm\"]=exports;wasmMemory=Module["asm\"]["\"\"];updateGlobalBufferAndViews(wasmMemory.buffer);wasmTable=Module["asm\"]["\"\"];

function receiveInstantiatedSource(output) {receiveInstance(output["instance"])}

function instantiateArrayBuffer(receiver) {return getBinaryPromise().then(function(binary) {
return WebAssembly.instantiate(binary,info)})
.then(receiver,function(reason) {
if(err\"failed to asynchronously prepare wasm: \"+reason;abort(reason))})

function instantiateAsync() {
if(!wasmBinaryFile) {
return Promise.resolve().then(function() {
return instantiateArrayBuffer(receiveInstantiatedSource())})
}

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() {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"]["ja"]}.apply(null,arguments);var
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=============================================================================

*/

import './flags_wasm';

import {backend_util, BackendTimingInfo, DataStorage, DataType, deprecationWarn, engine, env, KernelBackend, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasmModule, WasmFactoryConfig} from './wasm-out/tfjs-backend-wasm';

import {BackendWasmThreadedSimdModule} from './wasm-out/tfjs-backend-wasm-threaded-simd';

import wasmFactoryThreadedSimd from '../wasm-out/tfjs-backend-wasm-threaded-simd.js';

import wasmWorkerContents from '../wasm-out/tfjs-backend-wasm-threaded-simd.worker.js';

import wasmFactory from '../wasm-out/tfjs-backend-wasm.js';

interface TensorData {
  id: number;
  memoryOffset: number;
  shape: number[];
  dtype: DataType;
  refCount: number;
  /** Only used for string tensors, storing encoded bytes. */
  stringBytes?: Uint8Array[];
}

export type DataId = object;  // object instead of {} to force non-primitive.

export class BackendWasm extends KernelBackend {
  // 0 is reserved for null data ids.
  private dataIdNextNumber = 1;

  constructor(public wasm: BackendWasmModule|BackendWasmThreadedSimdModule) {
    super();

    this.wasm.tfjs.initWithThreadsCount(threadsCount);
    actualThreadsCount = this.wasm.tfjs.getThreadsCount();

    this.dataIdMap = new DataStorage(this, engine());

    write(values: backend_util.BackendValues, shape: number[], dtype: DataType): DataId {
      const dataId = {id: this.dataIdNextNumber++};

      this.move(dataId, values, shape, dtype, 1);
      return dataId;
    }

    numDataIds(): number {
      return this.dataIdMap.numDataIds();
    }

    async time(f: () => void): Promise<BackendTimingInfo> {
      const start = util.now();
      f();
      const kernelMs = util.now() - start;
      return {kernelMs};
    }

    move(dataId: DataId, values: backend_util.BackendValues, shape: number[], dtype: DataType, refCount: number): void {
      const id = this.dataIdNextNumber++;
      if (dtype === 'string') {
        const stringBytes = values as Uint8Array[];
      }

      const bytes = this.wasm.HEAPU8.slice(
        memoryOffset,
        memoryOffset + util.sizeFromShape(shape) * util.bytesPerElement(dtype));
      return typedArrayFromBuffer(bytes.buffer, dtype);
    }

    /**
     * Dispose the memory if the dataId has 0 refCount. Return true if the memory
     * is released, false otherwise.
     * @param dataId
     * @param force Optional, remove the data regardless of refCount
     */
    disposeData(dataId: DataId, force = false): boolean {
      const data = this.dataIdMap.get(dataId);
      if (data != null) {
        data.refCount--;
        if (!force && data.refCount > 0) {
          return false;
        }

        this.wasm._free(data.memoryOffset);
        this.wasm.tfjs.disposeData(data.id);
        this.dataIdMap.delete(dataId);
      }
      return true;
    }

    /** Return refCount of a `TensorData`. */
    refCount(dataId: DataId): number {
      const data = this.dataIdMap.get(dataId);
      return data.refCount + 1;
    }

    floatPrecision(): 32 {
      return 32;
    }

    getMemoryOffset(dataId: DataId): number {
      return this.dataIdMap.get(dataId).memoryOffset;
    }

    dispose() {
      this.wasm.tfjs.dispose();
    }

    // Testing.
    getMemoryOffset(dataId: DataId): number {
      return this.dataIdMap.get(dataId).memoryOffset;
    }

    dispose(true) {
      this.wasm.tfjs.dispose();
    }

    disposed() {
      this.wasm.tfjs.dispose();
    }
error
    // messages.\n    return;\n  }\n  initAborted = true;\n  const rejectMsg = 'Make sure the server can serve the `.wasm` file relative to the `bundle.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  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()], { 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  // The WASM module has been successfully created by the factory.\n  // Any error will be caught by the onAbort callback defined above.\n  wasm.then(module) => {\n    initialized = true;\n    initAborted = false;\n    const voidReturnType = null;\n    // Using the tfjs namespace to avoid conflict with emscripten's API.\n    module.tfjs = {\n      init: module.cwrap('init', null, []),\n      initWithThreadsCount: module.cwrap('init_with_threads_count', null, ['number']),\n      getThreadsCount: module.cwrap('get_threads_count', 'number', []),\n      registerTensor: module.cwrap('register_tensor', null, ['number', 'number', 'number']),\n      disposeData: module.cwrap('dispose_data', voidReturnType, ['number']),\n      dispose: module.cwrap('dispose', voidReturnType, []),\n    };\n    resolve({wasm: module});\n  });\n};\n\nfunction typedArrayFromBuffer(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  }
}
\nconst wasmBinaryNames = ['tfjs-backend-wasm.wasm', 'tfjs-backend-wasm-simd.wasm', 'tfjs-backend-wasm-threaded-simd.wasm'] as const;\ntype WasmBinaryName = typeof wasmBinaryNames[number];
\nlet wasmPath: string = null;\nlet wasmPathPrefix: string = null;\nlet wasmFileMap: {[key in WasmBinaryName]?: string} = {};
let initAborted = false;
let customFetch = false;

/**\n * @deprecated Use `setWasmPaths` instead.\n * Sets the path to the `.wasm` file which will be fetched when the wasm * backend is initialized.\n *\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 * @doc {heading: 'Environment', namespace: 'wasm'}\n */
export function setWasmPath(path: string, usePlatformFetch = false): void {
  deprecationWarn(`setWasmPath has been deprecated in favor of setWasmPaths and will be removed in a future release.\n`);\n  if (initAborted) {\n    throw new Error(`The WASM backend was already initialized. Make sure you call ` +\n      `tf.setBackend()` or `tf.ready()` before you call ` +\n      `tf.setBackend()` or `tf.ready()`);\n  }
  wasmPath = path;
  customFetch = usePlatformFetch;
}

/**\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(\n * \n * ```\n * Will be removed in a future release.\n *\n * @param prefixOrFileMap This can be either a string or object:\n *\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, simd-\n *     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 your WASM binaries are not all located in the\n *     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 * @doc {heading: 'Environment', namespace: 'wasm'}\n */
export function setWasmPaths(prefixOrFileMap: string| {[key in WasmBinaryName]?: string}, usePlatformFetch = false): void {
  if (initAborted) {\n    throw new Error(`The WASM backend was already initialized. Make sure you call ` +\n      `tf.setBackend()` or `tf.ready()` before you call ` +\n      `tf.setBackend()` or `tf.ready()`);\n  }
  // The WASM backend was already initialized. Make sure you call ` +\n  // `tf.setBackend()` or `tf.ready()` before you call ` +\n  // `tf.setBackend()` or `tf.ready()`;\n  if (typeof prefixOrFileMap === 'string') {\n    wasmPathPrefix = prefixOrFileMap;\n  } else {\n    wasmFileMap = prefixOrFileMap;\n    const missingPaths =\n      wasmBinaryNames.filter(name =>\n        wasmFileMap[name] == null);\n    if (missingPaths.length > 0) {\n      throw new Error(`The WASM backend was already initialized. Make sure you call ` +\n        `tf.setBackend()` or `tf.ready()` before you call ` +\n        `tf.setBackend()` or `tf.ready()`);\n    }
  }
}
Error(`
  'There were no entries found for the following binaries: ` +
  `{missingPaths.join('`, `')}. Please either call setWasmPaths with a ` +
  `map providing a path for each binary, or with a string indicating ` +
  `the directory where all the binaries can be found.'
);`)

let actualThreadsCount = -1;

wasmFileMap = {};

wasmPaths = [];

initAborted = false;

wasmPath = null;

wasmPathPrefix = null;

wasmFileMap = {};

customFetch = false;

initAborted = false;

wasmPath = null;

wasmPathPrefix = null;

wasmFileMap = {};

customFetch = false;

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Open Source Used in Cisco Meeting Server (formerly Acano Server) 3.4  4713
Open Source Used in Cisco Meeting Server (formerly Acano Server) 3.4  4719
Open Source Used In Cisco Meeting Server (formerly Acano Server) 3.4 4722
import {KernelConfig, KernelFunc, slice_util, StridedSlice, StridedSliceAttrs, StridedSliceInputs, TensorInfo, util} from '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';
import {reshape} from './Reshape';
import {slice} from './Slice';

let wasmStridedSlice: (xId: number, xStridesBytes: Uint8Array, xRank: number, beginBytes: Uint8Array, endBytes: Uint8Array, stridesBytes: Uint8Array, outShapeBytes: Uint8Array, outStridesBytes: Uint8Array, outShapeLength: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmStridedSlice = backend.wasm.cwrap(StridedSlice, null /*void*/, [
    'number', // xId
    'array', // xStrides
    'number', // xRank
    'array', // begin
    'array', // end
    'array', // strides
    'array', // outputShape
    'array', // outputStrides
    'number', // outputShapeLength
    'number', // outId
  ]);}

export function stridedSlice(args: {
  backend: BackendWasm,
  inputs: StridedSliceInputs,
  attrs: StridedSliceAttrs
}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {x} = inputs;

  const {
    begin,
    end,
    strides,
    beginMask,
    endMask,
    ellipsisMask,
    newAxisMask,
    shrinkAxisMask
  } = attrs;

  const {
    finalShapeSparse,
    finalShape,
    isIdentity,
    sliceDim0,
    isSimpleSlice,
    begin: $begin,
    end: $end,
    strides: $strides
  } =
      slice_util.sliceInfo(
          x.shape, begin, end, strides, beginMask, endMask, ellipsisMask, newAxisMask, shrinkAxisMask);

  let result;

  if (isIdentity) {
    // Optimization #1, slice is a no-op plus reshape
    result = reshape({inputs: {x}, backend, attrs: {shape: finalShape}});
  } else if (sliceDim0 || isSimpleSlice) {
    // Optimization #2, slice is memory contiguous (only occurs in dim 0)
    util.assert(x.shape.length >= 1,
        () => `Input must have rank at least 1, got: ${x.shape.length}`);

    const size = slice_util.computeOutShape($begin, $end, $strides);
    // To tolerate begin[0] > end[0] (a 0-output slice), we min(begin, end).
    const constliced = slice({inputs: {x}, backend, attrs: {begin: $begin, size}});
    result =
        reshape({inputs: {x: constliced}, backend, attrs: {shape: finalShape}});
    backend.disposeData(constliced.dataId);
  } else {
    const out =
        backend.makeOutput(finalShapeSparse, 'float32');

    const xId = backend.dataIdMap.get(x.dataId).id;
    const xStridesBytes =
        new Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);
    const beginBytes =
        new Uint8Array(new Int32Array($begin).buffer);
    const endBytes =
        new Uint8Array(new Int32Array($end).buffer);
    const stridesBytes =
        new Uint8Array(new Int32Array($strides).buffer);

    const
        outputShapeBytes =
            new Uint8Array(new Int32Array(finalShapeSparse).buffer);
    const outStridesBytes =
        new Uint8Array(new Int32Array(finalShapeSparse).buffer);

    const result =
        wasmStridedSlice(
            xId, xStridesBytes, x.shape.length,
            beginBytes, endBytes, stridesBytes,
            outputShapeBytes, outStridesBytes, finalShapeSparse.length, outId);

    result = reshape({inputs: {x}, backend, attrs: {shape: finalShape}});

    backend.disposeData(out.dataId);
  }

  return result;
}

export const stridedSliceConfig: KernelConfig = {
  kernelName: StridedSlice,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: stridedSlice as {} as KernelFunc
};
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 * limitations under the License.
 */

import {_FusedMatMul, _FusedMatMulAttrs, _FusedMatMulInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {FusableActivation} from './types';

let wasmFusedMatMul:
    (aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,
     bShape: Uint8Array, bShapeSize: number, transposeA: boolean,
     transposeB: boolean, activation: number,
     biasId: number, preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>
void;

function setup(backend: BackendWasm) {
  wasmFusedMatMul = backend.wasm.cwrap(_FusedMatMul,
null /* void */, 
    'number',  // a_id
    'array',   // a_shape
    'number',  // a_shape.length
    'number',  // b_id
    'array',   // b_shape
    'number',  // b_shape.length
    'boolean', // transposeA
    'boolean', // transposeB
    'number', // activation
    'number', // biasId
    'number', // preluActivationWeightsId
    'number', // leakyreluAlpha
    'number', // outId
    'number');
}

// This enum must align with the enum defined in cc/backend.h.
export enum CppDType {
  float32 = 0,
  int32 = 1,
  bool = 2,
  string = 3,
  complex64 = 4
}

// Must match enum in cc/fusable_activations.h.
export enum FusableActivation {
  linear = 0,
  relu = 1,
  relu6 = 2,
  prelu = 3,
  leakyrelu = 4,
  sigmoid = 5,
  elu = 6
}
'array', // b_shape
'number', // b_shape.length
'number', // transpose_a
'number', // transpose_b
'number', // activation
'number', // biasId
'number', // preluActivationWeightsId
'number', // leakyreluAlpha
'number' // out_id
];

function fusedBatchMatMul(args: {
  inputs:
    _FusedMatMulInputs,
  backend: BackendWasm,
  attrs: _FusedMatMulAttrs
}) {
  const {inputs, backend, attrs} = args;

  const [a, b, bias, preluActivationWeights] = inputs;
  if (a.dtype !== 'float32' || b.dtype !== 'float32') {
    throw new Error(
      `_FusedMatMul for non non-float32 tensors not yet supported: `);
  }

  const {transposeA, transposeB, activation, leakyreluAlpha} = attrs;
  const aId = backend.dataIdMap.get(a.dataId).id;
  const bId = backend.dataIdMap.get(b.dataId).id;

  let biasId = 0;
  if (bias != null) {
    const biasData = backend.dataIdMap.get(bias.dataId);
    if (biasData.shape.length !== 1) {
      throw new Error(
        `_FusedMatMul only supports rank-1 bias but got ` +
        `rank ${biasData.shape.length}.`);
    }
    biasId = biasData.id;
  }

  const preluActivationWeightsId = preluActivationWeights == null ?
    0 :
    backend.dataIdMap.get(preluActivationWeights.dataId).id;

  const fusedActivation =
    FusableActivation[activation as {} as keyof typeof FusableActivation];
  if (fusedActivation == null) {
    throw new Error(
      `${activation} activation not yet supported for
FusedConv2D`);
  }

  const batchDim = a.shape[0];

  const out =
    backend.makeOutput([batchDim, leftDim, rightDim], a.dtype);
  const outId = backend.dataIdMap.get(out.dataId).id;

  const aShapeBytes = new Uint8Array(new Int32Array(a.shape).buffer);
  const bShapeBytes = new Uint8Array(new Int32Array(b.shape).buffer);

  wasmFusedMatMul(aId, aShapeBytes, a.shape.length, bId, bShapeBytes, b.shape.length,
    transposeA, transposeB, fusedActivation, biasId, preluActivationWeightsId,
    leakyreluAlpha || 0, outId);

  return out;
}

export const fusedMatMulConfig: KernelConfig = {
  kernelName: _FusedMatMul,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: fusedBatchMatMul as {} as KernelFunc
};
import {Abs, KernelConfig} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';

export const absConfig: KernelConfig = createUnaryKernelConfig(Abs);

const supportsFullBroadcast = true;

export const absConfig: KernelConfig = createUnaryKernelConfig(Abs);

export const addConfig: KernelConfig = createBinaryKernelConfig(Add);

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export const absConfig: KernelConfig = createUnaryKernelConfig(Abs);
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---

```javascript
import {AddN, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {CppDType} from './types';

let wasmFunc: (inputIds: Uint8Array, inputIdsLen: number, dtype: number, outId: number) => void;

function setupFunc(backend: BackendWasm): void {
  wasmFunc = backend.wasm.cwrap(AddN, null /* void */,
    ['array',   // input_ids
      'number',  // input_ids.length
      'number',  // dtype
      'number',  // out_id
    ]);  // @license
}

function addn(args: {inputs: TensorInfo[], backend: BackendWasm}) {
  const {inputs, backend} = args;
  const out = backend.makeOutput([inputs[0].shape, inputs[0].dtype]);

  // Short-circuit zero-sized tensors.
  if (util.sizeFromShape(out.shape) === 0) {
    return out;
  }

  const inputIds = inputs.map(x => backend.dataIdMap.get(x.dataId).id);
  const inputIdsBytes = new Uint8Array(new Int32Array(inputIds).buffer);

  const outId = backend.dataIdMap.get(out.dataId).id;
  wasmFunc(inputIdsBytes, inputIds.length, CppDType[out.dtype], outId);

  return out;
}

export const addNConfig: KernelConfig = {
  kernelName: AddN,
  backendName: 'wasm',
  setupFunc,
  kernelFunc: addn as {} as KernelFunc,
};
```

---

```javascript
import {Identity, IdentityInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';

import {TensorInfo} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

export function identity(args: {inputs: IdentityInputs, backend: BackendWasm}): TensorInfo {
  const {inputs: {x}, backend} = args;
  const out = backend.makeOutput(x.shape, x.dtype);
  const inVals = backend.typedArrayFromHeap(x);
  const outVals = backend.typedArrayFromHeap(out);
  outVals.set(inVals);
  return out;
}

export const identityConfig: KernelConfig = {
  kernelName: Identity,
  backendName: 'wasm',
  kernelFunc: identity as {} as KernelFunc,
};
```

---

```javascript
import {KernelConfig, KernelFunc, TensorInfo, Transpose, TransposeAttrs, TransposeInputs} from '@tensorflow/tfjs-core';

import {Identity, IdentityInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {Identity, IdentityInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';

import {TensorInfo} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

export function transpose(args: {inputs: TransposeInputs, backend: BackendWasm, attrs: TransposeAttrs}): TensorInfo {
  const {inputs, backend, attrs} = args;
  // Reduce any dimensions with size one. Lower-rank transpose kernel performs better due to simpler memory access pattern.
  const reducedShape = removeOneSizeDims(inputs.x.shape, attrs.perm);
  const permIsNoOp = true;
  for (let i = 0; i < attrs.perm.length; i++) {
    if (attrs.perm[i] !== i) {
      permIsNoOp = false;
    }
  }
  const out = backend.makeOutput([reducedShape, inputs.x.dtype]);

  if (permIsNoOp) {
    return out;
  }

  const outId = backend.dataIdMap.get(out.dataId);  // @license
```
cloned = identity([[inputs, backend]]);

cloned.shape = outShape;

return cloned;

const out = backend.makeOutput(outShape, x.dtype);
const xId = backend.dataIdMap.get(x.dataId);
const outId = backend.dataIdMap.get(out.dataId);
const permBytes = new Uint8Array(new Int32Array(perm).buffer);
const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);

wasmTranspose(xId, xShapeBytes, x.shape.length, CppDType[x.dtype], outId, permBytes, x.perm.length);

return out;

unfunction computeOutShape(inShape: number[], perm: number[]): number[] {
  let outShape = new Array(inShape.length);
  for (let i = 0; i < outShape.length; ++i) {
    outShape[i] = inShape[perm[i]];
  }

  return outShape;
}

unfunction removeOneSizeDims(shape: number[], perm: number[]): number[] {
  let newShape: number[] = [];
  let newPerm: number[] = [];
  for (let i = 0; i < shape.length; ++i) {
    if (shape[i] !== 1) {
      newShape.push(shape[i]);
    }
    if (shape[perm[i]] !== 1) {
      newPerm.push(perm[i]);
    }
  }
  return [newShape, newPerm];
}

export const transposeConfig: KernelConfig = {
  kernelName: Transpose,
  backendName: 'wasm',
  kernelFunc: transpose as {},
  setupFunc: setup,
};

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 */

import {All, AllAttrs, AllInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util} from
  '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';
import {permuteAxesAndTranspose} from './kernel_utils';

let wasmAll: (xId: number, reduceSize: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmAll = backend.wasm.cwrap(All, null /*void*/, ['number, number, number']);
}

function all(args: {backend: BackendWasm, inputs: AllInputs, attrs: AllAttrs}):
  TensorInfo {
  const {backend, inputs, attrs} = args;
  const {axis, keepDims} = attrs;
  const {x} = inputs;
  const xId = backend.dataIdMap.get(x.dataId);
  let inputId = xId;
  let input = x;

  const {transposed, axes, originalAxes, inputWasTransposed} =
      permuteAxesAndTranspose(x, axis, backend);
  if (inputWasTransposed) {
    const transposedId = backend.dataIdMap.get(transposed.dataId);
    input = transposed;
    inputId = transposedId;
  }
  const inputRank = input.shape.length;

  backend_util.assertAxesAreInnerMostDims('all', axes, inputRank);
  const [outShape, reduceShape] =
  backend_util.computeOutAndReduceShapes(input.shape, axes);

  const reduceSize = util.sizeFromShape(reduceShape);
  const outId = backend.dataIdMap.get(out.dataId);
  if (util.sizeFromShape(input.shape) !== 0) {
    const outId = backend.dataIdMap.get(out.dataId);
    wasmAll(inputId, reduceSize, outId);
    if (inputWasTransposed) {
      // dispose of the transposed tensor.
      backend.disposeData(transposed.dataId);
      if (keepDims) {
        // reshape newShape =
        backend_util.expandShapeToKeepDim(out.shape, originalAxes);
      }
      out.shape = newShape;
      return out;
    }
  }
  const out = backend.makeOutput(outShape, x.dtype);
  const outId = backend.dataIdMap.get(out.dataId);
  const permBytes = new Uint8Array(new Int32Array(perm).buffer);
  const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);

  wasmTranspose(xId, xShapeBytes, x.shape.length, CppDType[x.dtype], outId, permBytes, x.perm.length);
  return out;
}

export const allConfig: KernelConfig = {
  kernelName: All,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: all as {},
};

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 */
import {backend_util, TensorInfo, util} from '@tensorflow/tfjs-core';
import {BackendWasm} from './backend_wasm';
import {transpose} from './Transpose';

/**
 * Compute permutation axes and do a transpose if necessary.
 * Used by reduction ops.
 * @param x input TensorInfo
 * @param axis reduction axes
 * @param backend wasm backend instance
 */
export function permuteAxesAndTranspose(x: TensorInfo,
    axis: number[][],
    backend: BackendWasm): {
  transposed: TensorInfo|null,
  axes: number[][],
  originalAxes: number[][],
  inputWasTransposed: boolean
} {
  const xShape = x.shape;
  const xRank = x.shape.length;
  const originalAxes = util.parseAxisParam(axis, xShape);
  let axes = originalAxes;
  const permutedAxes = backend_util.getAxesPermutation(axes, xRank);
  let xTransposed = null;
  let inputWasTransposed = false;
  if (permutedAxes !== null) {
    const newShape: number[] = new Array(xRank);
    for (let i = 0; i < newShape.length; i++) {
      newShape[i] = xShape[permutedAxes[i]];
    }
    axes = backend_util.getInnerMostAxes(axes.length, xRank);
    xTransposed = transpose({inputs: {x}, attrs: {perm: permutedAxes, backend}});
    const xId = backend.dataIdMap.get(x.dataId).id;
    const transposedId = backend.dataIdMap.get(xTransposed.dataId).id;
    if (transposedId !== xId) {
      inputWasTransposed = true;
    }
  }

  return {transposed: xTransposed, originalAxes, axes, inputWasTransposed};
}

import {Any, AnyAttrs, AnyInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {permuteAxesAndTranspose} from './kernel_utils';

let wasmAny: (xId: number, reduceSize: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmAny = backend.wasm.cwrap(Any,
      null /*void*/, 
      ['number, number, number']);
}

function any(args: {backend: BackendWasm, inputs: AnyInputs,
    attrs: AnyAttrs}):
    TensorInfo {
  const {backend, inputs, attrs} = args;
  const {axis, keepDims} = attrs;
  const {x} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  let inputId = xId;
  let input = x;

  const {transposed, axes, originalAxes, inputWasTransposed} =
      permuteAxesAndTranspose(x, axis,
          backend);
  if (inputWasTransposed) {
    const transposedId = backend.dataIdMap.get(transposed.dataId).id;
    input = transposed;
    inputId = transposedId;
  }

  const inputRank = input.shape.length;
  backend_util.assertAxesAreInnerMostDims('any', axes, inputRank);
  const [outShape, reduceShape] =
      backend_util.computeOutAndReduceShapes(input.shape, axes);
  const reduceSize =
      util.sizeFromShape(reduceShape);
  const outId = backend.dataIdMap.get(out.dataId).id;
  if (util.sizeFromShape(input.shape) !== 0) {
    const outId = backend.dataIdMap.get(out.dataId).id;
    wasmAny(inputId, reduceSize, outId);
  }
  if (inputWasTransposed) {
    const transposedId = backend.dataIdMap.get(transposed.dataId).id;
    backend.disposeData(transposedId);
  }
  if (keepDims) {
    const outId = backend.dataIdMap.get(out.dataId).id;
    backend.disposeData(outId);
  }
  return
}
import {BackendWasm} from '../backend_wasm';
import {permuteAxesAndTranspose} from '../kernel_utils';
import {CppDType} from './types';

let wasmFunc: (xId: number, dtype: number, outerSize: number, innerSize: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmFunc = backend.wasm.cwrap(ArgMax, null /* void */ , [ 'number', // x_id
    'number', // y_id
    'number' // out_id
  ]);}

function argmax(
    args: {inputs: ArgMaxInputs, backend: BackendWasm, attrs: ArgMaxAttrs}) {
  const {backend, inputs, attrs} = args;
  const {axis} = attrs as {} as ArgMaxAttrs;
  const {x} = inputs as {} as ArgMaxInputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  let inputId = xId;
  let input = x;

  const {transposed, axes, inputWasTransposed} = permuteAxesAndTranspose(x, axis, backend);
  if (inputWasTransposed) {
    const transposedId = backend.dataIdMap.get(transposed.dataId).id;
    if (transposedId !== xId) {
      // transpose was not a no-op. We will need to dispose of this.
      // once we are done.
      input = transposed;
      inputId = transposedId;
    }
  }

  const outShape = input.shape.slice(0, -1);
  const out = backend.makeOutput(outShape, 'int32');
  const outId = backend.dataIdMap.get(out.dataId).id;
  const outerSize = util.sizeFromShape(out.shape);
  const innerSize = input.shape[axes[0]];
  wasmFunc(inputId, CppDType[input.dtype], outerSize, innerSize, outId);

  if (inputWasTransposed) {
    // dispose of the transposed tensor.
    backend.disposeData(transposed.dataId);
  }

  return out;
}

export const argMaxConfig: KernelConfig = {
  kernelName: ArgMax,
  backendName: 'wasm',
  kernelFunc: argmax as {} as KernelFunc,
  setupFunc: setup
};
```javascript
export const avgPoolConfig: KernelConfig = {
  kernelName: AvgPool,
  setupFunc: setup,
  kernelFunc: avgPool as {} as KernelFunc
};

export const reshapeConfig: KernelConfig = {
  kernelName: Reshape,
  backendName: 'wasm',
  kernelFunc: reshape as {} as KernelFunc
};

import {KernelConfig, KernelFunc, Reshape, ReshapeAttrs, ReshapeInputs, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

export function reshape(
    args: {inputs: ReshapeInputs, attrs: ReshapeAttrs, backend: BackendWasm}) {
  const {inputs, attrs} = args;
  const {x} = inputs;
  const {shape} = attrs;

  const xSize = util.sizeFromShape(x.shape);
  const $shape = util.inferFromImplicitShape(shape, xSize);

  util.assert(
      xSize === util.sizeFromShape($shape),
      () => `new shape: ${$shape}, old shape: ${x.shape}. New shape and old ` +
          `shape must have the same number of elements.`);

  return {dataId: x.dataId, shape: $shape, dtype: x.dtype};
}

import {BatchMatMul, BatchMatMulAttrs, BatchMatMulInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {reshape} from './Reshape';

let wasmBatchMatMul: (aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,
    bShape: Uint8Array, bShapeSize: number, transposeA: boolean,
    transposeB: boolean, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmBatchMatMul = backend.wasm.cwrap(BatchMatMul,
          null /* void */, [
    'number',  // a_id
    'array',   // a_shape
    'number',  // a_shape.length
    'number',  // b_id
    'array',   // b_shape
    'number',  // b_shape.length
    'number',  // transpose_a
    'number',  // transpose_b
    'number'   // out_id
  ])
}

function batchMatMul(args: {
  inputs: BatchMatMulInputs,
  backend: BackendWasm,
  attrs: BatchMatMulAttrs
}) {
  const {inputs, backend, attrs} = args;
  const {a, b} = inputs;
  const {transposeA, transposeB} = attrs;

  if (a.dtype !== 'float32' || b.dtype !== 'float32') {
    throw new Error(`BatchMatMul for non non-float32 tensors not yet supported.`);
  }

  const aRank = a.shape.length;
  const bRank = b.shape.length;

  const innerShapeA = transposeA ? a.shape[aRank - 2] : a.shape[aRank - 1];
  const innerShapeB = transposeB ? b.shape[bRank - 1] : b.shape[bRank - 2];

  util.assert(aRank > 2 && bRank > 2 && (aRank === bRank || aRank === 1 || bRank === 1), () => `Error in matMul: the input batch dimensions must either be the same or at least one input batch dimension must be 1. Got input batch dimensions of (${a.shape}) and (${b.shape}).`);

  const batchDimsCompatible: boolean = in

  return {aRank: a.shape.length, bRank: b.shape.length, innerShapeA: innerShapeA, innerShapeB: innerShapeB, outputShape: outputShape, outputShapeA: outputShapeA, outputShapeB: outputShapeB, batch dims: batchDims, matMul: matMul}.withInferSize();
}
```

---

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${a.shape} and ` +
          `${b.shape} and transposeA=${transposeA}` +
          ` and transposeB=${transposeB}` +
          ` must match.`);

  const a3dShape = transposeA ? 
          [batchDimA, innerShapeA, outerShapeA] : 
          [batchDimA, outerShapeA, innerShapeA];
  const b3dShape = transposeB ? [batchDimB, outerShapeB, innerShapeB] : 
          [batchDimB, innerShapeB, outerShapeB];

  // The rest of the implementation is designed to operate on rank-3 tensors
  const a3dId = backend.dataIdMap.get(a3d.dataId);
  const b3dId = backend.dataIdMap.get(b3d.dataId);
  const leftDim = transposA ? a3d.shape[2] : a3d.shape[1];
  const batchDim = Math.max(batchDimA, batchDimB);
  const out = backend.makeOutput([batchDim, leftDim, rightDim], a3d.dtype);
  backend.disposeData(a3d.dataId);
  backend.disposeData(b3d.dataId);

  out.shape = outShape;
  return out;
```js
import {backend_util, KernelConfig, KernelFunc, Slice, slice_util, util} from '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';
import {sliceImplCPU} from '../kernel_utils/shared';

export function slice(
    args: {inputs: SliceInputs, attrs: SliceAttrs, backend: BackendWasm}) {
  const {inputs: {x}, attrs: {begin, size}, backend} = args;

  const [begin_, size_] = slice_util.parseSliceParams(x, begin, size);

  const isContinous = slice_util.isSliceContinous(x.shape, begin_, size_);
  const xVals = backend.readSync(x.dataId);
  const out = backend.makeOutput(size_, x.dtype);
  const xStrides = util.computeStrides(x.shape);
  const outData = backend.dataIdMap.get(out.dataId);

  if (isContinous) {
    const flatOffset = slice_util.computeFlatOffset(begin_, xStrides);

    if (x.dtype === 'string') {
      outData.stringBytes = (xVals as Uint8Array[]) .slice(flatOffset, flatOffset +
```
const xReshaped = tf.transpose({inputs: [x], backend, attr: {perm: permuted}});
const xReshapedReshaped = tf.reshape({inputs: [xReshaped], backend, attr: {shape: reshapedPermuted}});
const result = tf.slice({inputs: [xReshapedReshaped], backend, attr: {begin: sliceBeginCoords, size: sliceSize}});
backend.disposeData(xReshaped.dataId);
backend.disposeData(xReshaped.dataId);

return result;
}

export const batchToSpaceNDConfig: KernelConfig = {
  kernelName: 'BatchToSpaceND',
  backendName: 'wasm',
  kernelFunc: batchToSpaceND as {} as KernelFunc
};

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 */

import {Cast, CastAttrs, CastInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';
import {TensorInfo} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

export function cast(
    args: {inputs: CastInputs, attrs: CastAttrs, backend: BackendWasm}):
    TensorInfo {
  const {inputs: {x}, attrs: {dtype}, backend} = args;
  const out = backend.makeOutput(x.shape, dtype);
  const inVals = backend.typedArrayFromHeap(x);
  const outVals = backend.typedArrayFromHeap(out);
  outVals.set(inVals);

  return out;
}

export const castConfig: KernelConfig = {
  kernelName: 'Cast',
  backendName: 'wasm',
  kernelFunc: cast as {} as KernelFunc,
};

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 */

import {ClipByValue, ClipByValueAttrs, ClipByValueInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';

export const ceilConfig: KernelConfig = createUnaryKernelConfig(Ceil);

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 */

import {KernelConfig, Ceil} from '@tensorflow/tfjs-core';

export const ceilConfig: KernelConfig = createUnaryKernelConfig(Ceil);
simplyConcat) {
  // Use built-in TypedArray.set() method for speed.
  let offset = 0;
  inputs.forEach(input => {
    const size = util.sizeFromShape(input.shape);
    if (simplyConcat && dtype !== 'string') {
      // Use built-in TypedArray.set() method for speed.
      let offset = 0;
      inputs.forEach(input => {
        const size = util.sizeFromShape(input.shape);
        outVals.set(input.vals, offset);
        offset += size;
      });
    } else {
      let colOffset = 0;
      inputs.forEach(input => {
        const decodedData = dtype === 'string' ?
          backend_util.fromUint8ToStringArray(input.vals) :
          input.vals;
        let tIdx = 0;
        for (let row = 0; row < input.shape[0]; ++row) {
          const resIdx = row * outShape[1] + colOffset;
          for (let col = 0; col < input.shape[1]; ++col) {
            outVals[resIdx + col] = decodedData[tIdx++];
          }
        }
        colOffset += input.shape[1];
      });
    }
    return outVals;
  });
}
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```javascript
const out = backend.makeOutput(convInfo.outShape, 'float32');
  const outId = backend.dataIdMap.get(out.dataId).id;
  wasmConv2d(
      xId, x.shape[0], x.shape[1], x.shape[2], filterId,
      filterHeight, filterWidth, padTop, padRight, padBottom, padLeft, isSamePad,
      dilationHeight, dilationWidth, strideHeight, strideWidth, inputChannels,
      outputChannels, outId); return out;
}

export
```

```javascript
const conv2DConfig: KernelConfig = {
  kernelName: Conv2D,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: conv2d as {} as KernelFunc
};
```

```javascript
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 */

import {backend_util, Conv2DBackpropInput, Conv2DBackpropInputAttrs, Conv2DBackpropInputOutputs, Conv2DBackpropOutputs, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmConv2DBackpropInput: (
    dyId: number, filterId: number, batchSize: number,
    filterHeight: number, filterWidth: number, inHeight: number, inWidth: number, inChannels: number,
    outHeight: number, outWidth: number, outChannels: number,
    strideHeight: number, strideWidth: number,
    topPad: number, leftPad: number,
    fltS0: number, fltS1: number, fltS2: number, xBatchStride: number,
    xColStride: number,xChannelStride: number,
    yBatchStride: number, yRowStride: number,
    yColStride: number, yChannelStride: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmConv2DBackpropInput = backend.wasm.cwrap(Conv2DBackpropInput, null, ['number',  // dyId
    'number',  // filterId
    'number',  // batchSize
    'number',  // filterHeight
    'number',  // filterWidth
    'number',  // inHeight
    'number',  // inWidth
    'number',  // inChannels
    'number',  // outHeight
    'number',  // outWidth
    'number',  // outChannels
    'number',  // strideHeight
    'number',  // strideWidth
    'number',  // topPad
    'number',  // leftPad
    'number',  // fltS0
    'number',  // fltS1
    'number',  // fltS2
    'number',  // xBatchStride
    'number',  // xColStride
    'number',  // xChannelStride
    'number',  // yBatchStride
    'number',  // yRowStride
    'number',  // yColStride
    'number',  // yChannelStride
    'number',  // outId
  ]);}

function conv2DBackpropInput(args: {
  backend: BackendWasm,
  inputs: Conv2DBackpropInputInputs,
  attrs: Conv2DBackpropInputAttrs
}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {dy, filter} = inputs;
  const {strides, pad, dataFormat,
      dimRoundingMode, inputShape} = attrs;

  const dilations = 1;

  const $dataFormat = backend_util.convertConv2DDataFormat(dataFormat);
  const convInfo = backend_util.computeConv2DInfo(
    inputShape, filter.shape as [number, number, number, number], strides,
    dilations, pad, dimRoundingMode,
    false /* depthwise */, $dataFormat);
  const [batchSize, filterHeight, filterWidth, inChannels, inHeight, inWidth, outChannels, outHeight, outWidth, strideHeight, strideWidth] = convInfo;
  const topPad = filterHeight - 1 - convInfo.padInfo.top;
  const leftPad = filterWidth - 1 - convInfo.padInfo.left;
  const isChannelsLast = convInfo.dataFormat === 'channelsLast';
  const dxStrides = util.computeStrides(convInfo.inShape);
  const dyStrides = util.computeStrides(dy.shape);

  const xBatchStride = dxStrides[0];
  const xRowStride = isChannelsLast ? dxStrides[1] : dxStrides[2];
  const xColStride = isChannelsLast ? dxStrides[0] : dxStrides[1];
  const yBatchStride = dyStrides[0];
  const yRowStride = isChannelsLast ? dyStrides[1] : dyStrides[2];
  const yColStride = isChannelsLast ? dyStrides[0] : dyStrides[1];

  const out = backend.makeOutput(convInfo.outShape, 'float32');
  const outId = backend.dataIdMap.get(out.dataId).id;
  const dyId = backend.dataIdMap.get(dy.dataId).id;
  const filterId = backend.dataIdMap.get(filter.dataId).id;
  const dxId = backend.dataIdMap.get(dx.dataId).id;
  const dyId = backend.dataIdMap.get(dy.dataId).id;
  const filterId = backend.dataIdMap.get(filter.dataId).id;
  const outId = backend.dataIdMap.get(out.dataId).id;
```
```javascript
wasmConv2DBackpropInput(dyId, filterId, batchSize, filterHeight, filterWidth, inHeight, inWidth, inChannels, outHeight, outWidth, outChannels, strideHeight, strideWidth, topPad, leftPad,fltS0, fltS1, fltS2, xBatchStride, xRowStride, xColStride, xChannelStride, yBatchStride, yRowStride, yColStride, yChannelStride, outId); return out;
}

export const conv2DBackpropInputConfig: KernelConfig = {
  kernelName: Conv2DBackpropInput,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: conv2DBackpropInput as {} as KernelFunc
};

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 */

import {CropAndResize, CropAndResizeAttrs, CropAndResizeInputs, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {cast} from './Cast';

enum InterpolationMethod {
  bilinear = 0,
  nearest = 1
}

let wasmCropAndResize: (imagesId: number, boxesId: number, boxIndId: number, numBoxes: number, imagesShape: Uint8Array, cropHeight: number, cropWidth: number, method: number, extrapolationValue: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmCropAndResize = backend.wasm.cwrap(CropAndResize, null /*void*/, 
    'number',  // imagesId
    'number',  // boxesId
    'number',  // boxIndId
    'number',  // numBoxes
    'array',   // images shape
    'number',  // cropHeight
    'number',  // cropWidth
    'number',  // method
    'number',  // extrapolation value
    'number'  // out id
  ]);
}

function cropAndResize(args: {
  backend: BackendWasm,
  inputs: CropAndResizeInputs,
  attrs: CropAndResizeAttrs
}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {method, extrapolationValue, cropSize} = attrs;
  const {image, boxes, boxInd} = inputs;

  const numBoxes = boxes.shape[0];
  const [cropHeight, cropWidth] = cropSize as [number, number];
  const outShape = [numBoxes, cropHeight, cropWidth, image.shape[3]];
  let imagesData = backend.dataIdMap.get(image.dataId);
  let castedData;
  if (image.dtype !== 'float32') {
    castedData = cast({backend, inputs: {x: image}, attrs: {dtype: 'float32'}});
    imagesData = backend.dataIdMap.get(castedData.dataId);
  }
  const imagesId = imagesData.id;
  const boxesId = backend.dataIdMap.get(boxes.dataId).id;
  const boxIndId = backend.dataIdMap.get(boxInd.dataId).id;
  const out = backend.makeOutput(outShape, 'float32');
  const outId = backend.dataIdMap.get(out.dataId).id;
  imagesShapeBytes = new Uint8Array(new Int32Array(image.shape).buffer);
  wasmCropAndResize(imagesId, boxesId, boxIndId, numBoxes, imagesShapeBytes, cropHeight, cropWidth, imagesId, boxesId, boxIndId, numBoxes, imagesShapeBytes, cropHeight, cropWidth, InterpolationMethod[method as {} as keyof typeof InterpolationMethod], extrapolationValue, outId); if (castedData != null) {
    backend.disposeData(castedData.dataId);
  }
  return out;
}

export const cropAndResizeConfig: KernelConfig = {
  kernelName: CropAndResize,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: cropAndResize as {} as KernelFunc
};

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import {Cos, KernelConfig} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';

export const cosConfig: KernelConfig = createUnaryKernelConfig(Cos);

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 */

```

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```
Open Source Used In Cisco Meeting Server (formerly Acano Server) 3.4  4747

```javascript
function setup(backend: BackendWasm): void {
  wasmDepthToSpace = backend.wasm.cwrap(DepthToSpace, null /*void*/, 
    ["number", 
      "number", 
      "number", 
      "number", 
      "array", 
      "array", 
      "number", 
      "number", 
      "number"]);
}

export function depthToSpace(args: {
  backend: BackendWasm,
  inputs: DepthToSpaceInputs,
  attrs: DepthToSpaceAttrs
}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {x} = inputs;
  const {blockSize, dataFormat} = attrs;
  const batchSize = x.shape[0];
  const inputHeight = (dataFormat === 'NHWC') ? x.shape[1] : x.shape[2];
  const inputWidth = (dataFormat === 'NHWC') ? x.shape[2] : x.shape[3];
  const inputDepth = (dataFormat === 'NHWC') ? x.shape[3] : x.shape[1];
  const outputHeight = inputHeight * blockSize;
  const outputWidth = inputWidth * blockSize;
  const outputDepth = inputDepth / (blockSize * blockSize);
  const outputShape = (dataFormat === 'NHWC') ? 
      [batchSize, outputHeight, outputWidth, outputDepth] : 
      [batchSize, outputDepth, outputHeight, outputWidth];
  const xId = backend.dataIdMap.get(x.dataId).id;
  const xStridesBytes = new Uint8Array(new Int32Array(x.shape).buffer);
  const outputShapeBytes = new Uint8Array(new Int32Array(outputShape).buffer);
  const outStridesBytes = new Uint8Array(new Int32Array(outputShape).buffer);
  const outId = backend.dataIdMap.get(output.dataId).id;
  const channelsLast = dataFormat === 'NHWC' ? 1 : 0;
  const convInfo = backend_util.computeConv2DInfo((x as Tensor4D).shape, (filter as Tensor4D).shape, 
      strides, dilations, pad, dimRoundingMode);
  const Sdilations = dilations === null ? [1, 1] : dilations;
  const convInfo = backend_util.computeConv2DInfo(
      (x as Tensor4D).shape, (filter as Tensor4D).shape, 
      Sdilations as number | [number, number], pad, dimRoundingMode, true /* depthwise */);
}
```
const filterHeight = convInfo.filterHeight;
const filterWidth = convInfo.filterWidth;
const padTop = convInfo.padInfo.top;
const padRight = convInfo.padInfo.right;
const padBottom = convInfo.padInfo.bottom;
const padLeft = convInfo.padInfo.left;
const dilationHeight = convInfo.dilationHeight;
const dilationWidth = convInfo.dilationWidth;
const strideHeight = convInfo.strideHeight;
const strideWidth = convInfo.strideWidth;
const inputChannels = convInfo.inChannels;
const outputChannels = convInfo.outChannels;
const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;

if (convInfo.dataFormat !== 'channelsLast') {
  throw new Error('wasm backend DepthwiseConv2dNative does not support dataFormat: ' + convInfo.dataFormat'. Please use 'channelsLast'.');
}

const out = backend.makeOutput(convInfo.outShape, 'float32');
const outId = backend.dataIdMap.get(out.dataId);

wasmDepthwiseConv2d(xId, x.shape[0], x.shape[1], x.shape[2], filterId, filterHeight, filterWidth, padTop, padRight, padBottom, padLeft, isSamePad, dilationHeight, dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels, outId); return out;

export const depthwiseConv2dNativeConfig: KernelConfig = {
  kernelName: DepthwiseConv2dNative,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: depthwiseConv2d as {} as KernelFunc
};

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 */

const supportsFullBroadcast = false;
export const equalConfig: KernelConfig = createBinaryKernelConfig(Equal, supportsFullBroadcast, 'bool');

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const supportsFullBroadcast = false;
export const expConfig: KernelConfig = createUnaryKernelConfig(Exp, 'float32');

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 */

const supportsFullBroadcast = false;
export const eluConfig: KernelConfig = createUnaryKernelConfig(Elu, 'float32');

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 */

const supportsFullBroadcast = false;
export const zeroConfig: KernelConfig = createUnaryKernelConfig(Zero, 'float32');

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import {ExpandDims, ExpandDimsAttrs, ExpandDimsInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';
import {reshape} from './Reshape';

export function expandDims(args: {
  inputs: ExpandDimsInputs,
  attrs: ExpandDimsAttrs,
  backend: BackendWasm
}) {
  const {inputs, attrs, backend} = args;
  const {input} = inputs;
  const {dim} = attrs;

  const inputRank = input.shape.length;
  const newShape = input.shape.slice();
  let $dim = dim;
  if (dim < 0) {
    // Negative value is counted from the tail of rank.
    util.assert((inputRank + 1) <= dim,
      () => `Axis must be in the interval [-(${inputRank + 1}), ${inputRank}]`);
    $dim = inputRank + dim + 1;
  }
  newShape.splice($dim, 0, 1);

  return reshape({inputs: {x: input}, backend, attrs: {shape: newShape}});
}

export const expandDimsConfig: KernelConfig = {
  kernelName: ExpandDims,
  backendName: 'wasm',
  kernelFunc: expandDims as {} as KernelFunc,
};

import {KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';
import {Fill, FillAttrs} from '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';

export function fill(args: {attrs: FillAttrs, backend: BackendWasm}) {
  const {attrs: {shape, value, dtype}, backend} = args;
  const out = backend.makeOutput(shape, dtype);
  const outVals = backend.typedArrayFromHeap(out);
  outVals.fill(value as number);
  return out;
}

export const fillConfig: KernelConfig = {
  kernelName: Fill,
  backendName: 'wasm',
  kernelFunc: fill as {} as KernelFunc,
};

import {FlipLeftRight, FlipLeftRightInputs, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';

let wasmFlipLeftRight: (xId: number, batch: number, imageHeight: number, imageWidth: number, numChannels: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmFlipLeftRight = backend.wasm.cwrap(FlipLeftRight, null /* void */, [
    'number',  // xId
    'number',  // batch
    'number',  // imageHeight
    'number',  // imageWidth
    'number',  // numChannels
    'number',  // outId
  ]);
}

export function flipLeftRight(args: {inputs: FlipLeftRightInputs, backend: BackendWasm}): TensorInfo {
  const {inputs, backend} = args;
  const {image} = inputs;
  const out = backend.makeOutput(image.shape, image.dtype);
  const imgId = backend.dataIdMap.get(image.dataId).id;
  const outId = backend.dataIdMap.get(out.dataId).id;
  setup(backend);
  wasmFlipLeftRight(imageId, batch, imageHeight, imageWidth, numChannels) = image.shape;
  wasmFlipLeftRight(imgId, outId); return out;
}

export const flipLeftRightConfig: KernelConfig = {
  kernelName: FlipLeftRight,
  backendName: 'wasm',
  kernelFunc: flipLeftRight as {} as KernelFunc,
  setup: setup
};
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============================================================================

*/

import {FusedBatchNorm, FusedBatchNormAttrs, FusedBatchNormInputs, KernelConfig, KernelFunc,
TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let

  wasmBatchNorm: (xId: number, meanId: number, varianceId: number, offsetId: number, scaleId: number,
  varianceEpsilon: number, offsetId: number) => void;

function setup(backend: BackendWasm): void {
  wasmBatchNorm = backend.wasm.cwrap(FusedBatchNorm, null /* void */, ['number', 'number',
  'number', 'number', 'number', 'number', 'number']);
}

function fusedBatchNorm(args: {
  backend: BackendWasm,
  inputs: FusedBatchNormInputs,
  attrs: FusedBatchNormAttrs
}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {varianceEpsilon} = attrs;
  const {x, mean, variance, offset, scale} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  const meanId = backend.dataIdMap.get(mean.dataId).id; //

  wasmBatchNorm(xId, meanId, varianceId, offsetId, scaleId,
    varianceEpsilon, outId);
  return out;
}

export const fusedBatchNormConfig: KernelConfig = {
  kernelName: FusedBatchNorm,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: fusedBatchNorm as {} as KernelFunc
};

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 */

import {Floor, KernelConfig} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from
  './unary_kernel';

export const floorConfig: KernelConfig = createUnaryKernelConfig(Floor);

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import {FloorDiv, KernelConfig} from '@tensorflow/tfjs-core';

import {createBinaryKernelConfig} from
  './binary_kernel';

const supportsFullBroadcast = false;
export const floorDivConfig: KernelConfig =
  createBinaryKernelConfig(FloorDiv, supportsFullBroadcast);

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import {backend_util, FusedConv2D, FusedConv2DAtrs, FusedConv2DInputs, KernelConfig, KernelFunc,
Tensor4D} from '@tensorflow/tfjs-core';

import
FusableActivation} from './types';

let wasmFusedConv2d:
    (xId: number, batchSize: number, inputHeight: number, inputWidth: number, filterId: number, filterHeight: number, filterWidth: number, biasId: number, dilatationHeight: number, dilatationWidth: number, strideHeight: number, strideWidth: number, inputChannels: number, outputChannels: number, activation: number, preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>
        void;

function setup(backend: BackendWasm) {
    wasmFusedConv2d = backend.wasm.cwrap(FusedConv2D, null /* void */, [
        'number',  // xId
        'number',  // batchSize
        'number',  // inputHeight
        'number',  // inputWidth
        'number',  // filterId
        'number',  // filterHeight
        'number',  // filterWidth
        'number',  // biasId
        'number',  // padTop
        'number',  // padRight
        'number',  // padBottom
        'number',  // padLeft
        'number',  // activation
        'number',  // outputChannels
        'number',  // outId
    ]);
}

function fusedConv2d(args: {
    inputs: FusedConv2DInputs,
    backend: BackendWasm,
    attrs: FusedConv2DAttrs
}) {
    const {inputs, backend, attrs} = args;
    const {x, filter, bias, preluActivationWeights} = inputs;
    const {
        strides,  // strides
        dilations,  // dilations
        dataFormat,  // dataFormat
        dimRoundingMode,  // dimRoundingMode
        activation,  // activation
        leakyreluAlpha  // leakyreluAlpha
    } = attrs;
    const convInfo = backend_util.computeConv2DInfo(
        (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations, dataFormat, dimRoundingMode);
    const fusedActivation =
        FusableActivation[activation as {} as keyof typeof FusableActivation];
    if (fusedActivation == null) {
        throw new Error(`FusedConv2D only supports rank-1 bias but got rank ${biasData.shape.length}.`);
    }

    const xId = backend.dataIdMap.get(x.dataId).id;
    const filterId = backend.dataIdMap.get(filter.dataId).id;
    const outputChannels = convInfo.outChannels;
    const biasId = 0;
    if (bias != null) {
        const biasData = backend.dataIdMap.get(bias.dataId);
        if (biasData.shape.length !== 1) {
            throw new Error(`FusedConv2D bias shape (${biasData.shape}) does not match the number of output channels`);
        }
        if (biasData.shape[0] !== outputChannels) {
            throw new Error(`FusedConv2D bias shape (${biasData.shape}) does not match the number of output channels`);
        }
        const filterHeight = convInfo.filterHeight;
        const filterWidth = convInfo.filterWidth;
        const padTop = convInfo.padInfo.top;
        const padRight = convInfo.padInfo.right;
        const padBottom = convInfo.padInfo.bottom;
        const padLeft = convInfo.padInfo.left;
        const dilationHeight = convInfo.dilationHeight;
        const dilationWidth = convInfo.dilationWidth;
        const strideHeight = convInfo.strideHeight;
        const strideWidth = convInfo.strideWidth;
        const inputChannels = convInfo.inChannels;
        const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;
        const batchSize = convInfo.batchSize;
        const inHeight = convInfo.inHeight;
        const inWidth = convInfo.inWidth;
        if (dataFormat !== 'NHWC') {
            throw new Error(`wasm backend FusedConv2D does not support dataFormat: '${dataFormat}'. Please use 'NHWC'.`);
        }

        const out = backend.makeOutput(convInfo.outShape, 'float32');
        const outId = backend.dataIdMap.get(out.dataId).id;
        const preluActivationWeightsId = preluActivationWeights == null ? null :
            wasmFusedConv2d(xId, batchSize, inHeight, inWidth, filterId, filterHeight, filterWidth, biasId, padTop, padRight, padBottom, padLeft, isSamePad, dilationHeight, dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels);

        return out;
    }
}

export const fusedConv2DConfig:
    KernelConfig = {
        kernelName: FusedConv2D,
        backendName: 'wasm',
        setupFunc: setup,
        kernelFunc:
            fusedConv2d as {} as KernelFunc
    };

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 */

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import {backend_util, FusedDepthwiseConv2D, FusedDepthwiseConv2DAttrs, FusedDepthwiseConv2DInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {FusableActivation} from './types';

let wasmFusedDepthwiseConv2d:
    (xId: number, batchSize: number, inputHeight: number, inputWidth: number,
     filterId: number, filterHeight: number, filterWidth: number, biasId: number, padTop: number, padRight: number, padBottom: number, padLeft: number, isSamePad: number, dilationHeight: number, dilationWidth: number, strideHeight: number, strideWidth: number, inputChannels: number, outputChannels: number, activation: number, preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>
     void;

function setup(backend: BackendWasm) {
  wasmFusedDepthwiseConv2d =
    backend.wasm.cwrap(FusedDepthwiseConv2D, null /* void */, [
        'number',  // xId
        'number',  // batchSize
        'number',  // inputHeight
        'number',  // inputWidth
        'number',  // filterId
        'number',  // filterHeight
        'number',  // filterWidth
        'number',  // biasId
        'number',  // padTop
        'number',  // padRight
        'number',  // padBottom
        'number',  // padLeft
        'number',  // isSamePad
        'number',  // dilationHeight
        'number',  // dilationWidth
        'number',  // strideHeight
        'number',  // strideWidth
        'number',  // inputChannels
        'number',  // outputChannels
        'number',  // activation
        'number',  // preluActivationWeightsId
        'number',  // leakyreluAlpha
        'number',  // outId
      ]);}

function fusedDepthwiseConv2d(args: {
  inputs: FusedDepthwiseConv2DInputs,
  backend: BackendWasm,
  attrs: FusedDepthwiseConv2DAttrs
}) {
  const {inputs, attrs, backend} = args;
  const {x, filter, bias,
    preluActivationWeights} = inputs;
  const {
    strides,
    pad,
    dilations,
    dataFormat,
    dimRoundingMode,
    activation,
    leakyreluAlpha
  } = attrs;

  const convInfo =
      backend_util.computeConv2DInfo(
          (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,
          pad, dimRoundingMode, true /* depthwise */);

  const fusedActivation =
      FusableActivation[activation as {} as keyof typeof FusableActivation];
  if (fusedActivation == null) {
    throw new Error(
        `${activation} activation not yet supported for FusedDepthwiseConv2D ` +
        `in the wasm backend.`);
  }

  const xId =
      backend.dataIdMap.get(x.dataId).id;
  const filterId = backend.dataIdMap.get(filter.dataId).id;

  const outputChannels = convInfo.outChannels;
  let biasId = 0;
  if (bias != null) {
    const biasData =
        backend.dataIdMap.get(bias.dataId);
    if (biasData.shape.length !== 1) {
      throw new Error(
          `FusedDepthwiseConv2D only supports rank-1 bias but got ` +
          `rank ${biasData.shape.length}.`);
    }
    if (biasData.shape[0] !== outputChannels) {
      throw new Error(
          `FusedDepthwiseConv2D bias shape (${biasData.shape}) does not ` +
          `match the number of output channels (${outputChannels}).`);
    }
    biasId = biasData.id;
  }

  const filterHeight = convInfo.filterHeight;
  const filterWidth = convInfo.filterWidth;
  const padTop = convInfo.padInfo.top;
  const padRight = convInfo.padInfo.right;
  const padBottom = convInfo.padInfo.bottom;
  const padLeft = convInfo.padInfo.left;
  const dilationHeight = convInfo.dilationHeight;
  const dilationWidth = convInfo.dilationWidth;
  const strideHeight = convInfo.strideHeight;
  const strideWidth = convInfo.strideWidth;
  const inputChannels = convInfo.inChannels;
  const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;
  const batchSize =
      convInfo.batchSize;
  const inHeight = convInfo.inHeight;
  const inWidth = convInfo.inWidth;
  if (dataFormat !== 'NHWC') {
    throw new Error(
        `wasm backend FusedDepthwiseConv2D does not support ` +
        `dataFormat: '${dataFormat}'. Please use 'NHWC'.`);
  }
  const outId =
      backend.makeOutput(convInfo.outShape, 'float32');
  const outId =
      backend.dataIdMap.get(outId.dataId).id;
  const preluActivationWeightsId =
      backend.dataIdMap.get(preluActivationWeights.dataId).id;
  const leakyreluAlpha =
      backend.dataIdMap.get(leakyreluAlpha.dataId).id;
  const outId =
      backend.dataIdMap.get(outId.dataId).id;

  wasmFusedDepthwiseConv2d(xId, batchSize, inHeight, inWidth, filterId, filterHeight, filterWidth, biasId, padTop, padRight, padBottom, padLeft, isSamePad, dilationHeight, dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels, fusedActivation, preluActivationWeightsId, leakyreluAlpha, outId) =>
      void;
  return out;
}

export const fusedDepthwiseConv2DConfig: KernelConfig = {
  kernelName: FusedDepthwiseConv2D,
  backendName: 'wasm'
}
```typescript
import {TensorInfo} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {CppDType} from './types';

let wasmGatherNd: (xId: number, dtype: CppDType, indicesId: number, numSlices: number, sliceRank: number, sliceSize: number, strides: Uint8Array, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmGatherNd = backend.wasm.cwrap(GatherNd, null /*void*/, [
    'number',  // xId
    'number',  // dtype
    'number',  // indicesId
    'number',  // numSlices
    'number',  // sliceRank
    'number',  // sliceSize
    'array',   // strides
    'number'   // outId
  ]);
}

function gatherNd(args: {backend: BackendWasm, inputs: GatherNdInputs, params: GatherNdParams}):
    TensorInfo {
  const {backend, inputs, params} = args;
  const {indices, numSlices, sliceSize, strides, sliceRank} = inputs;

  const xData = backend.dataIdMap.get(params.dataId);
  const xId = xData.id;

  const indicesData = backend.dataIdMap.get(indices.dataId);
  const indicesId = indicesData.id;

  const stridesBytes = new Uint8Array(new Int32Array(strides).buffer);

  const out = backend.makeOutput(xData.shape, xData.dtype);
  if (numSlices === 0) {
    return out;
  }

  const outId = backend.dataIdMap.get(out.dataId).id;

  wasmGatherNd(xId, CppDType[params.dtype], indicesId, numSlices, sliceRank, sliceSize, stridesBytes, outId);

  return out;
}

export const gatherNdConfig: KernelConfig = {
  kernelName: GatherNd,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: gatherNd
};
```

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shapeInfo.outerSize, shapeInfo.dimSize, shapeInfo.sliceSize

const indicesSize = util.sizeFromShape(indices.shape);

const flattenIndex = reshape(\n  \n  inputs: [{ indices, \n    attr: { \n      shape: [shapeInfo.batchSize, indicesSize / shapeInfo.batchSize], \n      backend: true } }] \n  \n  flatenOutputShape = \n  \n  [shapeInfo.batchSize, shapeInfo.outerSize, indicesSize / shapeInfo.batchSize, shapeInfo.sliceSize]; \n
const out = backend.makeOutput(flatenOutputShape, x.dtype);

if (util.sizeFromShape(x.shape) !== 0) \n  \n  const stridesSize = flattenX.shape.length - 1;

  const xData = backend.dataIdMap.get(flattenX.dataId);

  const xId = xData.id;

  const indicesData = backend.dataIdMap.get(flattenIndex.dataId);

  const indicesId = indicesData.id;

  const outId = backend.dataIdMap.get(out.dataId).id;

  const xStridesBytes = new Uint8Array(
    new Int32Array(util.computeStrides(flattenX.shape)).buffer);

  const outStridesBytes = new Uint8Array(
    new Int32Array(util.computeStrides(flatenOutputShape)).buffer);

  wasmGather(
    xId, CppDType[x.dtype],
    xStridesBytes, stridesSize, indicesId, 
    shapeInfo.batchSize, outStridesBytes, outId);

  backend.disposeData(flattenX.dataId);

  backend.disposeData(flattenIndex.dataId);

  const out = backend.makeOutput(x.shape, 'float32');

  if (util.sizeFromShape(x.shape) !== 0) {
    const outId = backend.dataIdMap.get(out.dataId).id;
    wasmGather(xId, CppDType[x.dtype], alpha, outId);
  }

  return out;

}\n
export const gatherV2Config: KernelConfig = {
  kernelName: GatherV2,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: gatherV2 as {} as KernelFunc
};

import {KernelConfig, KernelFunc, LeakyRelu, LeakyReluAttrs, LeakyReluInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {CppDType} from './types';

let wasmFunc: (xId: number, dtype: number, leakyreluAlpha: number, outId: number) => void;

function setupFunc(backend: BackendWasm): void {
  wasmFunc = backend.wasm.cwrap(LeakyRelu,
    null /* void */, 
    ['number',  // x_id
     'number',  // dtype
     'number',  // leakyrelu_alpha
     'number', // out_id]
  );
}

export function leakyRelu(
    inputs: LeakyReluInputs, attrs: LeakyReluAttrs,
    backend: BackendWasm): TensorInfo {
  const {inputs: {x}, attrs: {alpha}, backend} = args;

  const xId = backend.dataIdMap.get(x.dataId).id;

  // According to TF API, LeakyRelu returns float32 when input is either float32 or int32;
  const out = backend.makeOutput(x.shape, 'float32');

  if (util.sizeFromShape(x.shape) !== 0) {
    const outId = backend.dataIdMap.get(out.dataId).id;
    wasmGather(xId, CppDType[x.dtype], alpha, outId);
  }

  return out;
}

export const leakyReluConfig: KernelConfig = {
  kernelName: LeakyRelu,
  backendName: 'wasm',
  setupFunc: setupFunc,
  kernelFunc: leakyRelu as {} as KernelFunc
};

import {Greater, KernelConfig} from '@tensorflow/tfjs-core';

import {createBinaryKernelConfig} from './binary_kernel';

const supportsFullBroadcast = false;
export const greaterConfig: KernelConfig =

  createBinaryKernelConfig(Greater, supportsFullBroadcast, 'bool');

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=============================================================================

*\nimport {GreaterEqual, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = false;\n\nexport const greaterEqualConfig: KernelConfig =\ncreateBinaryKernelConfig(GreaterEqual, supportsFullBroadcast, 'bool');\n*/

```javascript
import {GreaterEqual, KernelConfig} from '@tensorflow/tfjs-core';
import {createBinaryKernelConfig} from './binary_kernel';
const supportsFullBroadcast = false;
export const greaterEqualConfig: KernelConfig =
createBinaryKernelConfig(GreaterEqual, supportsFullBroadcast, 'bool');
```
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=============================================================================

*/

import {KernelConfig, LessEqual} from '@tensorflow/tfjs-core';

import {createBinaryKernelConfig} from './binary_kernel';

const supportsFullBroadcast = false;
export const lessEqualConfig: KernelConfig =

createBinaryKernelConfig(LessEqual, supportsFullBroadcast, 'bool');

```javascript
import {KernelConfig, Log} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';
export const logConfig: KernelConfig = createUnaryKernelConfig(Log);

import {KernelConfig, LogicalAnd} from '@tensorflow/tfjs-core';

import {createBinaryKernelConfig} from './binary_kernel';

const supportsFullBroadcast = false;
export const logicalAndConfig: KernelConfig =

createBinaryKernelConfig(LogicalAnd, supportsFullBroadcast, 'bool');

import {backend_util, KernelConfig, KernelFunc, MaxPool, MaxPoolAttrs, MaxPoolInputs, Tensor4D, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmMaxPool: (
    xId: number, batchSize: number, inputHeight: number, inputWidth: number,
    filterHeight: number, filterWidth: number, padTop: number, padRight: number,
    padBottom: number, padLeft: number, dilationHeight: number,
    dilationWidth: number, strideHeight: number, strideWidth: number, outputChannels: number, outputChannels: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmMaxPool = backend.wasm.cwrap(MaxPool, null /* void */, 

  [ 'number',  // xId
    'number',  // batchSize
    'number',  // inputHeight
    'number',  // inputWidth
    'number',  // filterHeight
    'number',  // filterWidth
    'number',  // padTop
    'number',  // padRight
    'number',  // padBottom
    'number',  // padLeft
    'number',  // dilationHeight
    'number',  // dilationWidth
    'number',  // strideHeight
    'number',  // strideWidth
    'number',  // outputChannels
    'number',  // outputChannels
    'number',  // outId
  ]); /

  function maxPool(
    args: {inputs: MaxPoolInputs, backend: BackendWasm, attrs: MaxPoolAttrs}) {
    const {inputs, attrs, backend} = args;
    const xId = inputs.x.dataId;
    backend.dataIdMap.get(xId).id;
    const x = inputs.x as Tensor4D;
    // TF API supports int32 input. CPU and WebGL backend also support int32.
    // WASM backend doesn't support it because it uses xnnpack which only
    // supports float32.
    // Add the following assert only for the WASM backend instead of at core op
    // level.
    x.dtype
```
=== 'float32',
      () =>
          `Error in MaxPool: only float32 input is supported. Got ${x.dtype}.`);

  const
      filterSize, strides, pad, dimRoundingMode) = attrs;
  const convInfo = backend_util.computePool2DInfo(x.shape, filterSize, strides, 1 /* dilations */);
  const filterHeight = convInfo.filterHeight;
  const filterWidth = convInfo.filterWidth;
  const padTop = convInfo.padTop;
  const padRight = convInfo.padRight;
  const padBottom = convInfo.padBottom;
  const padLeft = convInfo.padLeft;
  const dilationHeight = convInfo.dilationHeight;
  const dilationWidth = convInfo.dilationWidth;
  const strideHeight = convInfo.strideHeight;
  const strideWidth = convInfo.strideWidth;
  const inputChannels = convInfo.inChannels;
  const outputChannels = convInfo.outChannels;

  if (convInfo.dataFormat !== 'channelsLast') {
    throw new Error('wasm backend does not support dataFormat':" + '{convInfo.dataFormat}'. Please use 'channelsLast'.");
  }

  const out = backend.makeOutput(convInfo.outShape, 'float32');
  const outId = backend.dataIdMap.get(out.dataId).id;

  wasmMaxPool(
      xId, x.shape[0], x.shape[1], x.shape[2],
      filterHeight, filterWidth,
      padTop, padRight, padBottom, padLeft, dilationHeight, dilationWidth,
      strideHeight, strideWidth, inputChannels, outputChannels, outId);
  return out;
}

export const maxPoolConfig: KernelConfig = {
  kernelName: MaxPool,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: maxPool as {} as KernelFunc
};

export const maximumConfig: KernelConfig = createBinaryKernelConfig(Maximum, supportsFullBroadcast);

export function mean(args: {
    backend: BackendWasm,
    inputs: MeanInputs,
    attrs: MeanAttrs
}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {axis, keepDims} = attrs;
  const {x} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  let inputId = xId;
  let input = x;

  const {transposed, axes, originalAxes, inputWasTransposed} =
      permuteAxesAndTranspose(x, axis, backend);

  const reductionAxes = backend_util.getInnerMostAxes(axes.length, input.shape.length);

  const wasmMeanId = backend.wasm.cwrap(Mean, null /*void*/, ['number, number, number']);

  const output = wasmMean(inputId, reductionAxes.length, wasmMeanId);
  // The output values correspond to the reductionAxes that were transposed.
  return {shape: output.shape, dataId: backend.dataIdMap.get(output.dataId).id, type: x.dtype};
}

// Backend-specific implementation of mean

export function nativeMean(args: {
    backend: BackendWasm,
    inputs: MeanInputs,
    attrs: MeanAttrs
}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {axis, keepDims} = attrs;
  const {x} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;

  let inputId = xId;
  let input = x;

  const [transposed, axes, originalAxes, inputWasTransposed] =
      permuteAxesAndTranspose(x, axis, backend);

  const reductionAxes = axes;

  if (inputWasTransposed) {
    const transposedId = backend.dataIdMap.get(transposed.dataId, id);

    if (transposedId !== xId) {
      // transpose was not a no-op. We will need to dispose of this\n          // once we are done.
      input = transposed;
      inputId = transposedId;
      reductionAxes = backend_util.getInnerMostAxes(reductionAxes.length, input.shape.length);
    }
  }

  const reductionAxesAreInnerMostDims = reductionAxes.length === input.shape.length;

  const output = mean(xId, reductionAxesAreInnerMostDims ? x : backend.reduceDimensions(inputId, reductionAxes),
      backend_util.getInnerMostAxes(reductionAxes.length, input.shape.length),
      reductionAxes, input.shape.length);

  return {shape: output.shape, dataId: backend.dataIdMap.get(output.dataId).id, type: x.dtype};
}
enum in MirrorPad.cc
enum MirrorPaddingMode {
  reflect = 0,
  symmetric = 1
}

let wasmMirrorPad: (
  xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype: number,
  prePaddingsBytes: Uint8Array, postPaddingsBytes: Uint8Array, mode: number,
  outId: number) => void;

function setup(backend: BackendWasm) {
  wasmMirrorPad = backend.wasm.cwrap(MirrorPad, null /* void */); //
  const xId = backend.dataIdMap.get(x.dataId).id;
  const out = backend.makeOutput(outShape, x.dtype);
  const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);
  const prePaddingsBytes =
    new Uint8Array(new Int32Array(prePaddingsFlat).buffer);
  const postPaddingsBytes =
    new Uint8Array(new Int32Array(postPaddingsFlat).buffer);
  wasmMirrorPad(xId, xShapeBytes, x.shape.length, CppDType[x.dtype],
    prePaddingsBytes, postPaddingsBytes,
    MirrorPaddingMode[mode], outId);
  return out;
}

export const mirrorPadConfig: KernelConfig = {
  kernelName: MirrorPad,
  backendName: 'wasm',
  kernelFunc: mirrorPad as {} as KernelFunc,
  setupFunc: setup
};

import {KernelConfig, Minimum} from '@tensorflow/tfjs-core';

import {createBinaryKernelConfig} from
  './binary_kernel';
const supportsFullBroadcast = false;
export const minimumConfig: KernelConfig =
  createBinaryKernelConfig(Minimum, supportsFullBroadcast);

import {KernelConfig, KernelFunc, NonMaxSuppressionV3, NonMaxSuppressionV3Attrs,
  NonMaxSuppressionV3Inputs, TensorInfo} from '@tensorflow/tfjs-core';

import {NonMaxSuppressionV3Inputs, TensorInfo} from '@tensorflow/tfjs-core';
Since we are not using scores for V3, we have to delete it from the heap:

```cpp
backend.wasm._free(pSelectedScores);
backend.wasm._free(pValidOutputs);
const selectedIndicesTensor = backend.makeOutput([selectedSize], 'int32', pSelectedIndices);
return selectedIndicesTensor;
```

```cpp
export const nonMaxSuppressionV3Config: KernelConfig = {
  kernelName: NonMaxSuppressionV3,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: kernelFunc as {} as KernelFunc,
};
```

```cpp
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 * limitations under the License.
 */

```cpp
import {KernelConfig, Multiply} from '@tensorflow/tfjs-core';
import {createBinaryKernelConfig} from './binary_kernel';

const supportsFullBroadcast = true;
export const multiplyConfig: KernelConfig = createBinaryKernelConfig(Multiply, supportsFullBroadcast);
```

```cpp
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 * distributed under the License is distributed on an "AS IS" BASIS,
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 * limitations under the License.
 */

```cpp
import {KernelConfig, Neg} from '@tensorflow/tfjs-core';
import {createUnaryKernelConfig} from './unary_kernel';
export const negConfig: KernelConfig = createUnaryKernelConfig(Neg);
```

```cpp
/**
 * Parse the result of the c++ method, which has the shape equivalent to `Result`.
 */
export function parseResultStruct(backend: BackendWasm, resOffset: number): Result {
  const result = new Int32Array(backend.wasm.HEAPU8.buffer, resOffset, 4);
  const pSelectedIndices = result[0];
  const selectedSize = result[1];
  const pSelectedScores = result[2];
  const pValidOutputs = result[3];
  // Since the result was allocated on the heap, we have to delete it.
  backend.wasm._free(resOffset);
  return {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs};
}
```

```cpp
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 * limitations under the License.
 */

```cpp
import {BackendWasm} from '../backend_wasm';

// Analogous to `struct Result` in `non_max_suppression_impl.h`

```cpp
interface Result {
  pSelectedIndices: number;
  selectedSize: number;
  pSelectedScores: number;
  pValidOutputs: number;
}
```

```cpp
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 * limitations under the License.
 */

```cpp
// Since we are not using scores for V3, we have to delete it from the heap.

```cpp
backend.wasm._free(pSelectedScores);
backend.wasm._free(pValidOutputs);
const selectedIndicesTensor = backend.makeOutput([selectedSize], 'int32', pSelectedIndices);
return selectedIndicesTensor;
```
```javascript
import {KernelConfig, KernelFunc, NonMaxSuppressionV4, NonMaxSuppressionV4Inputs, TensorInfo} from '@tensorflow/tfjs-core';

NonMaxSuppressionV4.inputs, TensorInfo) from '@tensorflow/tfjs-core';

const [backend_wasm] = await import('@tensorflow/tfjs-backend-wasm');

const backend = backend_wasm.createBackend();

const input = Tensor.fromValues([1, 2, 3, 4, 5, 6]);

const output = backend.run([input], 'tfjs-backend-wasm', {precision: 'int32', maxBatchSize: 10});

console.log(output);
```
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=============================================================================

---

import {KernelConfig, KernelFunc, OneHot, OneHotAttrs, OneHotInputs} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmOneHot: (indicesId: number, depth: number, onValue: number, offValue: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmOneHot = backend.wasm.cwrap(OneHot, null /* void */, ['number', 'number', 'number', 'number', 'number']);
}

function oneHot(args: {inputs: OneHotInputs, attrs: OneHotAttrs, backend: BackendWasm}) {
  const {inputs, backend, attrs} = args;
  const {indices} = inputs;
  const {depth, onValue, offValue} = attrs;

  const out = backend.makeOutput([...indices.shape, depth], 'int32');
  const outId = backend.dataIdMap.get(out.dataId).id;

  const indicesData = backend.dataIdMap.get(indices.dataId);
  const indicesId = indicesData.id;

  wasmOneHot(indicesId, depth, onValue, offValue, outId);

  return out;
}

export const oneHotConfig: KernelConfig = {
  kernelName: OneHot,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: oneHot as {} as KernelFunc,
};

---

import {KernelConfig, NotEqual} from '@tensorflow/tfjs-core';

import {createBinaryKernelConfig} from './binary_kernel';

const supportsFullBroadcast = false;
export const notEqualConfig: KernelConfig = createBinaryKernelConfig(NotEqual, supportsFullBroadcast, 'bool');

---

import {KernelConfig, KernelFunc, OnesLike, OnesLikeInputs} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

function onesLike(args: {inputs: OnesLikeInputs, backend: BackendWasm}) {
  const {inputs: {x}, backend} = args;
  const out = backend.makeOutput(x.shape, x.dtype);

  const outVals = backend.typedArrayFromHeap(out);
  outVals.fill(1);
  return out;
}

export const onesLikeConfig: KernelConfig = {
  kernelName: OnesLike,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: onesLike as {} as KernelFunc,
};
import {KernelConfig, KernelFunc, Pack, PackAttr, PackInputs, TensorInfo, util} from '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';

export function pack(
    args: {inputs: PackInputs, backend: BackendWasm, atts: PackAttr}): TensorInfo {
  const {inputs, backend, atts} = args;
  const {axis} = atts;

  if (inputs.length === 1) {
    return expandDims(
        {inputs: {input: inputs[0]}, backend, atts: {dim: axis}});
  }

  const shape = inputs[0].shape;
  const dtype = inputs[0].dtype;

  inputs.forEach(t => {
    util.assertShapesMatch(
        shape, t.shape,
        'All tensors passed to stack must have matching shapes');
    util.assert(
        dtype === t.dtype,
        () => 'All tensors passed to stack must have matching dtypes');
  });

  const intermediateTensorInfos: TensorInfo[] = [];
  const expandedTensors = inputs.map(t => {
    const expandedT =
        expandDims({inputs: {input: t}, backend, atts: {dim: axis}});
    intermediateTensorInfos.push(expandedT);
    return expandedT;
  });

  const result = concat({inputs: expandedTensors, backend, atts: {dim: axis}});
  intermediateTensorInfos.forEach(t =>
      backend.disposeData(t.dataId));
  return result;
}

export const packConfig: KernelConfig = {
  kernelName: Pack,
  backendName: 'wasm',
  kernelFunc: pack as {} as KernelFunc
};
```javascript
import {KernelConfig, KernelFunc, Prelu, PreluInputs} from '@tensorflow/tfjs-core';

import {BackendWasm} from '@tensorflow/tfjs-backend-wasm';

import {cast} from './Cast';

let wasmPrelu: (xId: number, weightsId: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmPrelu = backend.wasm.cwrap(Prelu, null /* void */, [
    'number', // 'x_id' 'number', // weights_id 'number' // out_id
  ]);  //n'unfunction prelu(backend: BackendWasm) 'n un function setup(backend: BackendWasm) ...

  const {x, alpha} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  const weightsId = backend.dataIdMap.get(alpha.dataId).id;
  let inputId = xId;
  const input = x;
  let castedInput = input;
  if (input.dtype !== 'float32') {
    castedInput = cast({backend, inputs: {x}, attrs: {dtype: 'float32'}});
    inputId = backend.dataIdMap.get(castedInput.dataId).id;
  }

  const out = backend.makeOutput(x.shape, 'float32');
  const outId = backend.dataIdMap.get(out.dataId).id;
  wasmPrelu(inputId, weightsId, outId);

  if (input.dtype !== 'float32') {
    backend.disposeData(castedInput.dataId);
  }
  return out;
}

export const preluConfig: KernelConfig = {
  kernelName: Prelu,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: prelu as {} as KernelFunc
};
```
function prod(inputId, reduceSize, CppDType[out.dtype], outId): number {
  const outId = backend.dataIdMap.get(out.dataId).id;
  const out = backend.makeOutput(out.shape, 'float32');
  if (util.sizeFromShape(input.shape) !== 0) {
    const outId = backend.dataIdMap.get(out.dataId).id;
    wasmProd(inputId, reduceSize, CppDType[out.dtype], outId); // dispose of the transposed tensor.
    backend.disposeData(transposed.dataId); // dispose of the transposed tensor.
    const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);
    out.shape = newShape;
    return out;
  }
  const port = prodConfig(kernelConfig);
  wasm[outId, /*out*/];
  return out;
}

export const prodConfig: KernelConfig = {
  kernelName: Prod,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: prod as {} as KernelFunc
};

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 */

import {KernelConfig, KernelFunc, ResizeBilinear, ResizeBilinearAttrs, ResizeBilinearInputs, TensorInfo} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmResizeBilinear: (
    xId: number, batch: number, oldHeight: number, oldWidth: number,
    numChannels: number, newHeight: number, newWidth: number,
    alignCorners: number, halfPixelCenters: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmResizeBilinear = backend.wasm.cwrap(ResizeBilinear, null /*void*/, 
    ['number', // xId
    'number', // batch
    'number', // oldHeight
    'number', // oldWidth
    'number', // numChannels
    'number', // newHeight
    'number', // newWidth
    'number'] // alignCorners
  );
}

function resizeBilinear(args: {
  backend: BackendWasm,
  inputs: ResizeBilinearInputs,
  attrs: ResizeBilinearAttrs
}): TensorInfo {
  const {backend, inputs, attrs} = args;

  const {images} = inputs;
  const {alignCorners, halfPixelCenters, size} = attrs;
  const [newHeight, newWidth] = size;

  const [batch, oldHeight, oldWidth, numChannels] = images.shape;
  const outShape = [batch, newHeight, newWidth, numChannels];
  const xId = backend.dataIdMap.get(images.dataId).id;

  const xData = backend.makeOutput(outShape, 'float32');
  if (util.sizeFromShape(images.shape) === 0) {
    return xData;
  }
  const outId = backend.dataIdMap.get(out.dataId).id;

  const out = backend.makeOutput(out.shape, 'float32');
  if (util.sizeFromShape(images.shape) === 0) {
    return out;
  }

  const outId = backend.dataIdMap.get(out.dataId).id;
  wasmResizeBilinear(xId, batch, oldHeight, oldWidth, numChannels, newHeight, newWidth, alignCorners ? 1 : 0, halfPixelCenters ? 1 : 0, outId);

  return out;
}

export const resizeBilinearConfig: KernelConfig = {
  kernelName: ResizeBilinear,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: resizeBilinear as {} as KernelFunc
};

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 */

import {KernelConfig, KernelFunc, Range, RangeAttrs, TensorInfo} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';
import {rangeImplCPU} from '../kernel_utils/shared';

export const range =
    (args: {backend: BackendWasm, inputs: RangeInputs, attrs: RangeAttrs}): TensorInfo => {
      const {backend, inputs, attrs} = args;
      const {start, stop, step, dtype, size} = inputs;
      const {alignCorners, halfPixelCenters} = attrs;
      const values = rangeImplCPU(start, stop, step, dtype, size);

      const out = backend.makeOutput([values.length], dtype);
      const outVals = backend.typedArrayFromHeap(out);
      outVals.set(values);
      return out;
    };

export const rangeConfig: KernelConfig = {
  kernelName: Range,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: range as {} as KernelFunc
};
KernelFunc

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 */

import { util } from '@tensorflow/tfjs-core';
export function rangeImpl(start, stop, step, dtype) {
    const sameStartStop = start === stop;
    const increasingRangeNegativeStep = start < stop && step < 0;
    const decreasingRangePositiveStep = stop < start && step > 0;
    if (sameStartStop || increasingRangeNegativeStep ||
        decreasingRangePositiveStep) {
        return util.makeZerosTypedArray(0, dtype);
    }
    const numElements = Math.abs(Math.ceil((stop - start) / step));
    const values = util.makeZerosTypedArray(numElements, dtype);
    if (stop < start && step === 1) {
        // Auto adjust the step's sign if it hasn't been set // (or was set to 1)
        step = -step;
    }
    values[0] = start;
    for (let i = 1; i < values.length; i++) {
        values[i] = values[i - 1] + step;
    }
    return values;
}
import {KernelConfig, KernelFunc, Reverse, ReverseAttrs, ReverseInputs, TensorInfo, util} from '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';
import {identity} from './Identity';
import {reshape} from './Reshape';

let wasmReverse: (
    xId: number, axes: Uint8Array,
    axesLength: number, outShape: Uint8Array,
    outShapeLength: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmReverse = backend.wasm.cwrap(Reverse, null, [
    'number',  // x_id
    'array',   // axes
    'number',  // axes_length
    'array',   // out_shape
    'number',  // out_shape_length
    'number'   // out_id
  ]);}

export function reverse(
    args: {inputs: ReverseInputs, backend: BackendWasm, attrs: ReverseAttrs}):
    TensorInfo {
  const {inputs, backend, attrs} = args;
  const {x} = inputs;
  const {dims} = attrs;

  const axes = util.parseAxisParam(dims, x.shape);

  if (x.shape.length === 0) {
    return identity({inputs: {x}, backend});
  }

  const out = backend.makeOutput(x.shape, x.dtype);
  const xId = backend.dataIdMap.get(x.dataId).id;
  const outId = backend.dataIdMap.get(out.dataId).id;

  const axesBytes = new Uint8Array(new Int32Array(axes).buffer);
  const outShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);

  wasmReverse(
      xId, axesBytes, axes.length, outShapeBytes, x.shape.length,
      outId);

  const reshaped =
      reshape({inputs: {x: out}, attrs: {shape: x.shape}, backend});

  backend.disposeData(out.dataId);
  return reshaped;
}

export const reverseConfig: KernelConfig = {
  kernelName: Reverse,
  backendName: 'wasm',
  kernelFunc: reverse as {} as KernelFunc,
  setupFunc: setup
};

import {KernelConfig, KernelFunc, RotateWithOffset, RotateWithOffsetAttrs, RotateWithOffsetInputs,
        TensorInfo} from '@tensorflow/tfjs-core';
import {backend_util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmRotate: (
    xId: number, batch: number, imageHeight: number, imageWidth: number,
    numChannels: number, radians: number, centerX: number, centerY: number,
    fillBytes: Uint8Array, fillLength: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmRotate = backend.wasm.cwrap(RotateWithOffset, null /* void */,
      ['number',  // xId
       'number',  // batch
       'number',  // imageHeight
       'number',  // imageWidth
       'number',  // numChannels
       'number',  // radians
       'number',  // centerX
       'number',  // centerY
       'array',   // fillBytes
       'number',  // fillLength
       'number',  // outId
      ]);}

export function rotateWithOffset(args: {
  inputs: RotateWithOffsetInputs,
  backend: BackendWasm,
  attrs: RotateWithOffsetAttrs
}): TensorInfo {
  const {inputs, backend, attrs} = args;
  const {image} = inputs;
  const {radians, fillValue, center} = attrs;

  const out = backend.makeOutput(image.shape, image.dtype);
  const imageId = backend.dataIdMap.get(image.dataId).
  const outId = backend.dataIdMap.get(out.dataId).

  const backendDisp = backend.disposeData(out.dataId);
  const res = rotateWithOffset(config: {
    X: imageId,
    batch: batch,
    imageHeight: imageHeight,
    imageWidth: imageWidth,
    numChannels: numChannels,
    radians: radians,
    centerX: centerX,
    centerY: centerY,
    fillBytes: fillBytes,
    fillLength: fillLength,
    outId: outId,
  });

  return outId;
}

export const rotateWithOffsetConfig: KernelConfig = {
  kernelName: RotateWithOffset,
  backendName: 'wasm',
  kernelFunc: rotateWithOffset as {} as KernelFunc,
  setupFunc: setup
};
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=============================================================================

*\n\nimport {KernelConfig, KernelFunc, scatter_util, ScatterNd, ScatterNdAttrs, ScatterNdInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\n
import { BackendWasm } from '../backend_wasm';\n
import {CppDType} from './types';\n
let wasmScatterNd: (\n    indicesId: number, updatesId: number, dtype: CppDType, sliceRank: number,\n    numUpdates: number, sliceSize: number, strides: Uint8Array, \n    outputSize: number, outId: number) => void;\n
function setup(backend: BackendWasm): void {
  wasmScatterNd = backend.wasm.cwrap(ScatterNd, null /*void*/, [\n    'number',  // indicesId
    'number',  // updatesId
    'number',  // dtype
    'number',  // sliceRank
    'number',  // numUpdates
    'number',  // sliceSize
    'array',   // strides
    'number',  // outputSize
    'number'   // outId
  ]);\n}

function scatterNd(\n    args: {backend: BackendWasm, inputs: ScatterNdInputs, attrs: ScatterNdAttrs}: \n    TensorInfo {
  const {backend, inputs, attrs} = args;\n  const {indices, updates} = inputs;\n  const {shape} = attrs;\n
  const out = backend.makeOutput(shape, updates.dtype);\n  if (util.sizeFromShape(shape) === 0) {\n    return out;\n  }\n
  const {sliceRank, numUpdates, sliceSize, strides, \n    outputSize} = scatter_util.calculateShapes(updates, indices, shape);\n
  const indicesData = backend.dataIdMap.get(indices.dataId);\n  const indicesId = indicesData.id;\n
  const updatesData = backend.dataIdMap.get(updates.dataId);\n  const updatesId = updatesData.id;\n
  const stridesBytes = new Uint8Array(new Int32Array(strides).buffer);\n
  const outId = backend.dataIdMap.get(out.dataId).id;\n
  wasmScatterNd(indicesId, updatesId, CppDType[updates.dtype], sliceRank, numUpdates, sliceSize, \n    stridesBytes, outputSize, outId);\n
  return out;\n}\n
export const scatterNdConfig: KernelConfig = {\n  kernelName: ScatterNd, \n  backendName: 'wasm', \n  setupFunc: setup, \n  kernelFunc: scatterNd as {} as KernelFunc
};

=============================================================================

*\n\nimport {KernelConfig, Round} from '@tensorflow/tfjs-core';\n
import {createUnaryKernelConfig} from './unary_kernel';\n
export const roundConfig: KernelConfig = createUnaryKernelConfig(Round);

=============================================================================

*\n\nimport {KernelConfig, Rsqrt} from '@tensorflow/tfjs-core';\n
import {createUnaryKernelConfig} from './unary_kernel';\n
export const rsqrtConfig: KernelConfig = createUnaryKernelConfig(Rsqrt);

=============================================================================

*\n\nimport {KernelConfig, Rsqrt} from '@tensorflow/tfjs-core';\n
import {createUnaryKernelConfig} from './unary_kernel';\n
export const rsqrtConfig: KernelConfig = createUnaryKernelConfig(Rsqrt);

```
```javascript
import {KernelConfig, KernelFunc, Select, SelectInputs, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmSelect: (conditionId: number, tId: number, eId: number, offset: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmSelect = backend.wasm.cwrap('SelectV2', null, ['number', 'conditionId', 'number', 'tId', 'number', 'eId', 'number', 'offset', 'number', 'outId'],);
}

function select(args: {inputs: SelectInputs, backend: BackendWasm}) {
  const {inputs, backend} = args;
  const {condition, t, e} = inputs;

  const conditionId = backend.dataIdMap.get(condition.dataId).id;
  const tId = backend.dataIdMap.get(t.dataId).id;
  const eId = backend.dataIdMap.get(e.dataId).id;
  const out = backend.makeOutput(t.shape, t.dtype);
  const outId = backend.dataIdMap.get(out.dataId).id;

  const cRank = condition.shape.length;
  const tRank = t.shape.length;
  const offset = cRank === 0 || cRank > 1 || tRank === 1 ? 1 : util.sizeFromShape(t.shape.slice(1));

  wasmSelect(conditionId, tId, eId, offset, outId);
  return out;
}

export const selectConfig: KernelConfig = {
  kernelName: Select,
  backendName: 'wasm',
  kernelFunc: select as {} as KernelFunc,
  setupFunc: setup
};
```

```
import {KernelConfig, KernelFunc, Sigmoid, SigmoidInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmFunc: (xId: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmFunc = backend.wasm.cwrap(Sigmoid, null /* void */, ['number', 'number']);
}

function sigmoid(args: {backend: BackendWasm, inputs: SigmoidInputs}):
    TensorInfo {
  const {backend, inputs: {x}} = args;
  const xId = backend.dataIdMap.get(x.dataId).id;
  const out = backend.makeOutput(x.shape, x.dtype);
  const outId = backend.dataIdMap.get(out.dataId).id;

  // Short-circuit zero-sized tensors.
  if (util.sizeFromShape(out.shape) === 0) {
    return out;
  }

  wasmFunc(xId, outId);
  return out;
}

export const sigmoidConfig: KernelConfig = {
  kernelName: 'Sigmoid',
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: sigmoid as {} as KernelFunc
};
```

```
import {KernelConfig, KernelFunc, Softmax, SoftmaxAttrs, SoftmaxInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmFunc: (xId: number, outId: number, channels: number, batch: number) => void;

function setup(backend: BackendWasm) {
  wasmFunc = backend.wasm.cwrap('Softmax', null /* void */, ['number', 'number', 'number', 'number']);
}

function softmax(args: {backend: BackendWasm, inputs: SoftmaxInputs, attrs: SoftmaxAttrs}):
    TensorInfo {
  const {backend, inputs: {logits}, attrs: {dim}} = args;
  const xId = backend.dataIdMap.get(logits.dataId).id;
  const out = backend.makeOutput(x.shape, x.dtype);
  const outId = backend.dataIdMap.get(out.dataId).id;

  // Short-circuit zero-sized tensors.
  if (util.sizeFromShape(out.shape) === 0) {
    return out;
  }

  wasmFunc(xId, outId, channels, batch);
  return out;
}

export const softmaxConfig: KernelConfig = {
  kernelName: Softmax,
  backendName: 'wasm',
```
setupFunc: setup,
  kernelFunc: softmax as {} as KernelFunc
};

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 *
 *=============================================================================
 */

import {KernelConfig, Sin} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';

export const sinConfig: KernelConfig = createUnaryKernelConfig(Sin);

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 *=============================================================================
 */

import {backend_util, KernelConfig, KernelFunc, ReshapeAttrs, ReshapeInputs, SpaceToBatchND, SpaceToBatchNDAttrs, SpaceToBatchNDInputs, TensorInfo, TransposeAttrs, TransposeInputs, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {padV2Config} from './PadV2';
import {reshape} from './Reshape';
import {transpose} from './Transpose';

function spaceToBatchND(args: {
  inputs: SpaceToBatchNDInputs,
  backend: BackendWasm,
  attrs: SpaceToBatchNDAttrs
}) {
  const {inputs, backend, attrs} = args;
  const {x} = inputs;
  const {blockShape, paddings} = attrs;

  const prod = util.sizeFromShape(blockShape);

  const completePaddings: Array<[number, number]> = [[0, 0]];
  completePaddings.push(...(paddings as Array<[number, number]>));

  for (let i = 1 + blockShape.length; i < x.shape.length; ++i) {
    completePaddings.push([0, 0]);
  }

  const paddedX = padV2Config.kernelFunc({
    inputs: {x},
    backend,
    attrs: {paddings: completePaddings, constantValue: 0}
  }) as TensorInfo;

  const reshapedPaddedShape = backend_util.getReshaped(paddedX.shape, blockShape, prod, false);
  const permutedReshapedPaddedPermutation = backend_util.getPermuted(reshapedPaddedShape.length, blockShape.length, false);

  const reshapeInputs: ReshapeInputs = {x: paddedX};
  const reshapeAttrs: ReshapeAttrs = {shape: reshapedPaddedShape};
  const paddedXReshaped = reshape({inputs: reshapeInputs, backend, attr: reshapeAttr})

  const transposeInputs: TransposeInputs = {x: paddedXReshaped};
  const transposeAttrs: TransposeAttrs = {perm: permutedReshapedPaddedPermutation};
  const paddedXT = transpose({inputs: transposeInputs, backend, attr: transposeAttrs});

  return resultReshapeInputs: ReshapeInputs = {x: paddedXT};
  const resultReshapeAttr: ReshapeAttr = {shape: flattenShape};
  const result = reshape({inputs: resultReshapeInputs, backend, attr: resultReshapeAttr})
}

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 */
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```javascript
import {KernelConfig, KernelFunc, SplitV, SplitVAttrs, SplitVInputs, util} from '@tensorflow/tfjs-core';
import {backend_util} from '@tensorflow/tfjs-backend-wasm';

import {BackendWasm} from '../backend_wasm';

import {Slice} from './Slice';

export function splitV(
    args: {inputs: SplitVInputs, attrs: SplitVAttrs, backend: BackendWasm}) {
  const {inputs, attrs, backend} = args;
  const {x} = inputs;
  const {numOrSizeSplits, axis} = attrs;

  const $axis = util.parseAxisParam(axis, x.shape)[0];

  const splitSizes = backend_util.prepareSplitSize(x, numOrSizeSplits, $axis);
  const begin = new Array(x.shape.length).fill(0);

  const size = x.shape.slice();
  return splitSizes.map(s => {
    const xSliceSize = [...size];
    xSliceSize[$axis] = s;
    const xSlice = Slice({inputs: {x}, attrs: {begin, size: xSliceSize}, backend});
    begin[$axis] += s;
    return xSlice;
  });
}

export const splitVConfig: KernelConfig = {
  kernelName: SplitV,
  backendName: 'wasm',
  kernelFunc: splitV as {} as KernelFunc
};
```

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```javascript
import {KernelConfig, KernelFunc, Step, StepAttrs, StepInputs, TensorInfo} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {CppDType} from './types';

let wasmStep:
    (xId: number, alpha: number, dtype: number, outId: number) =>
        void;

function setup(backend: BackendWasm): void {
  wasmStep = backend.wasm.cwrap(Step, null /*void*/, [
    'number',  // x_id
    'number',  // alpha
    'number',  // dtype
    'number',  // out_id
  ]);}

function step(
    args: {backend: BackendWasm, inputs: StepInputs, attrs: StepAttrs}){
  const {backend, inputs, attrs} = args;
  const {alpha} = attrs;
  const {x} = inputs;

  const xId = backend.dataIdMap.get(x.dataId).id;

  const out = backend.makeOutput(x.shape, x.dtype);
  const outId = backend.dataIdMap.get(out.dataId).id;
  wasmStep(xId, alpha, CppDType[x.dtype], outId);
  return out;
}

export const stepConfig: KernelConfig = {
  kernelName: Step,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: step as {} as KernelFunc
};
```

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```javascript
import {KernelConfig, Sqrt} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';
export const sqrtConfig: KernelConfig = createUnaryKernelConfig(Sqrt);
```

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```javascript
import {KernelConfig, Square} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';
export const squareConfig: KernelConfig = createUnaryKernelConfig(Square);
```

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============================================================================

*/

import {KernelConfig, SquaredDifference} from '@tensorflow/tfjs-core';
import {createBinaryKernelConfig} from './binary_kernel';

const supportsFullBroadcast = true;

export const squaredDifferenceConfig: KernelConfig =
    createBinaryKernelConfig(SquaredDifference, supportsFullBroadcast);

import {KernelConfig, KernelFunc, slice_util, StridedSlice, StridedSliceAttrs, StridedSliceInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';
import {reshape} from './Reshape';
import {slice} from './Slice';

let wasmStridedSlice: (
    xId: number, xStridesBytes: Uint8Array,
    xRank: number,
    beginBytes: Uint8Array, endBytes: Uint8Array, stridesBytes: Uint8Array,
    outShapeBytes: Uint8Array, outStridesBytes: Uint8Array,
    outShapeLength: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmStridedSlice = backend.wasm.cwrap(StridedSlice, null /*void*/, [
    'number',  // xId
    'array',   // xStrides
    'number',  // xRank
    'array',   // beginBytes
    'array',   // endBytes
    'array',   // stridesBytes
    'array',   // outShapeBytes
    'array',   // outStridesBytes
    'number',  // outShapeLength
    'number',  // number,
    'array',   // begin
    'array',   // end
    'array',   // strides
    'number',  // outId
    'number',  // outShapeLength
    'number',  // number,
    'array'  // array
  ]);
}

export function stridedSlice(args: {
  backend: BackendWasm,
  inputs: StridedSliceInputs,
  attrs: StridedSliceAttrs
}): TensorInfo {
  const {backend, inputs, attrs} = args;

  const {x} = inputs;

  const {
    begin,
    end,
    strides,
    beginMask,
    endMask,
    ellipsisMask,
    newAxisMask,
    shrinkAxisMask
  } = attrs;

  const {
    finalShapeSparse,
    finalShape,
    isIdentity,
    sliceDim0,
    isSimpleSlice,
    begin: $begin,
    end: $end,
    strides: $strides
  } =
      slice_util.sliceInfo(
          x.shape, begin, end, strides, beginMask, endMask, ellipsisMask,
          newAxisMask, shrinkAxisMask);

  let result;

  if (isIdentity) {
    // Optimization #1, slice is a no-op plus reshape
    result = reshape({inputs: {x}, backend, attrs: {shape: finalShape}});
  } else if (sliceDim0 || isSimpleSlice) {
    // Optimization #2, slice is memory contiguous (only occurs in dim 0)
    util.assert(
        x.shape.length >= 1,
        () => `Input must have rank at least 1, got: ${x.shape.length}`);

    const size = slice_util.computeOutShape($begin, $end, $strides);
    // To tolerate begin[0] > end[0] (a 0-output slice), we min(begin, end).
    const sliced = slice({inputs: {x}, backend, attrs: {begin: $begin, size}});
    result =
        reshape({inputs: {x: sliced}, backend, attrs: {shape: finalShape}});
    backend.disposeData(sliced.dataId);
  } else {
    const out =

    result = reshape({inputs: [x], backend, attrs: {shape: finalShape}});
    backend.disposeData(sliced.dataId);
  }

  return result;
}

export const stridedSliceConfig: KernelConfig = {
  kernelName: StridedSlice,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: stridedSlice as {} as KernelFunc
};

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import {backend_util, KernelConfig, KernelFunc, Sum, SumAttrs, SumInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {permuteAxesAndTranspose} from './kernel_utils';
import {CppDType} from './types';

let wasmSum: (xId: number, reduceSize: number, dtype: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmSum = backend.wasm.cwrap(Sum, null /*void*/, [
    'number',  // input_id
    'number',  // reduce_size
    'number',  // dtype
    'number',  // out_id
  ]);}

function sum(args: {backend: BackendWasm, inputs: SumInputs, attrs: SumAttrs}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {axis, keepDims} = attrs;
  const {x} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  let inputId = xId;
  let input = x;

  const {transposed, axes, originalAxes, inputWasTransposed} = permuteAxesAndTranspose(x, axis, backend);

  let reductionAxes = axes;
  if (inputWasTransposed) {
    const transposedId = backend.dataIdMap.get(transposed.dataId).id;
    if (transposedId !== xId) {
      // transpose was not a no-op. We will need to dispose of this input once we are done.
      input = transposed;
      inputId = transposedId;
      reductionAxes = backend_util.getInnerMostAxes(inputWasTransposed, input.shape.length);
    }
  }

  backend_util.assertAxesAreInnerMostDims('sum', reductionAxes, input.shape.length);
  const [outShape, reduceShape] = backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);
  const reduceSize = util.sizeFromShape(reduceShape);
  const outId = backend.dataIdMap.get(out.dataId).id;
  if (util.sizeFromShape(input.shape) !== 0) {
    const outId = backend.dataIdMap.get(out.dataId).id;
    wasmSum(inputId, reduceSize, CppDType[out.dtype], outId);
  }

  if (inputWasTransposed) {
    // dispose of the transposed tensor.
    backend.disposeData(transposed.dataId);
  }

  if (keepDims) {
    // reshape
    const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);
    out.shape = newShape;
  }

  return out;
}

export const sumConfig: KernelConfig = {
  kernelName: Sum,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: sum as {} as KernelFunc
};
number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmTile = backend.wasm.cwrap(Tile, null /* void */, [
    'number', // x_id
    'array', // x_shape
    'number', // x_shape.length
    'array', // new_shape
    'number', // number
    'out_id
  ]);  
  wasmTile = backend.wasm.cwrap(Tile, null /* void */, [                  
    'number', // x_id
    'array', // x_shape
    'number', // x_shape.length
    'array', // new_shape
    'number', // number
    'out_id
  ]);  
}

function tile(
    args: {inputs: TileInputs, backend: BackendWasm, attrs: TileAttrs}) {
  const {inputs, backend, attrs} = args;
  const x = inputs.x;
  const xId = backend.dataIdMap.get(x.dataId).id;
  const {reps} = attrs;

  const newShape: number[] = new Array(x.shape.length);
  for (let i = 0; i < x.shape.length; i++) {
    newShape[i] = x.shape[i] * reps[i];
  }
  const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);
  const newShapeBytes = new Uint8Array(new Int32Array(newShape).buffer);

  const out = backend.makeOutput(newShape, x.dtype);
  const outId = backend.dataIdMap.get(out.dataId).id;
  wasmTile(xId, xShapeBytes, x.shape.length, newShapeBytes, newShape.length,
    CppDType[out.dtype], outId);
  return out;
}

export const tileConfig: KernelConfig = {
  kernelName: Tile,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: tile as {} as KernelFunc
};

import {KernelConfig, Tan} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';
export const tanConfig: KernelConfig = createUnaryKernelConfig(Tan);

import {KernelConfig, Tanh} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';
export const tanhConfig: KernelConfig = createUnaryKernelConfig(Tanh);

import {KernelConfig, KernelFunc, TopK, TopKAttrs, TopKInputs} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';
import {CppDType} from './types';

let wasmTopK: (xId: number, xShapeBytes: Uint8Array, xShapeLength: number,
  xDtype: CppDType, k: number, sorted: boolean, outValuesId: number,
  outIndicesId: number) => void;  
function setup(backend: BackendWasm) {
  wasmTopK = backend.wasm.cwrap(TopK, null /* void */, [
    'number', // x_id
    'array', // x_shape
    'number', // x_shape.length
    'number', // k
    'bool', // sorted
    'number', // outValuesId
    'number', // outIndicesId
  ]);  
}

export const topk: (args: {inputs: TopKInputs, backend: BackendWasm,
  attrs: TopKAttrs}) => TensorInfo[] = ({inputs, backend, attrs}) => {
  const {x} = inputs;
  const {k, sorted} = attrs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);
  const outputShape = x.shape.slice();
  const outValues = backend.makeOutput(outputShape, x.dtype);
  return [];
const outValuesId = backend.dataIdMap.get(outValues.dataId).id;
const outIndicesId = backend.dataIdMap.get(outIndices.dataId).id;
const wasmTopK = xId, xShapeBytes, x.shape.length, CppDType[x.dtype], k, sorted;

outValuesId = backend.dataIdMap.get(outValues.dataId).id;
outIndicesId = backend.dataIdMap.get(outIndices.dataId).id;

wasmTopK(xId, xShapeBytes, x.shape.length, CppDType[x.dtype], k, sorted);

return [outValues, outIndices];

export const topKConfig: KernelConfig = {
  kernelName: TopK,
  backendName: 'wasm',
  setupFunc:
    setup,
  kernelFunc: topk as {} as KernelFunc
};

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 */

import {KernelConfig, KernelFunc, TensorInfo, Transform, TransformAttrs, TransformInputs, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmTransform: (imageId: number, transformsId: number, isBatchTransform: boolean, batch: number, outHeight: number, outWidth: number, numChannels: number, imageWidth: number, imageHeight: number, strides: Uint8Array, stridesLength: number, interpolationModelId: number, fillModelId: number, fillValue: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmTransform = backend.wasm.cwrap(Transform, null /*void*/, [
    'number',  // imageId
    'number',  // transformsId
    'bool',    // isBatchTransform
    'number',  // batch
    'number',  // outHeight
    'number',  // outWidth
    'number',  // numChannels
    'number',  // imageWidth
    'number',  // imageHeight
    'array',   // strides
    'number',  // stridesLength
    'number',  // interpolationModeId
    'number',  // fillModeId
    'number',  // fillValue
    'number'   // outId
  ]);}

function transform(inputs: TransformInputs, attrs: TransformAttrs): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {image, transforms} = inputs;
  const {interpolation, fillMode, fillValue, outputShape} = attrs;

  const [batch, imageHeight, imageWidth, numChannels] = image.shape;
  const [outHeight, outWidth] = outputShape != null ? outputShape : [imageHeight, imageWidth];
  const outShape = [batch, outHeight, outWidth, numChannels] as [number, number, number, number];
  const strides = new Uint8Array(new Int32Array(util.computeStrides(image.shape)).buffer);

  const out = backend.makeOutput(outShape, image.dtype);
  const outId = backend.dataIdMap.get(out.dataId).id;

  const imageData = backend.dataIdMap.get(image.dataId);
  const imageId = imageData.id;

  const transformsData = backend.dataIdMap.get(transforms.dataId);
  const transformsId = transformsData.id;

  const interpolationModelId = interpolation === 'nearest' ? 1 : 2;
  let fillModelId = fillMode == null ? 0 : fillModelId;
  let switchMode = fillModelId;

  switchMode = switchMode === 'nearest' ? 1 : 2;
  break case reflect:
    fillModelId = 2;
  break case wrap:
    fillModelId = 3;
  break case nearest:
    fillModelId = 4;
  break default:
    fillModelId = 1;
  break;
}

wasmTransform(imageId, transformsId, [transforms.shape.length > 1 ? 1 : 0], batch, outHeight, outWidth, numChannels, imageWidth, imageHeight, strides, image.shape.length - 1, interpolationModelId, fillModelId, fillValue, outId);

return out;

export const transformConfig: KernelConfig = {
  kernelName: Transform,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: transform as {} as KernelFunc
};

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 */

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import {KernelConfig, KernelFunc, TensorInfo, Unpack, UnpackAttrs, UnpackInputs} from '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';
import {slice} from './Slice';

function unpack(args: {inputs: UnpackInputs, backend: BackendWasm, attrs: UnpackAttrs}): TensorInfo[] {
  const {inputs, backend, attrs} = args;
  const {value} = inputs;
  let {axis} = attrs;

  if (axis < 0) {
    axis += value.shape.length;
  }

  const numOutputs = value.shape[axis];
  const rank = value.shape.length;
  const outShape: number[] = new Array(rank - 1);
  let outIndex = 0;
  for (let i = 0; i < rank; i++) {
    if (i === axis) {
      outShape[outIndex++] = value.shape[i];
    }
  }

  const outs: TensorInfo[] = new Array(numOutputs);
  const begin = new Array(rank).fill(0);
  const size = value.shape.slice();
  size[axis] = 1;
  for (let i = 0; i < outs.length; i++) {
    begin[axis] = i;
    outs[i] = slice({inputs: {x: value}, attrs: {begin, size}, backend});
  }
  return outs.map(({dataId, dtype}) => ({dataId, dtype, shape: outShape}));
}

export const unpackConfig: KernelConfig = {
  kernelName: Unpack,
  backendName: 'wasm',
  kernelFunc: unpack as {} as KernelFunc,
};
'./kernels/Multiply';
import {negConfig} from './kernels/Neg';
import {nonMaxSuppressionV3Config} from './kernels/NonMaxSuppressionV3';
import {nonMaxSuppressionV4Config} from './kernels/NonMaxSuppressionV4';
import {nonMaxSuppressionV5Config} from './kernels/NonMaxSuppressionV5';
import {notEqualConfig} from './kernels/NotEqual';
import {oneHotConfig} from './kernels/OneHot';
import {onesLikeConfig} from './kernels/OnesLike';
import {packConfig} from './kernels/Pack';
import {padV2Config} from './kernels/PadV2';
import {powConfig} from './kernels/Pow';
import {preluConfig} from './kernels/Prelu';
import {prodConfig} from './kernels/Prod';
import {rangeConfig} from './kernels/Range';
import {realDivConfig} from './kernels/RealDiv';
import {reluConfig} from './kernels/Relu';
import {relu6Config} from './kernels/Relu6';
import {reshapeConfig} from './kernels/Reshape';
import {resizeBilinearConfig} from './kernels/ResizeBilinear';
import {reverseConfig} from './kernels/Reverse';
import {rotateWithOffsetConfig} from './kernels/RotateWithOffset';
import {roundConfig} from './kernels/Round';
import {rsqrtConfig} from './kernels/Rsqrt';
import {scatterNdConfig} from './kernels/ScatterNd';
import {selectConfig} from './kernels/Select';
import {sigmoidConfig} from './kernels/Sigmoid';
import {sinConfig} from './kernels/Sin';
import {sliceConfig} from './kernels/Slice';
import {softmaxConfig} from './kernels/Softmax';
import {spaceToBatchNDConfig} from './kernels/SpaceToBatchND';
import {splitVConfig} from './kernels/SplitV';
import {sqrtConfig} from './kernels/Sqrt';
import {squareConfig} from './kernels/Square';
import {squareDifferenceConfig} from './kernels/SquareDifference';
import {stepConfig} from './kernels/Step';
import {stridedSliceConfig} from './kernels/StridedSlice';
import {subConfig} from './kernels/Sub';
import {sumConfig} from './kernels/Sum';
import {tanConfig} from './kernels/Tan';
import {tileConfig} from './kernels/Tile';
import {topKConfig} from './kernels/TopK';
import {transformConfig} from './kernels/Transform';
import {transposeConfig} from './kernels/Transpose';
import {unpackConfig} from './kernels/Unpack';
import {zerosLikeConfig} from './kernels/ZerosLike';

// List all kernel configs here
const kernelConfigs: KernelConfig[] = [
  absConfig,
  addConfig,
  addNConfig,
  allConfig,
  anyConfig,
  argMaxConfig,
  avgPoolConfig,
  batchMatMulConfig,
  batchToSpaceNDConfig,
  castConfig,
  ceilConfig,
  clipByValueConfig,
  concatConfig,
  conv2DConfig,
  conv2DBackpropInputConfig,
  cosConfig,
  coshConfig,
  cropAndResizeConfig,
  cumsumConfig,
  depthToSpaceConfig,
  depthwiseConv2DNativeConfig,
  eluConfig,
  equalConfig,
  expConfig,
  expandDimsConfig,
  fillConfig,
  flipLeftRightConfig,
  floorConfig,
  floorDivConfig,
  fusedMatMulConfig,
  fusedBatchNormConfig,
  fusedConv2DConfig,
  fusedDepthwiseConv2DConfig,
  gatherNdConfig,
  gatherV2Config,
  greaterEqualConfig,
  greaterConfig,
  identityConfig,
  leakyReluConfig,
  lessConfig,
  lessEqualConfig,
  logConfig,
  logicalAndConfig,
  maxConfig,
  maximumConfig,
  maxPoolConfig,
  meanConfig,
  minConfig,
  minimumConfig,
  mirrorPadConfig,
  multiplyConfig,
  negConfig,
  nonMaxSuppressionV3Config,
  nonMaxSuppressionV4Config,
  nonMaxSuppressionV5Config,
  notEqualConfig,
  oneHotConfig,
  onesLikeConfig,
  packConfig,
  padV2Config,
  powConfig,
  preluConfig,
  prodConfig,
  rangeConfig,
  realDivConfig,
  reluConfig,
  relu6Config,
  reshapeConfig,
  resizeBilinearConfig,
  reverseConfig,
  rotateWithOffsetConfig,
  rsqrtConfig,
  roundConfig,
  scatterNdConfig,
  selectConfig,
  sigmoidConfig,
  sinConfig,
  sliceConfig,
  softmaxConfig,
  spaceToBatchNDConfig,
  splitVConfig,
  sqrtConfig,
  squareConfig,
  squareDifferenceConfig,
  stepConfig,
  stridedSliceConfig,
  subConfig,
  sumConfig,
  tanConfig,
  tanhConfig,
  tileConfig,
  topKConfig,
  transformConfig,
  transposeConfig,
  unpackConfig,
  zerosLikeConfig];

for (const kernelConfig of kernelConfigs) {
  registerKernel(kernelConfig);
}

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 */
import {KernelConfig, KernelFunc, ZerosLike, ZerosLikeInputs} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

function zerosLike(args: {inputs: ZerosLikeInputs, backend: BackendWasm}) {
  const {inputs: {x}, backend} = args;
  const out = backend.makeOutput(x.shape, x.dtype);
  const outVals = backend.typedArrayFromHeap(out);
  outVals.fill(0);
  return out;
}

export const zerosLikeConfig: KernelConfig = {
  kernelName: ZerosLike,
  backendName: 'wasm',
  kernelFunc: zerosLike
};
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-threadedsimd.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:\"sameorigin\"}).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(\"wasminstantiate\")})})}}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:\"sameorigin\"}).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
BADF:8,ECHILD:12,EAGAIN:6,EWOULDBLOCK:6,ENOMEM:48,EACCES:2,EFAULT:21,ENOTBLK:105,EB

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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_is(index,serializedNumCallArgs,argv.sync);stackRestore(stack);return ret var _emscripten_receive_on_main_thread_is_callArgs=[];var readAsmConstArgsArray=[];function readAsmConstArgs(sigPtr,buf){readAsmConstArgsArray.length=0;var ch,buf>>=2;while(ch<105){if(double & buf){buf++;}readAsmConstArgsArray.push(double);GROWABLE_HEAP_F64()[buf++] = double;GROWABLE_HEAP_I32()[buf++] = double;return readAsmConstArgsArray}function _emscripten_receive_on_main_thread_js(index,serializedNumCallArgs,argv)_emscripten_receive_on_main_thread_is_callArgs=[];var b=args>>3;for(var i=0;i<numCallArgs;i++) _emscripten_receive_on_main_thread_is_callArgs[i]=GROWABLE_HEAP_F64()[b+i] var isEmAsmConst=index<0;var func=isEmAsmConst?proxiedFunctionTable[index]:ASM_CONSTS[index-1];func.apply(null,_emscripten_receiver_on_main_thread_is_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){JSEvents.deferredCalls[i].targetFunction.apply(null,JSEvents.deferredCalls[i].argsList)}},eventHandlers:[],removeAllHandlersOnTarget:function(target,eventTypeString){for(var i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==target&&eventTypeString==JSEvents.eventHandlers[i].eventTypeString){JSEvents._removeHandler(i--)}}},removeAllEventListeners:function(){for(var i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==null){JSEvents.eventHandlers.splice(i,1)}}} for(var i=0;i<JSEvents.eventHandlers.length;++i){JSEvents.eventHandlers[i].handleEvent(JSEvents.eventHandlers[i].eventTypeString)}},runDeferredCalls:function(){if(!JSEvents.canPerformEventHandlerRequests()){return}for(var i=0;i<JSEvents.deferredCalls.length;++i){JSEvents.deferredCalls[i].targetFunction.apply(null,JSEvents.deferredCalls[i].argsList)}}}
errCalls();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--
)}}} },queueEventEventHandlerOnThread_iii: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

fullscreenEnabled:function(){return
document.fullscreenEnabled?document.webkitFullscreenEnabled} });function stringToNewUTF8(jsString){var
length=lengthBytesUTF8(jsString)+1;var cString=_malloc(length);stringToUTF8(jsString,cString,length);return

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
_emsccripten_set_offscreencanvas_size_on_target_thread(function(targetCanv
as,width,height){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
_emsccripten_set_offscreencanvas_size_on_target_thread(targetCanvas,width,height){targetCanvas=targetCanv 
as?UTF8ToString(targetCanvas):"";_emsccripten_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
_emsccripten_set_canvas_element_size_calling_thread(target,width,height){var
canvas=canvasEventTarget(target);if(!(canvas)return-
4;if(canvas.canvasSharedPtr)GROWABLE_HEAP_I32(canvas.canvasSharedPtr+2]=width;GROWABLE_HEAP 
I32(canvas.canvasSharedPtr+4]=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 
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]=width;GROWABLE_HEAP 
I32(canvas.canvasSharedPtr+12]=height;if(canvas.isProxy)targetThread=canvasProxyToMainThread(target,width,height);retu
rn 1} else{return 0} function
_emsccripten_set_canvas_element_size_main_thread(target,width,height){if(ENVIRONMENT_IS_PTHREAD)return

r_emsccripten_proxy_to_main_thread_js(2,1,target,width,height);return
tis=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),threadInfoStruct);Atomsics.store(GROWABLE_HEAP_U32(),tis+(80>>2),threadParams.stackSize);Atomsics.store(GROWABLE_HEAP_U32(),tis+(76>>2),stackHigh);Atomsics.store(GROWABLE_HEAP_U32(),tis+(104>>2),threadParams.stackSize);Atomsics.store(GROWABLE_HEAP_U32(),tis+(104+8>>2),stackHigh);Atomsics.store(GROWABLE_HEAP_U32(),tis+(104+12>>2),threadParams.detached);var
global_libc=_emscripten_get_global_libc();var
global_locale=global_libc+40;Atomsics.store(GROWABLE_HEAP_U32(),tis+(172>>2),global_locale);worker.pthread=pthread;var

function __pthread_create(pthread_ptr,attr,start_routine,arg){if(typeof SharedArrayBuffer==="undefined"){err("Current environment does not support SharedArrayBuffer, pthreads are not available\n");return 6}if(!pthread_ptr){err("pthread_create called with a null thread pointer!\n");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]===0?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,stackHigh:stackHigh};threadInfoStruct=threadInfoStruct;attr=start_routine,pthread_ptr:threadParams.pthread_ptr,transferList:transferList};if(ENVIRONMENT_IS_PTHREAD){threadParams.cmd="spawnThread";postMessage(threadParams,transferList)}else{spawnThread(threadParams)}return 0}

function __emscripten_do_pthread_join(thread,status,block){if(!ENVIRONMENT_IS_PTHREAD)return;var
self=pthread_self();if(!tb)return;var
cancelDenied=Atomsics.load(GROWABLE_HEAP_U32(),tb+56>>2);if(cancelDenied)return;var
canceled=Atomsics.load(GROWABLE_HEAP_U32(),tb+0>>2);if(canceled==2)throw\"Cancled\";function
_emsicpten_check_blocking_allowed(){if(ENVIRONMENT_IS_NODE)return;if(ENVIRONMENT_IS_WORKER)return;warnOnce("\"Blocking on the main thread is very dangerous, see
https://emsicpten.org/docs/porting/pthreads.html#blocking-on-the-main-browser-thread\"\);function
_emsicpten_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&;&_emsicpten_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
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WasmBackendModuleThreadedSimd;
nvar WasmBackendModule = (function() {
  if (typeof __filename !== 'undefined') __scriptDir = __scriptDir || __filename;
  return (isFunction(WasmBackendModule)) {
    WasmBackendModule = WasmBackendModule || {};
  };
  var Module = typeof WasmBackendModule !== 'undefined' ? WasmBackendModule : {};
  var readyPromiseResolve, readyPromiseReject; Module['ready'] = new Promise(function(resolve, reject) { readyPromiseResolve = resolve; readyPromiseReject = reject });

  moduleOverrides = {};
  var key;

  for (key in Module) {
    if (Module.hasOwnProperty(key)) {
      moduleOverrides[key] = Module[key];
    }
  }

  var arguments_ = [];
  var thisProgram = process.argv[1].replace(/\:\\/g, '/')

  var read_, readAsync, readBinary, setWindowTitle;

  if (ENVIRONMENT_IS_NODE) {
    read_ = function stream_read(filename, binary) {
      if (!nodeFS) nodeFS = require('fs');
      if (!nodePath) nodePath = require('path');
      return !binary ? nodeFS.readFileSync(filename) : new Uint8Array(nodeFS.readFileSync(filename, 'binary'))
    }

    readBinary = function readBinary(filename) {
      return read_(filename, true)
    }

    if (process.argv.length > 1) {
      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)
    }
  }

  if (ENVIRONMENT_IS_WEB || ENVIRONMENT_IS_WORKER) {
    read_ = function stream_read(url) {
      var xhr = new XMLHttpRequest;
      xhr.open('GET', url, true);
      xhr.send(null);
      return xhr.responseText
    }

    readBinary = function readBinary(url) {
      return read_(url, true)
    }

    readAsync = function readAsync(url, onload, onerror) {
      var xhr = new XMLHttpRequest;
      xhr.open('GET', url, true);
      xhr.responseType = 'arraybuffer';
      xhr.onload = function() {
        onload(xhr.response)
      }
      xhr.onerror = function() {
        onerror()
      }
      xhr.send(null)
    }
  }

  return Module
})()

WasmBackendModuleThreadedSimd;

WasmBackendModuleThreadedSimd;

WasmBackendModuleThreadedSimd;

WasmBackendModuleThreadedSimd;

WasmBackendModuleThreadedSimd;
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 __ATMAIN__ = [];

var __ATPOSTRUN__ = [];
var runtimeInitialized = false; __ATINIT__.push(function () {});

function preRun() { if (Module[" preRun"].length) { addOnPreRun(Module[" preRun"].shift()); } callRuntimeCallbacks(__ATPRERUN__); }

function initRuntime() { runtimeInitialized = true; callRuntimeCallbacks(__ATINIT__); }

preMain() { callRuntimeCallbacks(__ATMAIN__); }

function postRun() { if (Module[" postRun"].length) { addOnPostRun(Module[" postRun"].shift()); } callRuntimeCallbacks(__ATPOSTRUN__); }

addOnPreRun(cb) { __ATPRERUN__.unshift(cb); }

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(); } }

var callbacks = dependenciesFulfilled; dependenciesFulfilled = null; callback(); }

Module[" preloadedImages"].length = 0; Module[" preloadedAudios"].length = 0;

function abort(what) { if (Module[" onAbort"].length) { addOnAbort(Module[" onAbort"].shift()); } callRuntimeCallbacks(__ATPRERUN__); }

var wasmBinaryFile = "tfjs-backend-wasm.wasm";

if (!isDataURI(wasmBinaryFile)) { wasmBinaryFile = locateFile(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) { return receiveInstance(output["instance"]) }

function instantiateArrayBuffer(receiver) { return getBinaryPromise().then(function(binary) { return WebAssembly.instantiate(binary, info) });

function instantiateAsync() {
  if (!wasmBinary && typeof WebAssembly.instantiateStreaming == "function" && !isDataURI(wasmBinaryFile) && !isFileURI(wasmBinaryFile) && typeof fetch == "function") {
    return fetch(wasmBinaryFile, { credentials: "same-origin" }).then(function(response) {
      return WebAssembly.instantiateStreaming(response, info);
    }).then(receiver, function(reason) {
      err("failed to asynchronously prepare wasm: \"+reason+\"; abort(reason)");
    });
  } 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+\"; abort(reason)\n    abort(reason)");
  } else {
    return instantiateArrayBuffer(receiveInstantiatedSource());
  }

  if (typeof callRuntimeCallbacks == "function") {
    callRuntimeCallbacks(callbacks);
  }

  if (typeof _abort == "function") {
    _abort();
  }

  if (typeof _emscripten_memcpy_big == "function") {
    _emscripten_memcpy_big(dest, src, num);
  }

  if (typeof _emscripten_get_heap_size == "function") {
    return _emscripten_get_heap_size();
  }

  if (typeof _emscripten_resize_heap == "function") {
    return _emscripten_resize_heap(requestedSize);
  }

  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));
    } else {
      buffer.push(curr);
    }
  }, varargs: undefined, get: function() {
    var oldSize = _emscripten_get_heap_size();
    var maxHeapSize = 2147483648;
    if (requestedSize > maxHeapSize) {
      return false;
    }
    var cutDown = 1;
    while (cutDown.length > 0) {
      var callback = callbacks.shift();
      if (callback === undefined) {
        callback();
        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);
      }
    }
  }, fd_close: function(fd) {
    return 0;
  }, fd_seek: function(fd, offset_low, offset_high, whence, newOffset) {
    var ptr = HEAP32[fd + i + 4] + 4;
    return 0;
  }, setErrNo: function(value) {
    return value;
  }, setenv: function(name, value) {
    switch (name) {
      case "SDL_FBVEN" | _sysconf(name).switch(name)) {
        case 30: return 16384;
        case 85: var maxHeapSize = 2147483648;
        return maxHeapSize;
        case 80: case 81: case 79: return 12684;
        case 37: return 2048;
        case 0: return 2097152;
        case 3: return 65536;
        case 28: return 32768;
        case 44: return 32767;
        case 75: return 32767;
        case 38: return 36;
        case 39: return 28;
        case 34: return 7;
        case 35: return 67;
        case 36: return 72;
        case 37: return 47839;
        case 38: return 36;
        case 39: return 99;
        case 80: case 81: case 79: return 12684;
        case 37: return 2048;
        case 0: return 2097152;
        case 3: return 65536;
        case 28: return 32768;
        case 44: return 32767;
        case 75: return 32767;
      } else {
        return 0;
      }
    }
  },
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 6: return 6; case 73: return 4; case 84: if (typeof
navigator == "object") return navigator["hardwareConcurrency"] || 1; } setErrNo(28); return -1; 
var asmLibraryArg={"a":_abort,"d":_emscripten_memcpy_big,"e":_emscripten_resize_heap,"f":_f
d_seek,"b":_fd_write,"h":_pthread_create,"g":_pthread_join,"i":_sysconf}; var asm = createWasm();

___wasm_call_ctors=Module["___wasm_call_ctors"]=function(){return(___wasm_call_ctors=Module["___wasm
call_ctors"]= Module["asm"]['kl']).apply(null,arguments)};
var _init=Module["_init"]=function(){return(_init=Module["_init"]=Module["asm"]['lv']).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"]['mt']).apply(null,arguments)};

var _get_threads_count=Module["_get_threads_count"]=function(){return(_get_threads_count=Module["_get_threads
count"]=Module["asm"]['nt']).apply(null,arguments)};

var _register_tensor=Module["_register_tensor"]=function(){return(_register_tensor=Module["_register_tensor"]= Module["asm"]['v']).apply(null,arguments)};

var _dispose_data=Module["_dispose_data"]=function(){return(_dispose_data=Module["_dispose_data"]=Module["asm"]['vp']).apply(null,arguments)};

var _dispose=Module["_dispose"]=function(){return(_dispose=Module["_dispose"]=Module["asm"]['vq']).apply(null,arguments)};

var _Abs=Module["_Abs"]=function(){return(_Abs=Module["_Abs"]=Module["asm"]['vs']).apply(null,arguments)};

var _Add=Module["_Add"]=function(){return(_Add=Module["_Add"]=Module["asm"]['vt']).apply(null,arguments)};

var _AddN=Module["_AddN"]=function(){return(_AddN=Module["_AddN"]=Module["asm"]['vu']).apply(null,arguments)};

var _All=Module["_All"]=function(){return(_All=Module["_All"]=Module["asm"]['vv']).apply(null,arguments)};

var _Any=Module["_Any"]=function(){return(_Any=Module["_Any"]=Module["asm"]['vw']).apply(null,arguments)};

var _ArgMax=Module["_ArgMax"]=function(){return(_ArgMax=Module["_ArgMax"]=Module["asm"]['vx']).apply(null,arguments)};

var _AvgPool=Module["_AvgPool"]=function(){return(_AvgPool=Module["_AvgPool"]=Module["asm"]['vy']).apply(null,arguments)};

var _BatchMatMul=Module["_BatchMatMul"]=function(){return(_BatchMatMul=Module["_BatchMatMul"]= Module["asm"]['vz']).apply(null,arguments)};

var _Ceil=Module["_Ceil"]=function(){return(_Ceil=Module["_Ceil"]=Module["asm"]['va']).apply(null,arguments)};

var _ClipByValue=Module["_ClipByValue"]=function(){return(_ClipByValue=Module["_ClipByValue"]=Module["asm"]['vb']).apply(null,arguments)};

var _Conv2D=Module["_Conv2D"]=function(){return(_Conv2D=Module["_Conv2D"]=Module["asm"]['vc']).apply(null,arguments)};

var _Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=function(){return(_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]= Module["asm"]['vd']).apply(null,arguments)};

var _Cos=Module["_Cos"]=function(){return(_Cos=Module["_Cos"]=Module["asm"]['ve']).apply(null,arguments)};

var _Cosh=Module["_Cosh"]=function(){return(_Cosh=Module["_Cosh"]=Module["asm"]['vf']).apply(null,arguments)};

var _CropAndResize=Module["_CropAndResize"]=function(){return(_CropAndResize=Module["_CropAndResize"]}
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```javascript
// Example JavaScript code

// Function definitions and usage

// Example usage of imported functions

// Import statements

// Class definitions

// Constructor for BackendWasm

// Method for writing values

// Method for reading values

// Additional comments and metadata

// License information

// Import statements

// Class definitions

// Constructor for BackendWasm

// Method for writing values

// Method for reading values

// Additional comments and metadata

// License information
```

---

*License information*
this.readSync(dataId); \n } \n readSync(dataId: DataId): backend_util.BackendValues { \n   const {memoryOffset, dtype, shape, stringBytes} = this.dataIdMap.get(dataId); \n   if (dtype === 'string') { \n     return stringBytes; \n   } \n   const bytes = this.wasm.HEAPU8.slice(memoryOffset, memoryOffset + util.sizeFromShape(shape) * util.bytesPerElement(dtype)); \n   return typedArrayFromBuffer(bytes.buffer, dtype); \n } \n readSync(dataId: DataId): backend_util.BackendValues { \n   const {memoryOffset, memoryOffset + util.sizeFromShape(shape) * util.bytesPerElement(dtype)} = this.dataIdMap.get(dataId); \n   return typedArrayFromBuffer(bytes.buffer, dtype); \n } \n
readSync(dataId: DataId): backend_util.BackendValues { \n   const {memoryOffset, memoryOffset + util.sizeFromShape(shape) * util.bytesPerElement(dtype)} = this.dataIdMap.get(dataId); \n   return typedArrayFromBuffer(bytes.buffer, dtype); \n } \n
readSync(dataId: DataId): backend_util.BackendValues { \n   const {memoryOffset, memoryOffset + util.sizeFromShape(shape) * util.bytesPerElement(dtype)} = this.dataIdMap.get(dataId); \n   return typedArrayFromBuffer(bytes.buffer, dtype); \n } \n
/* */ * Dispose the memory if the dataId has 0 refCount. Return true if the memory is released, false otherwise. */ * @param dataIdDataId * @oaram force Optional, remove the data regardless of refCount */ *an disposeData(dataId: DataId: DataId: DataId) { \n   return true; \n } \n /** Return refCount of a `TensorData`. */ *an refCount(dataId: DataId: DataId) { \n   return 0; \n } \n incRef(dataId: DataId: DataId) { \n   if (!this.dataIdMap.has(dataId)) { \n     return false; \n   } \n   const data = this.dataIdMap.get(dataId); \n   data.refCount--; \n   if (data.refCount == 0) { \n     this.wasm._free(data.memoryOffset); \n     this.wasm.tfjs.disposeData(data.id); \n     this.dataIdMap.delete(dataId); \n   } \n   return true; \n } \n // Returns the memory offset of a tensor. Useful for debugging and unit testing. */ getMemoryOffset(dataId: DataId: DataId) { \n   return this.dataIdMap.get(dataId).memoryOffset; \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   memory(); \n } \n /* */ * Make a tensor info for the output of an op. If `memoryOffset` is not present, this method allocates memory on the WASM heap. If `memoryOffset` is present, the memory was allocated elsewhere (in c++) and we just record the pointer where that memory lives. * / * makeOutput: {shape: number[], dtype: DataType, memoryOffset?: number} */ TensorInfo { \n   let dataId: 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   } \n   const size = util.sizeFromShape(shape); \n   this.wasm.tfjs.registerTensor(id, size, memoryOffset); \n   return {dataId, shape, dtype: {shape, dtype, memoryOffset}}; \n } \n typedArrayFromHeap({shape, dtype, dataId}: TensorInfo) { \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   } \n   throw new Error(`Unknown dtype ${dtype}`); \n } \n createInstantiateWasmFunc(path: string) { \n   // this will be replace by rollup plugin patchWechatWebAssembly in npm // minprogram's output. \n   // tslint:disable-next-line:no-any \n   return { \n     util.fetch(path, {credentials: 'same-origin'}).then(response) => { \n       if (response['ok']) { \n         imports.env.a(`failed to load wasm binary file at '${path}'`); \n       } \n       response.arrayBuffer().then(binary => { \n         WebAssembly.instantiate(binary, {output: {}}).then(output => { \n           return { \n             buffer: this.wasm.HeapU8.buffer, \n           }; \n         }); \n       }); \n     }; \n   } \n } \n getPathToWasmBinary(simdSupported: boolean, threadsSupported: boolean, wasmModuleFolder: string) { \n   if (wasmPath != null) { \n     return wasmPath; \n   } \n   let path = `tfjs-backend-wasm.wasm`; \n   if (simdSupported && threadsSupported) { \n     path = `tfjs-backend-wasm-threaded-simd.wasm`; \n   } \n   if (wasmModuleFolder != null) { \n     path = `tfjs-backend-wasm-${wasmModuleFolder}.wasm`; \n   } \n   return path; \n } \n init(): Promise<BackendWasmModule> { \n   if (wasmPath != null) { \n     return Promise.resolve(new BackendWasmModule()); \n   } \n   const simdSupported = env().getAsync('WASM_HAS_SIMD_SUPPORT'); \n   return Promise.resolve(new BackendWasmModule());
env(),

    * @param path The path to the file that needs to be loaded.
    * @param

    return URL.createObjectURL(blob);
  }

  return new Promise((resolve, reject) => {
    const factoryConfig: WasmFactoryConfig = {};

    /**
     * This function overrides the Emscripten
     * module locateFile utility.
     * @param path The path to the main JavaScript file's directory.
     * @param prefix The path to the main JavaScript file's directory.
     */
    factoryConfig.locateFile = (path, prefix) => {
      if (path.endsWith('.wasm')) {
        const response = wasmWorkerContents;
        const blob = new Blob([response], {type: 'application/javascript'});
        return URL.createObjectURL(blob);
      }

      if (path.endsWith('.wasm')) {
        return getPathToWasmBinary(
            simdSupported as boolean, threadsSupported as boolean, wasmPathPrefix != null ? wasmPathPrefix : prefix);
      }
      return prefix + path;
  }

  // Use the instantiateWasm override when system fetch is not available.
  // Reference:
  // https://github.com/emscripten-core/emscripten/blob/2bca083cbdd5a4133db611bd74d04f7feeeafa907/tests/manual_wasm_instantiate.html
  return instantiateWasm =

  // The WASM module has been successfully
  // created by the factory.
  // Any error will be caught by the onAbort callback defined above.
  wasm.then((module) => {
    initialized = true;
    initAborted = false;
    const voidReturnType: string = null;
    module.tfjs = {
      init: module.cwrap('init', null, ['number']),
      initWithThreadsCount: module.cwrap('init_with_threads_count', null, ['number']),
      getThreadsCount: module.cwrap('get_threads_count', 'number', []),
      registerTensor: module.cwrap('register_tensor', null, ['number', 'number', 'number']),
      disposeData: module.cwrap('dispose_data', voidReturnType, ['number', 'number']),
      dispose: module.cwrap('dispose', voidReturnType, []),
    };

    resolve({wasm: module});
  });
}

function typedArrayFromBuffer(
    buffer: ArrayBuffer, dtype: DataType):

  switch (dtype) {
    case 'float32':
      return new Float32Array(buffer);
    case '

    throw new Error(`Unknown dtype ${dtype}`);
  }

  return new URL.createObjectURL(blob);
});

const wasmBinaryNames = [
  'tfjs-backend-wasm.wasm', 'tfjs-backend-wasm-simd.wasm',
  'tfjs-backend-wasm-threaded-simd.wasm'
] as const;

let wasmPath: string = null;
let wasmPathPrefix: string = null;
let wasmFileMap: {
  wasmPath: string } = {};

/**
 * @deprecated Use `setWasmPaths` instead.
 * Sets the path to the `.wasm` file
 * which will be fetched when the wasm
 * module 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

    throw new Error('The WASM backend was already initialized. Make sure you call +
}
"setWasmPath()" before you call `tf.setBackend()` or `tf.ready()`;

```javascript
if (initAborted) {
  throw new Error(
    'The WASM backend was already initialized. Make sure you call ' +
    `setWasmPaths()` before you call `tf.setBackend()` or ' +
    '`tf.ready()`');
}

if (typeof prefixOrFileMap === 'string') {
  wasmPathPrefix = prefixOrFileMap;
} else {
  wasmFileMap = prefixOrFileMap;
  const missingPaths =
    wasmBinaryNames.filter(name => wasmFileMap[name] == null);
  if (missingPaths.length > 0) {
    throw new Error(
      'There were no entries found for the following binaries: ` +
      `{missingPaths}. Please either call setWasmPaths with a ` +
      `map providing a path for each binary, or with a string indicating ` +
      `the directory where all the binaries can be found:` +
    });
  }

  customFetch = usePlatformFetch;
```

Used in unit tests.

```javascript
export function resetWasmPath(): void {
  wasmPath = null;
  wasmPathPrefix = null;
  wasmFileMap = {};
  customFetch = false;
  initAborted = false;
}:

let threadsCount = -1;
let actualThreadsCount = -1;

/**
 * Sets the number of threads that will be used by XNNPACK to create a threadpool (default to the number of logical CPU cores).
 */
export function setThreadsCount(numThreads: number) {
  threadsCount = numThreads;
}

/**
 * Gets the actual threads count that is used by XNNPACK.
 */
export function getThreadsCount(): number {
  if (actualThreadsCount === -1) {
    throw new Error(`WASM backend not initialized.`);
  }
  return actualThreadsCount;
}`
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Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/setup_test.js.map
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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/Sigmoid_test.cc
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/Exp.cc
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/CropAndResize.cc
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/leakyrelu_impl.h
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/check_macros.h
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/transpose_impl.h
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/LogicalAnd.cc
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/MaxPool.cc
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/MaxPool_test.cc
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/Tanh.cc
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/Pow.cc
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 * software distributed under the License is distributed on an "AS IS" BASIS,
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 * limitations under the License.
 *
 ***/

import {KernelConfig, KernelFunc, ZerosLike, ZerosLikeInputs} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

function zerosLike(args: {inputs: ZerosLikeInputs, backend: BackendWasm}) {
  const {inputs: {x}, backend} = args;
  const out = backend.makeOutput(x.shape, x.dtype);
```

---

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---

*/
```
import {KernelConfig, KernelFunc, Step, StepAttrs, StepInputs, TensorInfo} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {CppDType} from './types';

let wasmStep: (xId: number, alpha: number, dtype: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmStep = backend.wasm.cwrap(Step, null /*void*/, 
    'number',  // x_id
    'number',  // alpha
    'number',  // dtype
    'number',  // out_id
  );
}

function step(args: {backend: BackendWasm, inputs: StepInputs, attrs: StepAttrs}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {alpha} = attrs;
  const {x} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;

  const out = backend.makeOutput(x.shape, x.dtype);
  const outId = backend.dataIdMap.get(out.dataId).id;
  wasmStep(xId, alpha, CppDType[x.dtype], outId);
  return out;
}

export const stepConfig: KernelConfig = {
  kernelName: Step,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: step as {} as KernelFunc
};

const outVals = backend.typedArrayFromHeap(out);
outVals.fill(0);
return out;


export const zerosLikeConfig: KernelConfig = {
  kernelName: ZerosLike,
  backendName: 'wasm',
  kernelFunc: zerosLike as {} as KernelFunc
};
import {KernelConfig, KernelFunc, Softmax, SoftmaxAttrs, SoftmaxInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmFunc: (xId: number, outId: number, channels: number, batch: number) => void;

function setup(backend: BackendWasm): void {
  wasmFunc = backend.wasm.cwrap(Softmax, null /* void */, ['number',  // xId
    'number',  // outId
    'number',  // channels
    'number'   // batch
  ]);
}

function softmax(args: {backend: BackendWasm, inputs: SoftmaxInputs, attrs: SoftmaxAttrs}): TensorInfo {
  const {backend, inputs: {logits}, attrs: {dim}} = args;
  const xId = backend.dataIdMap.get(logits.dataId).id;
  const out = backend.makeOutput(logits.shape, logits.dtype);
  const outId = backend.dataIdMap.get(out.dataId).id;

  const channels = logits.shape[dim];
  const batch = util.sizeFromShape(logits.shape) / channels;

  // Short-circuit zero-sized tensors.
  if (util.sizeFromShape(out.shape) === 0) {
    return out;
  }

  wasmFunc(xId, outId, channels, batch);
  return out;
}

export const softmaxConfig: KernelConfig = {
  kernelName: Softmax,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: softmax as {} as KernelFunc
};

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Softmax.js.map
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// This enum must align with the enum defined in cc/backend.h.
export enum CppDType {
  float32 = 0,
  int32 = 1,
  bool = 2,
  string = 3,
  complex64 = 4
}

// Must match enum in cc/fusable_activations.h.
export enum FusableActivation {
  linear = 0,
  relu = 1,
  relu6 = 2,
  prelu = 3,
  leakyrelu = 4
}
function fusedBatchMatMul(args: {
  inputs: _FusedMatMulInputs,
  backend: BackendWasm,
  attrs: _FusedMatMulAttrs
}) {
  const {inputs, backend, attrs} = args;
  const {a, b, bias, preluActivationWeights} = inputs;

  if (a.dtype !== 'float32' || b.dtype !== 'float32') {
    throw new Error(
        `_FusedMatMul for non non-float32 tensors not yet supported.`);
  }

  const {transposeA, transposeB, activation, leakyreluAlpha} = attrs;
  const aId = backend.dataIdMap.get(a.dataId).id;
  const bId = backend.dataIdMap.get(b.dataId).id;

  let biasId = 0;
  if (bias != null) {
    const biasData = backend.dataIdMap.get(bias.dataId);
    if (biasData.shape.length !== 1) {
      throw new Error(
          `_FusedMatMul only supports rank-1 bias but got ` +
          `rank ${biasData.shape.length}.`);
    }
    biasId = biasData.id;
  }
  const preluActivationWeightsId = preluActivationWeights == null ?
      0 :
      backend.dataIdMap.get(preluActivationWeights.dataId).id;
  const fusedActivation =
      FusableActivation[activation as {} as keyof typeof FusableActivation];
  if (fusedActivation == null) {
    throw new Error(
        `${activation} activation not yet supported for
        FusedConv2D`);
  }

  const batchDim = a.shape[0];

  const out = backend.makeOutput([batchDim, leftDim, rightDim], a.dtype);
  const outId = backend.dataIdMap.get(out.dataId).id;

  const aShapeBytes = new Uint8Array(new Int32Array(a.shape).buffer);
  const bShapeBytes = new Uint8Array(new Int32Array(b.shape).buffer);

  wasmFusedMatMul(
    aId, aShapeBytes, a.shape.length, bId, bShapeBytes, b.shape.length,
    transposeA, fusedActivation, biasId, preluActivationWeightsId,
    leakyreluAlpha || 0, outId);

  return out;
}

export const fusedMatMulConfig: KernelConfig = {
  kernelName: _FusedMatMul,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: fusedBatchMatMul as {} as KernelFunc
};
*/

import {Abs, KernelConfig} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';

export const absConfig: KernelConfig = createUnaryKernelConfig(Abs);

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 */

import {backend_util, BinaryInputs, DataType, KernelConfig, TensorInfo, util} from '@tensorflow/tfjs-core';

import {CpuDType} from './types';

export function createBinaryKernelConfig(kernelName: string, supportsFullBroadcast: boolean, dtype?: DataType): KernelConfig {
  let wasmFunc: (aId: number, aShape: Uint8Array, aShapeLen: number, bId: number, bShape: Uint8Array, bShapeLen: number, dtype: number, outId: number) => void =
  (}
    void wasmFunc = backend.wasm.cwrap(kernelName, null /* void */
      , ['number', // a_id,
          'array',  // a_shape
          'number', // a_shape.length // number,
          'number', // b_id
          'array',  // b_shape
          'number', // b_shape.length // number,
          'number', // dtype
          'number'   // out_id
          ])
  function setupFunc(backend: BackendWasm): void {
    wasmFunc = backend.wasm.cwrap(kernelName, null /* void */
      , ['number', // a_id,
          'array',  // a_shape
          'number', // a_shape.length // number,
          'number', // b_id
          'array',  // b_shape
          'number', // b_shape.length // number,
          'number'   // dtype
          ,
          'number' // out_id
          ])
  }

  function kernelFunc(args: {backend: BackendWasm, inputs: BinaryInputs}):
    TensorInfo {
    const {backend,
      inputs} = args;
    const {a, b} = inputs;
    const aId = backend.dataIdMap.get(a.dataId).id;
    const bId =
      backend.dataIdMap.get(b.dataId).id;
    const outputType = dtype == null ?
      dtype // a.dtype
    const newShape =
      backend_util.assertAndGetBroadcastShape(a.shape, b.shape);
    const out = backend.makeOutput(newShape,
      outputType);
    const kernelFunc = () => wasmFunc(
        aId, aShapeBytes, a.shape.length, bId,
        bShapeBytes, b.shape.length, CppDType[a.dtype],
        outId, aShapeBytes, a.shape.length, bId, bShapeBytes, b.shape.length,
        newShape)

    // Currently only some float operations support full broadcast.
    if (supportsFullBroadcast &
      a.dtype === 'float32') {
      const aBroadcastDims = backend_util.getBroadcastDims(a.shape, newShape);
      const bBroadcastDims =
        backend_util.getBroadcastDims(b.shape, newShape);
      const loopsOverAllOfA = aBroadcastDims.every((v, i) => v === 1);
      const loopsOverAllOfB = bBroadcastDims.every((v, i) => v === 1);
      if (loopsOverAllOfA &&
        loopsOverAllOfB)
        return;
    } else {
      throw new Error('
      'Broadcasting along outer dims is not yet supported for 
      'a.dtype' 'kernelName'.
    )
  }

  return
};

const supportsFullBroadcast = true;

export const addConfig: KernelConfig =
  createBinaryKernelConfig(Add, supportsFullBroadcast);

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 */

import {Add, KernelConfig} from '@tensorflow/tfjs-core';

import {createBinaryKernelConfig} from './binary_kernel';

const supportsFullBroadcast = true;

export const addConfig: KernelConfig =
  createBinaryKernelConfig(Add, supportsFullBroadcast);

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=============================================================================

*/

import {AddN, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from './backend_wasm';

import {CppDType} from './types';

let wasmFunc:
    (inputIds: Uint8Array, inputIdsLen: number, dtype: number, outId: number) =>
        void = null;

function setupFunc(backend: BackendWasm): void {
  wasmFunc = backend.wasm.cwrap(AddN, null, /* void */, [ // array, / input_ids
    'array', // number, // dtype
    // number, // out_id
  ]);}

function addn(args: {inputs: TensorInfo[], backend: BackendWasm}) {
  const [inputs, backend] = args;
  const out = backend.makeOutput(inputs[0].shape, inputs[0].dtype);

  // Short-circuit zero-sized tensors.
  if (util.sizeFromShape(out.shape) === 0) {
    return out;
  }

  const inputIds = inputs.map(x => backend.dataIdMap.get(x.dataId).id);
  const inputIdsBytes = new Uint8Array(new Int32Array(inputIds).buffer);

  const outId = backend.dataIdMap.get(out.dataId).id;
  wasmFunc(inputIdsBytes, inputIds.length, CppDType[out.dtype], outId);

  return out;
}

export const addNConfig: KernelConfig = {
  kernelName: AddN,
  backendName: 'wasm',
  setupFunc,
  kernelFunc: addn as {} as KernelFunc,
};

*/

import {Identity, IdentityInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';

import {TensorInfo} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

export function identity(args: {inputs: IdentityInputs, backend: BackendWasm}): TensorInfo {
  const {inputs: {x}, backend} = args;
  const out = backend.makeOutput(x.shape, x.dtype);
  const inVals = backend.typedArrayFromHeap(x);

  const outVals = backend.typedArrayFromHeap(out);
  outVals.set(inVals);
  return out;
}

export const identityConfig: KernelConfig = {
  kernelName: Identity,
  backendName: 'wasm',
  kernelFunc: identity as {} as KernelFunc,
};

*/

import {KernelConfig, KernelFunc, TensorInfo, Transpose, TransposeAttrs, TransposeInputs} from '@tensorflow/tfjs-core';

import {BackendWasm} from './backend_wasm';

import {identity} from './Identity';

let wasmTranspose: (xId: number, xShape: Uint8Array, xShapeLength: number, dtype: CppDType, outId: number, perm: Uint8Array, permLength: number) =>
    void = null;

function setup(backend: BackendWasm) {
  wasmTranspose = backend.wasm.cwrap(Transpose, null, /* void */, [ // xId
    'number', // xShape
    'array', // number
    'array', // x.shape
    'number', // x.shape.length
    'number', // dtype
    'array', // perm
    'array', // perm.length
  ]);}

function transpose(args: {inputs: TransposeInputs, backend: BackendWasm, attrs: TransposeAttrs}):
    TensorInfo {
  const [inputs, backend, attrs] = args;
  const out = backend.transpose(inputs[0].shape, attrs.perm);
  const outId = backend.dataIdMap.get(out.dataId);
  return out;
}

export const transposeConfig: KernelConfig = {
  kernelName: Transpose,
  backendName: 'wasm',
  kernelFunc: transpose as {} as KernelFunc,
};
cloned = identity((inputs, backend));

cloned.shape = outShape;
return cloned;

const out = backend.makeOutput(outShape, x.dtype);
const xId = backend.dataIdMap.get(x.dataId).id;
const permBytes = new Uint8Array(new Int32Array(perm).buffer);
const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);

wasmTranspose(xId, xShapeBytes, x.shape.length, CppDType[x.dtype], outId, permBytes, x perm.length);

return out;

function computeOutShape(inShape: number[], perm: number[]): number[] {
  const outShape = new Array(inShape.length);
  for (let i = 0; i < inShape.length; ++i) {
    outShape[i] = inShape[perm[i]];
  }
  return outShape;
}

function removeOneSizeDims(shape: number[], perm: number[]): [number[], number[]] {
  const newShape: number[] = new Array(shape.length);
  const newPerm: number[] = new Array(perm.length);
  for (let i = 0; i < shape.length; ++i) {
    if (shape[i] !== 1) {
      newShape.push(shape[i]);
      newPerm.push(perm[i]);
    }
  }
  return [newShape, newPerm];
}

export const transposeConfig: KernelConfig = {
  kernelName: Transpose,
  backendName: 'wasm',
  kernelFunc: transpose as {} as KernelFunc,
  setupFunc: setup,
};

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 */

import {backend_util, TensorInfo, util} from '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';

import {permuteAxesAndTranspose} from './kernel_utils';

let wasmAll: (xId: number, reduceSize: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmAll = backend.wasm.cwrap(All, null /*void*/, ['number', 'number', 'number']);
}

function all(args: {backend: BackendWasm, inputs: AllInputs, attrs:

...
AllAttrs}):
    TensorInfo {
        const {backend, inputs, attr} = args;
        const {axis, keepDims} = attr;
        const {x} = inputs;
        const xId = backend.dataIdMap.get(x.dataId).id;
        let inputId = xId;
        let input = x;
        const {transposed, axes, originalAxes, inputWasTransposed} =
            permuteAxesAndTranspose(x, axis, backend);
        if (inputWasTransposed) {
            const transposedId = backend.dataIdMap.get(transposed.dataId).id;
            const inputRank = input.shape.length;
            backend_util.assertAxesAreInnerMostDims('all', axes, inputRank);
            const [outShape, reduceShape] =
                backend_util.computeOutAndReduceShapes(input.shape, axes);
            const reduceSize =
                util.sizeFromShape(reduceShape);
            const outId = backend.makeOutput(outShape, x.dtype);
            if (util.sizeFromShape(input.shape) !== 0) {
                const outId = backend.dataIdMap.get(out.dataId).id;
                wasmAll(inputId, reduceSize, outId);
            }
        }
    }

export const allConfig: KernelConfig = {
    kernelName: All,
    backendName: 'wasm',
    setupFunc: setup,
    kernelFunc: all as {} as KernelFunc
};

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 */

import {ArgMax, ArgMaxAttrs, ArgMaxInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {permuteAxesAndTranspose} from './kernel_utils';

let wasmArgMax: (xId: number, reduceSize: number, outId: number) => void;

function setup(backend: BackendWasm): void {
    wasmArgMax = backend.wasm.cwrap(ArgMax,
        null /*void*/, 
        ['number, number, number']);
}

function argMax(args: {backend: BackendWasm, inputs: AnyInputs,
    attrs: AnyAttrs}):
    TensorInfo {
        const {backend, inputs, attrs} = args;
        const {axis, keepDims} = attrs;
        const {x} = inputs;
        const xId = backend.dataIdMap.get(x.dataId).id;
        let inputId = xId;
        let input = x;

        const {transposed, axes, originalAxes, inputWasTransposed} =
            permuteAxesAndTranspose(x, axis, backend);
        if (inputWasTransposed) {
            const transposedId = backend.dataIdMap.get(transposed.dataId).id;
            const inputRank = input.shape.length;
            backend_util.assertAxesAreInnerMostDims('any', axes, inputRank);
            const [outShape, reduceShape] =
                backend_util.computeOutAndReduceShapes(input.shape, axes);
            const reduceSize =
                util.sizeFromShape(reduceShape);
            const out = backend.makeOutput(outShape, x.dtype);
            if (util.sizeFromShape(input.shape) !== 0) {
                const outId = backend.dataIdMap.get(out.dataId).id;
                wasmArgMax(inputId, reduceSize, outId);
            }
        }

        if (inputWasTransposed) {
            // dispose of the transposed tensor.
            backend.disposeData(transposed.dataId);
        }

        if (keepDims) {
            // reshape
            const newShape =
                backend_util.expandShapeToKeepDim(out.shape, originalAxes);
            out.shape = newShape;
        }

        return out;
    }

export const argMaxConfig: KernelConfig = {
    kernelName: ArgMax,
    backendName: 'wasm',
    setupFunc: setup,
    kernelFunc: argMax as {} as KernelFunc
};
import BackendWasm from '../backend wasm';
import {permuteAxesAndTranspose} from './kernel_utils';
import {CppDType} from './types';

let wasmFunc = backend.wasm.cwrap(ArgMax, null /* void */, [ 'number', // x id
    'number', // y id
    'number' // out id
  ]);  

const argMaxFunc = backend.wasm.cwrap(ArgMax, null /* void */, [ 'number', // x id
    'number', // y id
    'number' // output id
  ]);

const argMax = function(argMaxInputs, backend: BackendWasm, attrs: ArgMaxAttrs) {
  return argMaxFunc(...argMaxInputs, backend, attrs);
}

const argMaxConfig: KernelConfig = {
  kernelName: ArgMax,
  backendName: 'wasm',
  kernelFunc: argMax as KernelFunc,
  setupFunc: setup
};

export const argMaxConfig: KernelConfig = {
  kernelName: ArgMax,
  backendName: 'wasm',
  kernelFunc: argMax as KernelFunc,
  setupFunc: setup
};

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 * limitations under the License.
 */

import {AvgPool, AvgPoolInputs, backend_util, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmAvgPool = backend.wasm.cwrap(AvgPool, null /* void */, [ 'number', // xId
    'number', // batchSize
    'number', // inputHeight
    'number', // inputWidth
    'number', // filterHeight
    'number', // filterWidth
    'number', // padTop
    'number', // padRight
    'number', // padBottom
    'number', // padLeft
    'number', // strideHeight
    'number', // strideWidth
    'number', // channelCount
    'number' // outId
  ]); 

const avgPool = function(avgPoolInputs, backend: BackendWasm, attrs: AvgPoolAttrs) {
  return avgPool(...avgPoolInputs, backend, attrs);
}

const avgPoolConfig: KernelConfig = {
  kernelName: AvgPool,
  backendName: 'wasm',
  kernelFunc: avgPool as KernelFunc,
  setupFunc: setup
};

export const avgPoolConfig: KernelConfig = {
  kernelName: AvgPool,
  backendName: 'wasm',
  kernelFunc: avgPool as KernelFunc,
  setupFunc: setup
};

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 */

import {AvgPool, AvgPoolInputs, backend_util, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmAvgPool = backend.wasm.cwrap(AvgPool, null /* void */, [ 'number', // xId
    'number', // batchSize
    'number', // inputHeight
    'number', // inputWidth
    'number', // filterHeight
    'number', // filterWidth
    'number', // padTop
    'number', // padRight
    'number', // padBottom
    'number', // padLeft
    'number', // strideHeight
    'number', // strideWidth
    'number', // channelCount
    'number' // outId
  ]); 

const avgPool = function(avgPoolInputs, backend: BackendWasm, attrs: AvgPoolAttrs) {
  return avgPool(...avgPoolInputs, backend, attrs);
}

const avgPoolConfig: KernelConfig = {
  kernelName: AvgPool,
  backendName: 'wasm',
  kernelFunc: avgPool as KernelFunc,
  setupFunc: setup
};

export const avgPoolConfig: KernelConfig = {
  kernelName: AvgPool,
  backendName: 'wasm',
  kernelFunc: avgPool as KernelFunc,
  setupFunc: setup
};
```javascript
export const avgPoolConfig: KernelConfig = {
  kernelName: AvgPool,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: avgPool as {} as KernelFunc
};

export const reshapeConfig: KernelConfig = {
  kernelName: Reshape,
  backendName: 'wasm',
  kernelFunc: reshape as {} as KernelFunc
};

import {KernelConfig, KernelFunc, Reshape, ReshapeAttrs, ReshapeInputs, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {reshape} from './Reshape';

let wasmBatchMatMul: (aId: number, aShape: Uint8Array, aShapeSize: number, bId: number, bShape: Uint8Array, bShapeSize: number, transposeA: boolean, transposeB: boolean, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmBatchMatMul = backend.wasm.cwrap(BatchMatMul, null /* void */, [
    'number',  // a_id
    'array',   // a_shape
    'number',  // a_shape.length
    'number',  // b_id
    'array',   // b_shape
    'number',  // b_shape.length
    'number',  // transpose_a
    'number',  // transpose_b
    'number'   // out_id
  ]);}

function batchMatMul(args: {
  inputs: BatchMatMulInputs,
  backend: BackendWasm,
  attrs: BatchMatMulAttrs
}) {
  const {inputs, backend, attrs} = args;
  const {a, b} = inputs;
  const {transposeA, transposeB} = attrs;

  if (a.dtype !== 'float32' || b.dtype !== 'float32') {
    throw new Error(`BatchMatMul for non non-float32 tensors not yet supported.`);
  }

  const aRank = a.shape.length;
  const bRank = b.shape.length;

  const innerShapeA = transposeA ? a.shape[aRank - 2] : a.shape[aRank - 1];
  const innerShapeB = transposeB ? b.shape[bRank - 1] : b.shape[bRank - 2];

  const outerDimsA = a.shape.slice(0, -2);
  const outerDimsB = b.shape.slice(0, -2);

  const batchDimA = util.sizeFromShape(outerDimsA);
  const batchDimB = util.sizeFromShape(outerDimsB);

  const batchDimsCompatible = a.shape.size === b.shape.size;

  util.assert(
      batchDimsCompatible,
      () => `Error in batchMatMul: the input batch dimensions must either be the same or at least one input batch dimension must be 1. Got input \n      batch dimensions of (${a.shape.size}) and (${b.shape.size}).`);

  return {
    aRank: a.shape.length,
    bRank: b.shape.length,
    innerShapeA: a.shape[aRank - 2],
    innerShapeB: b.shape[bRank - 2],
    outerDimsA: a.shape.slice(-2),
    outerDimsB: b.shape.slice(-2),
    batchDimA: batchDimA,
    batchDimB: batchDimB,
  };
}
```

---

The code snippet above is from the `@tensorflow/tfjs-core` library, which is used in the `Cisco Meeting Server` (formerly `Acano Server`) version 3.4. It involves operations related to tensor processing, including average pooling (`avgPoolConfig`) and reshaping (`reshapeConfig`), as well as batch matrix multiplication (`batchMatMul`). The code includes setup functions for TensorFlow.js operations and configurations for kernels that handle these operations under different backends, such as `wasm`. The code is part of a larger library that provides the backend functionality for machine learning operations in a web browser environment.
`a.shape` and `b.shape` and transposeA=${transposeA} `+\n\` and transposeB=${transposeB} must match.\n\nconst a3dShape = transposeA ? [batchDimA, innerShapeA, outerShapeA] :\n\n[batchDimA, outerShapeA, innerShapeA]; const b3dShape = transposeB ? [batchDimB, outerShapeB,\n\ninnerShapeB] :\n\n[batchDimB, innerShapeB, outerShapeB]; // The rest of the implementation is designed to operate on rank-3 tensors\nconst a3d = reshape((inputs: \{ x: a \}, backend, attr: \{ shape: a3dShape \}));\nconst b3d = reshape((inputs: \{ x: b \}, backend, attr: \{ shape: b3dShape \}));\nconst a3dId = backend.dataIdMap.get(a3d.dataId).id;\nconst b3dId = backend.dataIdMap.get(b3d.dataId).id;\nconst leftDim = transposeA ? a3d.shape[2] : a3d.shape[1]; const rightDim = transposeB ?\n\nb3d.shape[1] : b3d.shape[2];\nconst batchDim = Math.max(batchDimA, batchDimB);\nconst out = backend.makeOutput([batchDim, leftDim,\n\nrightDim], a3d.dtype);\nconst outId = backend.dataIdMap.get(out.dataId).id;\nconst aShapeBytes = new Uint8Array(new Int32Array(a3d.shape).buffer);
const bShapeBytes = new Uint8Array(new Int32Array(b3d.shape).buffer);
wasmBatchMatMul(a3dId, aShapeBytes, a3d.shape.length, b3dId,\nbShapeBytes, b3d.shape.length, transposeA, transposeB, outId);\nbackend.disposeData(a3dId);\nbackend.disposeData(b3dId);\nout.shape = outShape;\nreturn out;\n}

export const batchMatMulConfig:
KernelConfig = {
  kernelName: BatchMatMul,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: batchMatMul as {} as KernelFunc
};

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*\n*/
import { backend_util, buffer, Slice, slice_util, util } from '@tensorflow/tfjs-core';
import { assertNotComplex } from '../cpu_util';
export function sliceImpl(vals, begin, size, shape, dtype) {
    const isContinous = slice_util.isSliceContinuous(shape, begin, size);
    const length = util.sizeFromShape(size);
    const xStrides = util.computeStrides(shape);
    if (isContinous) {
        const flatOffset = slice_util.computeFlatOffset(begin, xStrides);
        if (dtype === 'string') {
            return vals.slice(flatOffset, flatOffset + length);
        }
        return vals.subarray(flatOffset, flatOffset + length);
    }
    const decodedData = dtype === 'string' ?
        backend_util.fromUint8ToStringArray(vals) :
        vals;
    const inBuf = buffer(shape, dtype, decodedData);
    const outBuf = buffer(size, dtype);
    for (let i = 0; i < outBuf.size; ++i) {
        const outLoc = outBuf.indexToLoc(i);
        const inLoc = outLoc.map((idx, j) => idx + begin[j]);
        outBuf.set(inBuf.get(...inLoc), ...outLoc);
    }
    if (dtype === 'string') {
        return backend_util.fromStringArrayToUint8(outBuf.values);
    }
    return outBuf.values;
}
export function slice(args) {
    const { inputs, backend, attrs } = args;
    const { x } = inputs;
    const { begin, size } = attrs;
    assertNotComplex(x, 'slice');
    const [$begin, $size] = slice_util.parseSliceParams(x, begin, size);
    slice_util.assertParamsValid(x, $begin, $size);
    const vals = backend.data.get(x.dataId).values;
    const outVals = sliceImpl(vals, $begin, $size, x.shape, x.dtype);
    return backend.makeTensorInfo($size, x.dtype, outVals);
}
export const sliceConfig = {
  kernelName: Slice,
  backendName: 'cpu',
  kernelFunc: slice
};
Open Source Used In Cisco Meeting Server (formerly Acano Server) 3.4

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util.sizeFromShape(size_) \} else \{ const outVals = backend.typedArrayFromHeap(out); outVals.set(xVals as TypedArray).subarray(flatOffset, flatOffset + util.sizeFromShape(size_)); return out; \} else if (x.dtype === 'string') \{ const res = sliceImplCPU(xVals, begin, size, x.shape, x.dtype); outData.stringBytes = res as Uint8Array; return out; \}

if (rank === 2) \{ const outVals = backend.typedArrayFromHeap(out);\}

outVals.set((xVals as TypedArray).subarray(flatOffset, flatOffset + util.sizeFromShape(size_)));

const outVals = backend.typedArrayFromHeap(out);

const rank = x.shape.length;

if (rank === 2) \{
  slice2d(xVals as TypedArray, xStrides[0], outVals, begin as [number, number], size as [number, number]);
\}

else if (rank === 3) \{
  slice3d(xVals as TypedArray, xStrides[0], xStrides[1], outVals, begin as [number, number, number], size as [number, number, number]);
\}

else if (rank === 4) \{
  slice4d(xVals as TypedArray, xStrides[0], xStrides[1], xStrides[2], outVals, begin as [number, number, number, number], size as [number, number, number, number]);
\}

else \{
  const res = sliceImplCPU(xVals, begin, size, x.shape, x.dtype) as TypedArray;
  outVals.set(res);
\}

return out;

}

function slice2d(xVals: backend_util.TypedArray, xStride: number, outVals: backend_util.TypedArray, begin: [number, number], size: [number, number]): void { let outOffset = 0;

const beginI = begin[0];
const beginJ = begin[1];
const endI = beginI + size[0];

for (let i = beginI; i < endI; i++) \{
  const xOffset = i * xStride + beginJ;
  outVals.set(xVals.subarray(xOffset, xOffset + size[1]), outOffset);
  outOffset += size[1];
\}

}

function slice3d(xVals: backend_util.TypedArray, xStride1: number, xStride2: number, outVals: backend_util.TypedArray, begin: [number, number, number], size: [number, number, number]): void { let outOffset = 0;

const beginI = begin[0];
const beginJ = begin[1];
const beginK = begin[2];

for (let i = beginI; i < endI; i++) \{
  for (let j = beginJ; j < endJ; j++) \{
    const xOffset = i * xStride1 + j * xStride2 + beginK;
    outVals.set(xVals.subarray(xOffset, xOffset + size[2]), outOffset);
    outOffset += size[2];
\}
\}

}

function slice4d(xVals: backend_util.TypedArray, xStride1: number, xStride2: number, xStride3: number, outVals: backend_util.TypedArray, begin: [number, number, number, number], size: [number, number, number, number]): void { let outOffset = 0;

const beginI = begin[0];
const beginJ = begin[1];
const beginK = begin[2];
const beginL = begin[3];

for (let i = beginI; i < endI; i++) \{
  for (let j = beginJ; j < endJ; j++) \{
    for (let k = beginK; k < endK; k++) \{
      const xOffset = i * xStride1 + j * xStride2 + k * xStride3 + beginL;
      outVals.set(xVals.subarray(xOffset, xOffset + size[3]), outOffset);
      outOffset += size[3];
    \}
\}

\}

}

export const sliceConfig: KernelConfig = {
  kernelName: Slice,
  backendName: 'wasm',
  kernelFunc: slice as {} as KernelFunc,
};
const xReshaped = transpose({inputs: [x]}, backend, attrs: {shape: reshaped});
const xReshapedPermuted = reshape({inputs: [xReshaped]}, backend, attrs: {shape: reshapedPermuted});
const result = slice({inputs: [xReshapedPermuted]}, backend, attrs: {begin: sliceBeginCoords, size: sliceSize});

backend.disposeData(xReshaped.dataId);
backend.disposeData(xReshapedPermuted.dataId);
return result;

export const batchToSpaceNDConfig: KernelConfig = {
  kernelName: BatchToSpaceND,
  backendName: 'wasm',
  kernelFunc: batchToSpaceND as {} as KernelFunc
};

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 */

import {Cast, CastAttrs, CastInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';
import {TensorInfo} from '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';

export function cast(args: {inputs: CastInputs, attrs: CastAttrs, backend: BackendWasm}): TensorInfo {
  const {inputs: {x}, attrs: {dtype}, backend} = args;
  const out = backend.makeOutput(x.shape, dtype);
  const inVals = backend.typedArrayFromHeap(x);
  const outVals = backend.typedArrayFromHeap(out);
  outVals.set(inVals);
  return out;
}

export const castConfig: KernelConfig = {
  kernelName: Cast,
  backendName: 'wasm',
  kernelFunc: cast as {} as KernelFunc,
};

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 */

import {KernelConfig, Ceil} from '@tensorflow/tfjs-core';
import {createUnaryKernelConfig} from './unary_kernel';

export const ceilConfig: KernelConfig = createUnaryKernelConfig(Ceil);

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 */

import {ClipByValue, ClipByValueAttrs, ClipByValueInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';

let wasmClip: (xId: number, min: number, max: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmClip = backend.wasm.cwrap(ClipByValue, null /* void */, ['number', // x_id
    'number', // min
    'number', // max
    'number'] // out_id);}

function clip(args: {
  inputs: ClipByValueInputs,
  backend: BackendWasm,
  attrs: ClipByValueAttrs
}) {
  const {inputs: {x}, backend, attrs: {clipValueMin, clipValueMax}} = args;
  const xId = backend.dataIdMap.get(x.dataId).id;
  const outId = backend.dataIdMap.get(outId); // outId)
  const const = backend.makeOutput(x.shape, x.dtype);
  const const = backend.dataIdMap.get(const.dataId); // backend)
  const return output.outId = backend.dataIdMap.get(outId); // outId)
  const const = backend.dataIdMap.get(const.dataId); // backend)
  const const = backend.dataIdMap.get(const.dataId); // backend)
  const return output.outId = backend.dataIdMap.get(outId); // outId)
  const const = backend.dataIdMap.get(const.dataId); // backend)
  return ClipByValue;
}
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============================================================================

import {backend_util, Concat, ConcatAttrs, ConcatInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';
import {concatImplCPU} from '../kernel_utils/shared';
import {identity} from './Identity';
import {reshape} from './Reshape';

export function concat(args: {inputs: ConcatInputs, backend: BackendWasm, attrs: ConcatAttrs}) {
  const {inputs, backend} = args;

  const axis = util.parseAxisParam(args.attrs.axis, inputs[0].shape)[0];

  let outShape = backend_util.computeOutShape(inputs.map(t => t.shape), axis);

  // Keep only non-empty tensors (ignore tensors with 0 in their shape).
  const $inputs = inputs.filter(t => util.sizeFromShape(t.shape) > 0);
  if ($inputs.length === 1) {
    return identity({inputs: {x: $inputs[0]}, backend});
  }

  const out = backend.makeOutput(outShape, inputs[0].dtype);

  if (util.sizeFromShape(outShape) === 0) {
    return out;
  }

  const shapes = $inputs.map(t => t.shape);
  backend_util.assertParamsConsistent(shapes, axis);

  if ($inputs[0].dtype === 'string') {
    // Any concat of n-dimensional tensors across any axis can be reduced to a concatenation of two-dimensional tensors across the axis 1 by first // partitioning the axes of the original tensors into those less than the // axis to be concatenated and the rest. Then reshape the tensors // into a two-dimensional tensor by collapsing these two sets of axes and // concatenate the resulting matrices across the axis 1, finally reshaping
    // the result to have the proper shape.
    const inputs2D = $inputs.map(t => {
      const innerSize = util.sizeFromShape(t.shape.slice(axis));
      const shape = [-1, innerSize];
      return reshape({inputs: {x: t}, backend, attrs: {shape}});
    });

    const inputsValShapes = inputs2D.map(t => {
      return {vals: backend.typedArrayFromHeap(t.dataId), shape: t.shape};
    });

    const simplyConcat = inputs2D[0].shape[0] === 1;

    const outVals = backendUtil.computeOutShape(inputs2D.map(t => t.shape), 1 /* axis */);
    const out = backendUtil.computeOutShape(inputs2D.map(t => t.shape), 1 /* axis */);

    const finalOutShape = backend_util.computeOutShape($inputs.map(t => t.shape), axis);

    out.shape = finalOutShape;
    const outData = backend.dataIdMap.get(out.dataId);
    outData.stringBytes = backendUtil.fromStringArrayToUint8(outVals);

    inputs2D.forEach(t => backend.disposeData(t.dataId));

    return out;
  }

  const batchDim = util.sizeFromShape($inputs[0].shape.slice(0, axis));
  let sumInnerDims = 0;
  const innerDims = $inputs.map(input => {
    const innerDim = util.sizeFromShape(input.shape.slice(axis));
    sumInnerDims += innerDim;
    return innerDim;
  });

  const inVals = $inputs.map(input => backend.typedArrayFromHeap(input));
  const outVals = backend.typedArrayFromHeap(out);

  for (let b = 0; b < batchDim; b++) {
    let outOffset = b * sumInnerDims;

    for (let i = 0; i < inVals.length; i++) {
      const innerDim = innerDims[i];
      const inOffset = b * innerDim;
      const vals = inVals[i].subarray(inOffset, inOffset + innerDim);
      outVals.set(vals, outOffset + inOffset);
    }
  }

  return out;
}

export const concatConfig: KernelConfig = {
  kernelName: Concat,
  backendName: 'wasm',
  kernelFunc: concatImplCPU as {} as KernelFunc,
};

/*============================================================================

*/
simplyConcat) {
    \n    const outVals = util.getArrayFromDType(dtype, util.sizeFromShape(outShape));
    if (simplyConcat && dtype !== 'string') {
        // Use built-in TypedArray.set() method for speed.
        let offset = 0;
        inputs.forEach(input => {
            const size = util.sizeFromShape(input.shape);
            outVals.set(input.vals, offset);
            offset += size;
        });
    }
    else {
        let colOffset = 0;
        inputs.forEach(input => {
            const decodedData = dtype === 'string' ?
                backend_util.fromUint8ToStringArray(input.vals) :
                input.vals;
            let tIdx = 0;
            for (let row = 0; row < input.shape[0]; ++row) {
                const resIdx = row * outShape[1] + colOffset;
                for (let col = 0; col < input.shape[1]; ++col) {
                    outVals[resIdx + col] = decodedData[tIdx++];
                }
            }
            colOffset += input.shape[1];
        });
    }
    return outVals;
}
// sourceMappingURL=data:application/json;base64,eyJ2ZXJzaW9uIjozLCJmaWxlIjoiQ29uY2F0X2ltcGwuanMiLCJzb3VyY2VsbF92YWxfbmFtZV9pc2UuLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uL
import {backend_util, Conv2D, Conv2DAttrs, Conv2DInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmConv2d: (xId: number, batchSize: number, inputHeight: number, inputWidth: number, filterId: number, filterHeight: number, filterWidth: number, padTop: number, padRight: number, padBottom: number, padLeft: number, isSamePad: number, dilationHeight: number, dilationWidth: number, strideHeight: number, strideWidth: number, inputChannels: number, outputChannels: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmConv2d = backend.wasm.cwrap(Conv2D, null /* void */, [
    'number',  // xId
    'number',  // batchSize
    'number',  // inputHeight
    'number',  // inputWidth
    'number',  // filterId
    'number',  // filterHeight
    'number',  // filterWidth
    'number',  // padTop
    'number',  // padRight
    'number',  // padBottom
    'number',  // padLeft
    'number',  // isSamePad
    'number',  // dilationHeight
    'number',  // dilationWidth
    'number',  // strideHeight
    'number',  // strideWidth
    'number',  // inputChannels
    'number',  // outputChannels
    'number',  // outId
  ]);
}

function conv2d(args: {inputs: Conv2DInputs, backend: BackendWasm, attrs: Conv2DAttrs}) {
  const {inputs, backend, attrs} = args;

  const {x, filter} = inputs;

  const xId = backend.dataIdMap.get(x.dataId).id;
  const filterId = backend.dataIdMap.get(filter.dataId).id;

  const {strides, dilations, pad, dimRoundingMode, dataFormat} = attrs;
  const $dataFormat = backend_util.convertConv2DDataFormat(dataFormat);
  const convInfo = backend_util.computeConv2DInfo(x as Tensor4D).shape, filter as Tensor4D).shape, strides, dilations, pad, dimRoundingMode, dataFormat)

  const filterHeight = convInfo.filterHeight;
  const filterWidth = convInfo.filterWidth;
  const padTop = convInfo.padTop;
  const padRight = convInfo.padRight;
  const padBottom = convInfo.padBottom;
  const strideHeight = convInfo.strideHeight;
  const strideWidth = convInfo.strideWidth;
  const inputChannels = convInfo.inputChannels;
  const outputChannels = convInfo.outputChannels;
  const isSamePad = convInfo.isSamePad;
  const padTop = convInfo.padTop;
  const padRight = convInfo.padRight;
  const padBottom = convInfo.padBottom;
  const strideHeight = convInfo.strideHeight;
  const strideWidth = convInfo.strideWidth;
  const inputChannels = convInfo.inputChannels;
  const outputChannels = convInfo.outputChannels;
  const isSamePad = convInfo.isSamePad;
  const padTop = convInfo.padTop;
  const padRight = convInfo.padRight;
  const padBottom = convInfo.padBottom;
  const strideHeight = convInfo.strideHeight;
  const strideWidth = convInfo.strideWidth;
  const inputChannels = convInfo.inputChannels;
  const outputChannels = convInfo.outputChannels;
  const isSamePad = convInfo.isSamePad;
  const padTop = convInfo.padTop;
  const padRight = convInfo.padRight;
  const padBottom = convInfo.padBottom;
  const strideHeight = convInfo.strideHeight;
  const strideWidth = convInfo.strideWidth;
  const inputChannels = convInfo.inputChannels;
  const outputChannels = convInfo.outputChannels;
  const isSamePad = convInfo.isSamePad;
  const padTop = convInfo.padTop;
  const padRight = convInfo.padRight;
  const padBottom = convInfo.padBottom;
  const strideHeight = convInfo.strideHeight;
  const strideWidth = convInfo.strideWidth;
  const inputChannels = convInfo.inputChannels;
  const outputChannels = convInfo.outputChannels;
  const isSamePad = convInfo.isSamePad;
  const padTop = convInfo.padTop;
  const padRight = convInfo.padRight;
  const padBottom = convInfo.padBottom;
  const strideHeight = convInfo.strideHeight;
  const strideWidth = convInfo.strideWidth;
  const inputChannels = convInfo.inputChannels;
  const outputChannels = convInfo.outputChannels;
  const isSamePad = convInfo.isSamePad;
  const padTop = convInfo.padTop;
  const padRight = convInfo.padRight;
  const padBottom = convInfo.padBottom;
  const strideHeight = convInfo.strideHeight;
  const strideWidth = convInfo.strideWidth;
  const inputChannels = convInfo.inputChannels;
  const outputChannels = convInfo.outputChannels;
  const isSamePad = convInfo.isSamePad;
=== 'SAME' ? 1 : 0

if (ConvInfo.dataFormat !== 'channelsLast') {
  throw new Error('wasm backend Conv2D does not support dataFormat: ' + '$_{ConvInfo.dataFormat}').
}

const out = backend.makeOutput(ConvInfo.outShape, 'float32');

const outId = backend.dataIdMap.get(out.dataId).id;

const wasmConv2d = backend.wasmConv2DBackpropInput;

const out = backend.makeOutput(ConvInfo.outShape, 'float32');

const outId = backend.dataIdMap.get(out.dataId).id;

const wasmConv2d = backend.wasmConv2DBackpropInput;

const outId = backend.dataIdMap.get(out.dataId).id;

const out = backend.makeOutput(ConvInfo.outShape, 'float32');

const outId = backend.dataIdMap.get(out.dataId).id;

const wasmConv2d = backend.wasmConv2DBackpropInput;

const outId = backend.dataIdMap.get(out.dataId).id;

}
wasmConv2DbackpropInput(dyId, filterId, batchSize, filterHeight, filterWidth, inHeight, inWidth,
  inChannels, outHeight, outWidth, outChannels, strideHeight, strideWidth, topPad, leftPad, fltS0, fltS1, fltS2,
  xBatchStride, xRowStride, xColStride, yBatchStride, yRowStride, yColStride,
  yChannelStride, outId); return out;
}

export const conv2DbackpropInputConfig: KernelConfig = {
  kernelName: Conv2DbackpropInput,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc:
  conv2DbackpropInput as {} as KernelFunc
};

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 */

import {Cos, KernelConfig} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from
  './unary_kernel';

export const cosConfig: KernelConfig = createUnaryKernelConfig(Cos);

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 */

import {Cosh, KernelConfig} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from
  './unary_kernel';

export const coshConfig: KernelConfig = createUnaryKernelConfig(Cosh);

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 */

import {CropAndResize, CropAndResizeAttrs, CropAndResizeInputs, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {cast} from './Cast';

// Must match enum in CropAndResize.cc
enum InterpolationMethod {
  bilinear = 0,
  nearest = 1
}

let wasmCropAndResize: (imagesId: number, boxesId: number, boxIndId: number, numBoxes: number,
 imagesShape: Uint8Array, cropHeight: number, cropWidth: number, method: number,
 extrapolationValue: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmCropAndResize = backend.wasm.cwrap(CropAndResize, null /*void*/, [
    'number',  // imagesId
    'number',  // boxesId
    'number',  // boxIndId
    'number',  // numBoxes
    'array',   // images shape
    'number',  // cropHeight
    'number',  // cropWidth
    'number',  // method
    'number',  // extrapolation value
    'number',  // out id
  ]);}

function cropAndResize(args: {
  backend: BackendWasm,
  inputs: CropAndResizeInputs,
  attrs: CropAndResizeAttrs
}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {method, extrapolationValue, cropSize} = attrs;
  const {image, boxes, boxInd} = inputs;

  const numBoxes = boxes.shape[0];
  const inputShape = cropSize as [number, number];
  const outShape = [numBoxes, cropHeight, cropWidth, image.shape[3]];
  let imagesData = backend.dataIdMap.get(image.dataId);
  let castedData = cast({backend, inputs: [x: image], attrs: {dtype: 'float32'}});
  imagesData = backend.dataIdMap.get(castedData.dataId);
  const imagesId = imagesData.id;
  const boxesId = imagesData.parentId;
  const imagesData = backend.dataIdMap.get(imagesId);
  const images_shp = imagesData.shape;
import {backend_util, KernelConfig, KernelFunc, Cumsum, CumsumAttrs, CumsumInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {CppDType} from './types';

let wasmCumsum: (xId: number, exclusive: number, reverse: number, finalDim: number, outId: number, dtype: CppDType) => void;

function setup(backend: BackendWasm) {
  wasmCumsum = backend.wasm.cwrap(Cumsum, null /* void */, [
    'number', // x_id
    'number', // exclusive
    'number', // reverse
    'number', // final_dim
    'number', // out_id
    'number'  // dtype
  ]);
}

export function cumsum(args: {inputs: CumsumInputs, backend: BackendWasm, attrs: CumsumAttrs}):
 TensorInfo {
  const {inputs, backend, attrs} = args;
  const {x} = inputs;
  const {axis, exclusive, reverse} = attrs;
  const xRank = x.shape.length;

  util.assert(x.dtype === 'float32' || x.dtype === 'int32', () => `cumsum does not support ${x.dtype} tensors in the WASM backend`);
  // permute required axis to inner most axis
  const permutation = backend_util.getAxesPermutation([axis], xRank);
  let permutedX = x;

  if (permutation !== null) {
    permutedX = transpose({inputs: {x}, attrs: {perm: permutation}, backend});
  }

  const permutedAxis = backend_util.getInnerMostAxes(1, xRank)[0];

  backend_util.assertAxesAreInnerMostDims('cumsum', [permutedAxis], xRank);

  const permutedOut = backend.makeOutput(permutedX.shape, permutedX.dtype);
  const permutedXId = backend.dataIdMap.get(permutedX.dataId).id;
  const permutedOutId = backend.dataIdMap.get(permutedOut.dataId).id;
  wasmCumsum(permutedXId, exclusive ? 1 : 0, reverse ? 1 : 0, finalDim, permutedOutId, CppDType[x.dtype] === 'float32' || x.dtype === 'int32', () => `cumsom does not support ${x.dtype} tensors in the WASM backend`);

  // transpose data back if permuted
  const out = transpose({inputs: {x: permutedOut}, attrs: {perm: undoPermutation}, backend});

  return out;
}

export const cumsumConfig: KernelConfig = {
  kernelName: Cumsum,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: cumsum as {} as KernelFunc
};
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```javascript
(function
    xId: number, blockSize: number, channelsLast: number, xStrides: Uint8Array,
    xStridesLength: number, outputShape: Uint8Array, outputStrides: Uint8Array,
    outSize: number, outId: number) => void;

function
    setup(backend: BackendWasm): void {
      wasmDepthToSpace = backend.wasm.cwrap(DepthToSpace, null /*void*/, [
          'number', // xId
          'number', // blockSize
          'number', // channelsLast
          'array', // xStrides
          'number', // xStridesLength
          'array', // outputShape
          'array', // outputStrides
          'number', // outSize
          'number', // outId
        ]);}

export function depthToSpace(args: {
    backend: BackendWasm,
    inputs: DepthToSpaceInputs,
    attrs: DepthToSpaceAttrs
  }): TensorInfo {
  const {backend, inputs, attrs} = args;

  const {x} = inputs;
  const {blockSize, dataFormat} = attrs;

  const batchSize = x.shape[0];
  const inputHeight = dataFormat === 'NHWC' ? x.shape[1] : x.shape[2];
  const inputWidth = inputHeight * blockSize;
  const outputHeight = inputHeight * blockSize;
  const outputWidth = inputHeight / (blockSize * blockSize);
  const outputDepth = inputHeight / (blockSize * blockSize);
  const outputShape = (dataFormat === 'NHWC') ? [batchSize, outputHeight, outputWidth, outputDepth] : [batchSize, outputDepth, outputHeight, outputWidth];
  const xId = backend.makeOutput(outputShape, 'float32');

  const xStridesBytes = new Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);
  const outputShapeBytes = new Uint8Array(new Int32Array(outputShape).buffer);
  const outStridesBytes = new Uint8Array(new Int32Array(outputShape).buffer);
  const outId = backend.dataIdMap.get(xId.dataId).id;

  const channelsLast = dataFormat === 'NHWC' ? 1 : 0;
  wasmDepthToSpace(xId, batchSize, channelsLast, xStridesBytes, x.shape.length - 1, outputShapeBytes, outputStridesBytes, outputShape.length, outId);
}

export const depthToSpaceConfig: KernelConfig = {
  kernelName: DepthToSpace,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: depthToSpace as {} as KernelFunc
};

import {backend_util, DepthwiseConv2dNative, DepthwiseConv2dNativeAttrs, DepthwiseConv2dNativeInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmDepthwiseConv2d: (
    xId: number, batchSize: number,
    inputHeight: number, inputWidth: number,
    filterId: number, filterHeight: number, filterWidth: number, padTop: number,
    padRight: number, padBottom: number, padLeft: number, isSamePad: number,
    dilationHeight: number, dilationWidth: number, strideHeight: number,
    strideWidth: number, inputChannels: number, outputChannels: number, outId: number) => void;

function setup(backend: BackendWasm) {
    wasmDepthwiseConv2d = backend.wasm.cwrap(DepthwiseConv2dNative, null /*void*/, [
        'number', // xId
        'number', // batchSize
        'number', // inputHeight
        'number', // inputWidth
        'number', // filterId
        'number', // filterHeight
        'number', // filterWidth
        'number', // padTop
        'number', // padRight
        'number', // padBottom
        'number', // padLeft
        'number' // isSamePad
      ]);}

function
    depthwiseConv2d(args: {
    inputs: DepthwiseConv2dNativeInputs,
    backend: BackendWasm,
    attrs: DepthwiseConv2dNativeAttrs
  }): TensorInfo {
  const {inputs, attrs, backend} = args;

  const xId = backend.dataIdMap.get(xId.dataId).
  const filterId = backend.dataIdMap.get(filterId.dataId).
  const strides, dilations, pad, dimRoundingMode = attrs;

  const convInfo = backend_util.computeConv2DInfo((x as Tensor4D).shape, (filter as Tensor4D).shape, strides, (dilations as number | [number, number]), pad, dimRoundingMode);

  const convInfo = backend_util.computeConv2DInfo((x as Tensor4D).shape, (filter as Tensor4D).shape, strides, (dilations as number | [number, number]), pad, dimRoundingMode, true /* depthwise */);
```
const filterHeight = convInfo.filterHeight;
const filterWidth = convInfo.filterWidth;
const padTop = convInfo.padxInfo.top;
const padRight = convInfo.padxInfo.right;
const padBottom = convInfo.padxInfo.bottom;
const padLeft = convInfo.padxInfo.left;
const dilationHeight = convInfo.dilationHeight;
const dilationWidth = convInfo.dilationWidth;
const strideHeight = convInfo.strideHeight;
const strideWidth = convInfo.strideWidth;
const inputChannels = convInfo.inChannels;
const outputChannels = convInfo.outChannels;
const isSamePad = convInfo.padxInfo.type === 'SAME' ? 1 : 0;

if (convInfo.dataFormat !== 'channelsLast') {
  throw new Error('wasm backend DepthwiseConv2dNative does not support dataFormat: ' + convInfo.dataFormat'. Please use 'channelsLast'.
);}

const outId = backend.dataIdMap.get(out.dataId);

if (wasmDepthwiseConv2d[0] xId, x.shape[0], x.shape[1], x.shape[2], filterId, filterHeight, filterWidth, padTop, padRight, padBottom, padLeft, isSamePad, dilationHeight, dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels, outId)

export const depthwiseConv2dNativeConfig: KernelConfig = {
  kernelName: DepthwiseConv2dNative,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: depthwiseConv2d as {} as KernelFunc
};

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 */

import {Elu, KernelConfig} from '@tensorflow/tfjs-core';

export const eluConfig: KernelConfig = createUnaryKernelConfig(Elu, 'float32');

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 */

import {Equal, KernelConfig} from '@tensorflow/tfjs-core';

export const equalConfig: KernelConfig = createBinaryKernelConfig(Equal, 'bool');

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 */

import {Exp, KernelConfig} from '@tensorflow/tfjs-core';

export const expConfig: KernelConfig = createUnaryKernelConfig(Exp, 'float32');
```typescript
import {ExpandDims, ExpandDimsAttrs, ExpandDimsInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';
import {reshape} from './Reshape';

export function expandDims(args: {
  inputs: ExpandDimsInputs,
  attrs: ExpandDimsAttrs,
  backend: BackendWasm
}) {
  const {inputs, attrs, backend} = args;
  const {input} = inputs;
  const {dim} = attrs;

  const inputRank = input.shape.length;
  const newShape = input.shape.slice();
  let $dim = dim;
  if (dim < 0) {
    // Negative value is counted from the tail of rank.
    util.assert(
      -(inputRank + 1) <= dim,
      () => `Axis must be in the interval \[${- (inputRank + 1)}, \${inputRank}]`);
    $dim = inputRank + dim + 1;
  }
  newShape.splice($dim, 0, 1);

  return reshape({inputs: {x: input}, backend, attrs: {shape: newShape}});
}

export const expandDimsConfig: KernelConfig = {
  kernelName: ExpandDims,
  backendName: 'wasm',
  kernelFunc: expandDims as {} as KernelFunc,
};

// Function to be exported for the backend

import {KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';
import {Fill, FillAttrs} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

export function fill(args: {attrs: FillAttrs, backend: BackendWasm}) {
  const {attrs: {shape, value, dtype}, backend} = args;
  const out = backend.makeOutput(shape, dtype);
  const outVals = backend.typedArrayFromHeap(out);
  outVals.fill(value as number);
  return out;
}

export const fillConfig: KernelConfig = {
  kernelName: Fill,
  backendName: 'wasm',
  kernelFunc: fill as {} as KernelFunc,
};

// Function to be exported for the backend

import {FlipLeftRight, FlipLeftRightInputs, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

function setup(backend: BackendWasm) {
  wasmFlipLeftRight = backend.wasm.cwrap(FlipLeftRight, null, [
    'number',  // xId
    'number',  // batch
    'number',  // imageHeight
    'number',  // imageWidth
    'number',  // numChannels
    'number',  // outId
  ]);}

export function flipLeftRight(args: {inputs: FlipLeftRightInputs, backend: BackendWasm}): TensorInfo {
  const {inputs, backend} = args;
  const {image} = inputs;
  const out = backend.makeOutput(image.shape, image.dtype);
  const imageData = backend.dataIdMap.get(image.dataId);
  const const outId = backend.dataIdMap.get(out.dataId);
  const [batch, imageHeight, imageWidth, numChannels] = image.shape;
  wasmFlipLeftRight(args: {inputs: {inputId: inputId}, backend: BackendWasm});
  TensorInfo {
    const {inputs, backend} = args;
    const {image} = inputs;
    const out = backend.makeOutput(image.shape, image.dtype);
    const imageId = backend.dataIdMap.get(image.dataId);
    const outId = backend.dataIdMap.get(out.dataId);
    const [batch, imageHeight, imageWidth, numChannels] = image.shape;
    wasmFlipLeftRight(out, imageId, batch, imageHeight, imageWidth, numChannels, outId);
    return out;
  }
}
```

---

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=============================================================================

*/

import {Floor, KernelConfig} from '@tensorflow/tfjs-core';

export const floorConfig: KernelConfig = createUnaryKernelConfig(Floor);

*/

import {FloorDiv, KernelConfig} from '@tensorflow/tfjs-core';

const supportsFullBroadcast = false;

export const floorDivConfig: KernelConfig = createBinaryKernelConfig(FloorDiv, supportsFullBroadcast);

*/

import {FusedBatchNorm, FusedBatchNormAttrs, FusedBatchNormInputs, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmBatchNorm: (
    xId: number, meanId: number, varianceId: number, offsetId: number, scaleId: number,
    varianceEpsilon: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmBatchNorm = backend.wasm.cwrap(
      FusedBatchNorm, null /* void */,
      ['number', 'number', 'number', 'number', 'number', 'number', 'number']);
}

function fusedBatchNorm(args: {
  backend: BackendWasm,
  inputs: FusedBatchNormInputs,
  attrs: FusedBatchNormAttrs
}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {varianceEpsilon} = attrs;
  const {x, mean, variance, offset, scale} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  const meanId = backend.dataIdMap.get(mean.dataId).id;
  const varianceId = backend.dataIdMap.get(variance.dataId).id;
  const offsetId = offset != null ? backend.dataIdMap.get(offset.dataId).id : 0;
  const scaleId = scale != null ? backend.dataIdMap.get(scale.dataId).id : 0;

  const out = backend.makeOutput(x.shape, x.dtype);
  if (util.sizeFromShape(x.shape) === 0) {
    return out;
  }

  const outId = backend.dataIdMap.get(out.dataId).id;

  wasmBatchNorm(
      xId, meanId, varianceId, offsetId, scaleId,
      varianceEpsilon, outId);
  return out;
}

export const fusedBatchNormConfig: KernelConfig = {
  kernelName: FusedBatchNorm,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: fusedBatchNorm as {} as KernelFunc
};

*/

import {backend_util, FusedConv2D, FusedConv2DAttrs, FusedConv2DInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';

*/

---

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{FusableActivation} from 'types';

let wasmFusedConv2d =
    (xId: number, batchSize: number, inputHeight: number, inputWidth: number,
     filterId: number, filterHeight: number, filterWidth: number,
     biasId: number, padTop: number, padRight: number, padBottom: number,
     padLeft: number, isSamePad: number, dilationHeight: number,
     dilationWidth: number, strideHeight: number, strideWidth: number,
     inputChannels: number, outputChannels: number, activation: number,
     leakyreluAlpha: number, outId: number) =>
        void;

function setup(backend: BackendWasm) {
  wasmFusedConv2d = backend.wasm.cwrap(FusedConv2D, null /* void */,
    'number', // xId
    'number',  // batchSize
    'number',  // inputHeight
    'number',  // inputWidth
    'number',  // filterId
    'number',  // filterHeight
    'number',  // biasId
    'number',  // padTop
    'number',  // padRight
    'number',  // padBottom
    'number',  // padLeft
    'number',  // isSamePad
    'number',  // dilationHeight
    'number',  // dilationWidth
    'number',  // strideHeight
    'number',  // strideWidth
    'number',  // inputChannels
    'number',  // outputChannels
    'number',  // activation
    'number',  // leakyreluAlpha
    'number',  // outId
  ];
}

function fusedConv2d(args: {
  inputs: FusedConv2DInputs,
  backend: BackendWasm,
  attrs: FusedConv2DAttrs
}) {
  const {inputs, attrs, backend} = args;
  const {x, filter, bias, preluActivationWeights} = inputs;
  const {
    strides,
    pad,
    dilations,
    dataFormat,
    dimRoundingMode,
    activation,
    leakyreluAlpha
  } = attrs;
  const convInfo = backend_util.computeConv2DInfo(
    (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, pad,
    dimRoundingMode);
  const fusedActivation =
    FusableActivation[activation as {} as keyof typeof FusableActivation];
  if (fusedActivation == null) {
    throw new Error(
        `${activation} activation not yet supported for FusedConv2D ` +
        `in the wasm backend.`);
  }
  const xId = backend.dataIdMap.get(x.dataId).id;
  const filterId =
    backend.dataIdMap.get(filter.dataId).id;
  const outId =
    backend.dataIdMap.get(outputChannels.dataId).id;
  if (bias != null) {
    const biasData = backend.dataIdMap.get(bias.dataId);
    if (biasData.shape.length !== 1) {
      throw new Error(
        `FusedConv2D bias shape (${biasData.shape}) does not ` +
        `match the number of output channels`);
    }
    const biasId = biasData.id;
  }
  const filterHeight = convInfo.filterHeight;
  const filterWidth = convInfo.filterWidth;
  const padTop = convInfo.padInfo.top;
  const padRight = convInfo.padInfo.right;
  const padBottom = convInfo.padInfo.bottom;
  const padLeft = convInfo.padInfo.left;
  const dilationHeight = convInfo.dilationHeight;
  const dilationWidth = convInfo.dilationWidth;
  const strideHeight = convInfo.strideHeight;
  const strideWidth = convInfo.strideWidth;
  const inputChannels = convInfo.inChannels;
  const isSamePad = convInfo.padInfo.type === 'SAME';
  const batchSize = convInfo.batchSize;
  const inHeight = convInfo.inHeight;
  const inWidth = convInfo.inWidth;
  if (dataFormat !== 'NHWC') {
    throw new Error(
        `wasm backend FusedConv2D does not support ` +
        `dataFormat: '${dataFormat}'. Please use 'NHWC'.`);
  }
  const out =
    backend.makeOutput(convInfo.outShape, 'float32');
  const outId =
    backend.dataIdMap.get(out.dataId).id;
  if (preluActivationWeightsId == null) {
    wasmFusedConv2d(xId, batchSize, inHeight, inWidth, filterId, filterHeight, filterWidth,
     biasId, padTop, padRight, padBottom, padLeft, isSamePad,
     dilationHeight, dilationWidth, strideHeight, strideWidth,
     inputChannels, outputChannels,
     preluActivationWeightsId, leakyreluAlpha || 0, outId);
  } else {
    wasmFusedConv2d(xId, batchSize, inHeight, inWidth, filterId, filterHeight, filterWidth,
     biasId, padTop, padRight, padBottom, padLeft, isSamePad,
     dilationHeight, dilationWidth, strideHeight, strideWidth,
     inputChannels, outputChannels,
     preluActivationWeightsId, leakyreluAlpha || 0, outId);
  }

export const fusedConv2DConfig:
    KernelConfig = {
      kernelName: FusedConv2D,
      backendName: 'wasm',
      setupFunc: setup,
      kernelFunc:
        fusedConv2d as {} as KernelFunc
    };
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* \n
=============================================================================

*/

import {backend_util, FusedDepthwiseConv2D, FusedDepthwiseConv2DAttrs,
FusedDepthwiseConv2DInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {FusableActivation} from './types';

let wasmFusedDepthwiseConv2d:
    (xId: number, batchSize: number, inputHeight: number, inputWidth: number,
    filterId: number, filterHeight: number, filterWidth: number,
    biasId: number, padTop: number, padRight: number, padBottom: number,
    padLeft: number, isSamePad: number, dilationHeight: number,
    dilationWidth: number, strideHeight: number, strideWidth: number,
    inputChannels: number, outputChannels: number, activation: number,
    preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>
    void;

function setup(backend: BackendWasm) {
  wasmFusedDepthwiseConv2d =
    backend.wasm.cwrap(FusedDepthwiseConv2D, null /* void */,
    [ 'number',  // xId
      'number',  // batchSize
      'number',  // inputHeight
      'number',  // inputWidth
      'number',  // filterId
      'number',  // filterHeight
      'number',  // filterWidth
      'number',  // biasId
      'number',  // padTop
      'number',  // padRight
      'number',  // padBottom
      'number',  // padLeft
      'number',  // isSamePad
      'number',  // dilationHeight
      'number',  // dilationWidth
      'number',  // strideHeight
      'number',  // strideWidth
      'number',  // inputChannels
      'number',  // outputChannels
      'number',  // activation
      'number',  // leakyreluAlpha
      'number',  // outId
    ]);}

function fusedDepthwiseConv2d(args: {
  inputs: FusedDepthwiseConv2DInputs,
  backend: BackendWasm,
  attrs: FusedDepthwiseConv2DAttrs
}) {
  const {inputs, attrs, backend} = args;
  const {x, filter, bias,
    preluActivationWeights} = inputs;
  const {
    strides,
    pad,
    dilations,
    dataFormat,
    dimRoundingMode,
    activation,
    leakyreluAlpha
  } = attrs;

  const convInfo =
    backend_util.computeConv2DInfo(
      (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,
      pad, dimRoundingMode, true /* depthwise */);

  const fusedActivation =
    FusableActivation[activation as {} as keyof typeof FusableActivation];
  if (fusedActivation == null) {
    throw new Error(`FusedDepthwiseConv2D - activation not yet supported for FusedDepthwiseConv2D in the wasm backend.`);
  }

  const xId =
    backend.dataIdMap.get(x.dataId).id;
  const filterId = backend.dataIdMap.get(filter.dataId).id;

  const outputChannels = convInfo.outputChannels;
  const biasId = 0;
  if (bias != null) {
    const biasData =
      backend.dataIdMap.get(bias.dataId);
    if (biasData.shape.length !== 1) {
      throw new Error(`FusedDepthwiseConv2D only supports rank-1 bias but got `$ + biasData.shape.length + `.`);
    }
    if (biasData.shape[0] !== outputChannels) {
      throw new Error(`FusedDepthwiseConv2D bias shape ($biasData.shape) does not match the number of output channels ($outputChannels)`.);
    }
    biasId = biasData.id;
  }

  const filterHeight = convInfo.filterHeight;
  const filterWidth = convInfo.filterWidth;
  const padTop = convInfo.padTop;
  const padRight = convInfo.padRight;
  const padBottom = convInfo.padBottom;
  const padLeft = convInfo.padLeft;
  const dilationHeight = convInfo.dilationHeight;
  const dilationWidth = convInfo.dilationWidth;
  const strideHeight = convInfo.strideHeight;
  const strideWidth = convInfo.strideWidth;

  let outId = 0;
  if (dataFormat !== 'NHWC') {
    throw new Error(`wasm backend FusedDepthwiseConv2D does not support dataFormat:'` +
      dataFormat'. Please use 'NHWC'.`);
  }

  const out =
    backend.makeOutput(convInfo.outShape, 'float32');
  const outId = backend.dataIdMap.get(out.dataId).id;
  const preluActivationWeightsId = preluActivationWeights == null ?
    0 :
    backend.dataIdMap.get(preluActivationWeights.dataId).id;
  const isSamePad = convInfo.type === 'SAME' ? 1 : 0;
  const batchSize =
    backend.batchSize;
  const inHeight = convInfo.inHeight;
  const inWidth = convInfo.inWidth;

  if (dataFormat !== 'NHWC') {
    throw new Error(`wasm backend FusedDepthwiseConv2D does not support dataFormat:` +
      `$dataFormat`. Please use 'NHWC'`.);
  }

  return out;
}

export const fusedDepthwiseConv2DConfig: KernelConfig = {
  kernelName: FusedDepthwiseConv2D,
  backendName:

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import {gather_util, GatherNd, GatherNdInputs, KernelConfig, TensorInfo} from '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';
import {CppDType} from './types';

let wasmGatherNd: (
    xId: number, dtype: CppDType, indicesId: number, numSlices: number, sliceRank: number, sliceSize: number, strides: Uint8Array, outId: number) =>
    void;

function setup(backend: BackendWasm): void {
  wasmGatherNd = backend.wasm.cwrap(GatherNd, null /*void*/, 
    ['number',  // xId
     'number',  // dtype
     'number',  // indicesId
     'number',  // numSlices
     'number',  // sliceRank
     'number',  // sliceSize
     'array',   // strides
     'number'   // outId
  ]);}

function gatherNd(args: {backend: BackendWasm, inputs: GatherNdInputs}): TensorInfo {
  const {backend, inputs} = args;
  const {params, indices} = inputs;

  const [resultShape, numSlices, sliceSize, strides] =
      gather_util.prepareAndValidate(params, indices);

  const out = backend.makeOutput(resultShape, params.dtype);
  if (numSlices === 0) {
    return out;
  }

  const indicesShape = indices.shape;
  const sliceRank = indicesShape[indicesShape.length - 1];

  const xData = backend.dataIdMap.get(params.dataId);
  const xId = xData.id;
  const indicesData = backend.dataIdMap.get(indices.dataId);
  const indicesId = indicesData.id;

  const stridesBytes = new Uint8Array(new Int32Array(strides).buffer);

  const outId = backend.dataIdMap.get(out.dataId).id;

  wasmGatherNd(
      xId, CppDType[params.dtype], indicesId, numSlices, sliceRank, sliceSize,
      stridesBytes, outId);

  return out;
}

export const gatherNdConfig: KernelConfig = {
  kernelName: GatherNd,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: gatherNd
};
shapeInfo.outerSize, shapeInfo.dimSize
\n const indicesSize = util.sizeFromShape(indices.shape);
\n const flattenIndex = reshape({\n    inputs: {x: indices}, \n    attrs: {shape: [shapeInfo.batchSize, indicesSize / shapeInfo.batchSize]}, \n    backend \n  });
\n const flattenOutputShape = [\n    shapeInfo.batchSize, shapeInfo.outerSize, indicesSize / shapeInfo.batchSize, \n    shapeInfo.sliceSize \n  ];
\n const out = backend.makeOutput(flattenOutputShape, x.dtype);
\n if (util.sizeFromShape(x.shape) === 0) { \n    return out; \n  }
\n const stridesSize = flattenX.shape.length - 1;
\n const xData = backend.dataIdMap.get(flattenX.dataId);
\n const xId = xData.id;
\n const indicesData = backend.dataIdMap.get(flattenIndex.dataId);
\n const indicesId = indicesData.id;
\n const outId = backend.dataIdMap.get(out.dataId).id;
\n backend.disposeData(flattenX.dataId);
\n backend.disposeData(flattenIndex.dataId);
\n // reshape out.shape = shapeInfo.outputShape;
\n return out;
\n } \n\n export const gatherV2Config: KernelConfig = { \n    kernelName: GatherV2, \n    backendName: 'wasm', \n    setupFunc: setupFunc, \n    kernelFunc: gatherV2 as {} as KernelFunc \n};
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import {Greater, KernelConfig} from '@tensorflow/tfjs-core';
import {createBinaryKernelConfig} from './binary_kernel';

const supportsFullBroadcast = false;
export const greaterConfig: KernelConfig = createBinaryKernelConfig(Greater, supportsFullBroadcast, 'bool');

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import {GreaterEqual, KernelConfig} from '@tensorflow/tfjs-core';
import {createBinaryKernelConfig} from './binary_kernel';

const supportsFullBroadcast = false;
export const greaterEqualConfig: KernelConfig = createBinaryKernelConfig(GreaterEqual, supportsFullBroadcast, 'bool');

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import {KernelConfig, KernelFunc, LeakyRelu, LeakyReluAttrs, LeakyReluInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {CppDType} from './types';

let wasmFunc: (xId: number, dtype: number, leakyreluAlpha: number, outId: number) => void;

function setupFunc(backend: BackendWasm): void {
  wasmFunc = backend.wasm.cwrap(LeakyRelu, null /* void */, 
    ['number',  // x_id
    'number',  // dtype
    'number',  // leakyrelu_alpha
    'number',  // out_id
  ]);\n
  backend.disposeData(flattenX.dataId);
  backend.disposeData(flattenIndex.dataId);
  backend.disposeData(flattenOutputShape.dataId);
  // reshape out.shape = shapeInfo.outputShape;
  return out;
\n}
TensorInfo {
  const {inputs: [x], attrs: {alpha}, backend} = args;
  const xId = backend.dataIdMap.get(x.dataId).id;
  // According to TF API, LeakyRelu returns float32 when input is either
  // float32 or int32.
  const outId = backend.dataIdMap.get(out.dataId).id;
  wasmFunc(xId, CppDType[x.dtype], alpha, outId);
} return out;

export const leakyReluConfig: KernelConfig = {
  kernelName: LeakyRelu,
  backendName: 'wasm',
  setupFunc,
  kernelFunc: leakyRelu as {} as KernelFunc,
};
software

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=============================================================================

*/

import {backend_util, KernelConfig, KernelFunc, Max, MaxAttrs, MaxInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {CppDType} from './types';

let wasmMax: (xId: number, dtype: number, reduceSize: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmMax = backend.wasm.cwrap(Max, null /*void*/, [
    'number',  // x_id
    'number',  // dtype
    'number',  // reduce_size
    'number',  // out_id
  ]);}

function max(args: {backend: BackendWasm, inputs: MaxInputs, attrs: MaxAttrs}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {reductionIndices: axis, keepDims} = attrs;
  const {x} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  let inputId = xId;
  let input = x;

  const {transposed, axes, originalAxes, inputWasTransposed} = permuteAxesAndTranspose(x, axis, backend);

  if (inputWasTransposed) {
    const transposedId = backend.dataIdMap.get(transposed.dataId).id;
    input = transposed;
    inputId = transposedId;
  }

  const inputRank = input.shape.length;
  backend_util.assertAxesAreInnerMostDims('max', axes, inputRank);
  const [outShape, reduceShape] = backend_util.computeOutAndReduceShapes(input.shape, axes);
  const reduceSize = util.sizeFromShape(reduceShape);

  const out = backend.makeOutput(outShape, x.dtype);
  if (util.sizeFromShape(input.shape) !== 0) {
    const outId = backend.dataIdMap.get(out.dataId).id;
    wasmMax(inputId, CppDType[x.dtype], reduceSize, outId);
  }

  if (inputWasTransposed) {
    // dispose of the transposed tensor.
    backend.disposeData(transposed.dataId);
  }

  if (keepDims) {
    // reshape
    const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);
    out.shape = newShape;
  }

  return out;
}

export const maxConfig: KernelConfig = {
  kernelName: Max,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: max as {} as KernelFunc
};

*/

import {KernelConfig, Maximum} from '@tensorflow/tfjs-core';

const supportsFullBroadcast = false;
export const maximumConfig: KernelConfig = createBinaryKernelConfig(Maximum, supportsFullBroadcast);

*/

import {backend_util, KernelConfig, KernelFunc, MaxPool, MaxPoolAttrs, MaxPoolInputs, Tensor4D, util} from '@tensorflow/tfjs-core';

let wasmMaxPool: (xId: number, batchSize: number, inputHeight: number, inputWidth: number, filterHeight: number, filterWidth: number, padTop: number, padRight: number, padBottom: number, padLeft: number, dilationHeight: number, dilationWidth: number, strideHeight: number, strideWidth: number, inputChannels: number, outputChannels: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmMaxPool = backend.wasm.cwrap(MaxPool, null /*void*/, [
    'number',  // x_id
    'number',  // batchSize
    'number',  // inputHeight
    'number',  // inputWidth
    'number',  // filterHeight
    'number',  // filterWidth
    'number',  // padTop
    'number',  // padRight
    'number',  // padBottom
    'number',  // padLeft
    'number',  // dilationHeight
    'number',  // dilationWidth
    'number',  // strideHeight
    'number',  // strideWidth
    'number',  // inputChannels
    'number',  // outputChannels
    'number',  // outId
  ]);}}

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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// function maxPool\n(args: {inputs: MaxPoolInputs, backend: BackendWasm, attrs: MaxPoolAttrs}) {\n  const {inputs, attrs, backend} = args;\n  const x = inputs.x as Tensor4D;\n  const xId = backend.dataIdMap.get(x.dataId).id;\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\n  // backend instead of at core op\n  // level.\n  // /n // TODO: add support for int32 input.\n  // util.assert(x.dtype == 'float32', () => '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(x.shape, filterSize, strides, 1 /* dilations */, pad, dimRoundingMode);\n  \n  const out = backend.makeOutput(convInfo.outShape, 'float32');\n  const outId = backend.dataIdMap.get(out.dataId).id;\n  \n  wasmMaxPool(xId, x.shape[0], x.shape[1], x.shape[2], filterHeight, filterWidth, padTop, padRight, padBottom, padLeft, dilationHeight, dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels, outId);\n  return out;\n}
let castedInput = input; if (input.dtype !== 'float32') {
  castedInput = cast({backend, inputs: {x: input}, attrs: {dtype: 'float32'}});
}

let castedInput = input;
if (input.dtype !== 'float32') {
  castedInput = cast({backend, inputs: {x: input}, attrs: {dtype: 'float32'}});
  inputId = backend.dataIdMap.get(castedInput.dataId);
} else {
  const outId = backend.dataIdMap.get(out.dataId);
}

wasmMean(inputId, reduceSize, outId);
}

const out = backend.makeOutput(outShape, 'float32');
if (util.sizeFromShape(input.shape) !== 0) {
  const outId = backend.dataIdMap.get(out.dataId);
  wasmMean(inputId, reduceSize, outId);
}

if (inputWasTransposed) {
  // dispose of the transposed tensor.
  backend.disposeData(transposed.dataId);
}

if (keepDims) {
  const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);
  out.shape = newShape;
}

wasmMean(inputId, reduceSize, outId);
}

if (inputWasTransposed) {
  // dispose of the transposed tensor.
  backend.disposeData(transposed.dataId);
}

if (keepDims) {
  // reshape
  const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);
  out.shape = newShape;
}

wasmMean(inputId, reduceSize, outId);
}

export const meanConfig: KernelConfig = {
  kernelName: Mean,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: mean as {} as KernelFunc
};

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 */

import {backend_util, KernelConfig, TensorInfo, util} from '@tensorflow/tfjs-core';

import {permuteAxesAndTranspose} from './kernel_utils';
import {CppDType} from './types';

let wasmMin: (xId: number, dtype: number, reduceSize: number, outId: number) => void

function setup(backend: BackendWasm): void {
  wasmMin = backend.wasm.cwrap(Min, null /*void*/, [
    'number',  // x_id
    'number',  // dtype
    'number',  // reduce_size
    'number',  // out_id
  ]);}

function min(args: {backend: BackendWasm, inputs: MinInputs, attrs: MinAttrs}):
    TensorInfo {
  const {backend, inputs, attrs} = args;
  const {axis, keepDims} = attrs;
  const {x} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  let inputId = xId;
  let input = x;

  const {transposed, axes, originalAxes, inputWasTransposed} =
  permuteAxesAndTranspose(x, axis, backend);

  if (inputWasTransposed) {
    const transposedId = backend.dataIdMap.get(transposed.dataId);
    if (transposedId !== xId) {
      // transpose was not a no-op. We
      // will need to dispose of this
      // once we are done.
      input = transposed;
      inputId = transposedId;
    }
  }

  const inputRank = input.shape.length;
  backend_util.assertAxesAreInnerMostDims('min', axes, inputRank);
  const [outShape, reduceShape] =
  backend_util.computeOutAndReduceShapes(input.shape, axes);
  const reduceSize = util.sizeFromShape(reduceShape);
  const out = backend.makeOutput(out.shape, input.dtype);
}

export const minimumConfig: KernelConfig =

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 */

import {KernelConfig, Minimum} from '@tensorflow/tfjs-core';

import {createBinaryKernelConfig} from './binary_kernel';
const supportsFullBroadcast = false;
export const minimumConfig: KernelConfig =

*
createBinaryKernelConfig

import {KernelConfig, KernelFunc, MirrorPad, MirrorPadInputs} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

const supportsFullBroadcast = true;

const negConfig = createUnaryKernelConfig(Neg);

const multiplyConfig = createBinaryKernelConfig(Multiply, supportsFullBroadcast);

export const multiplyConfig: KernelConfig = multiplyConfig;

export const negConfig: KernelConfig = negConfig;
import {BackendWasm} from '../backend_wasm';

// Analogous to `struct Result` in `non_max_suppression_impl.h`.
interface Result {
  pSelectedIndices: number;
  selectedSize: number;
  pSelectedScores: number;
  pValidOutputs: number;
}

/**
 * Parse the result of the c++ method, which has the shape equivalent to:
 * `Result` export function parseResultStruct(backend: BackendWasm, resOffset: number): Result {
  const result = new Int32Array(backend.wasm.HEAPU8.buffer, resOffset, 4);
  const pSelectedIndices = result[0];
  const selectedSize = result[1];
  const pSelectedScores = result[2];
  const pValidOutputs = result[3];
  // Since the result was allocated on the heap, we have to delete it.
  backend.wasm._free(resOffset);
  return {
    pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs};
}

let wasmFunc: (boxesId: number, scoresId: number, maxOutputSize: number, iouThreshold: number, scoreThreshold: number) => number;

function setup(backend: BackendWasm): void {
  wasmFunc = backend.wasm.cwrap(NonMaxSuppressionV3,
      'number',  // Result*
      ['number',  // boxesId
       'number',  // scoresId
       'number',  // maxOutputSize
       'number',  // iouThreshold
       'number',  // scoreThreshold
      ]);}

function kernelFunc(args: {
  backend: BackendWasm,
  inputs: NonMaxSuppressionV3Inputs,
  attrs: NonMaxSuppressionV3Attrs
}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {iouThreshold, maxOutputSize, scoreThreshold} = attrs;
  const {boxes, scores} = inputs;

  const boxesId = backend.dataIdMap.get(boxes.dataId).id;
  const scoresId = backend.dataIdMap.get(scores.dataId).id;

  const resOffset = wasmFunc(boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold);

  const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} = parseResultStruct(backend, resOffset);

  // Since we are not using scores for V3, we have to delete it from the heap.
  backend.wasm._free(pSelectedScores);

  const selectedIndicesTensor = backend.makeOutput([selectedSize], 'int32', pSelectedIndices);

  return selectedIndicesTensor;
}

export const nonMaxSuppressionV3Config: KernelConfig = {
  kernelName: NonMaxSuppressionV3,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc as {} as KernelFunc,
};

============================================================================
import {KernelConfig, KernelFunc, NonMaxSuppressionV4, NonMaxSuppressionV4Inputs, TensorInfo} from '@tensorflow/tfjs-core';
import {BackendWasm} from './backend_wasm';

let wasmFunc: Function = backend.wasm.cwrap(NonMaxSuppressionV4, 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number');

function setup(backend: BackendWasm): void {
  wasmFunc = backend.wasm.cwrap(NonMaxSuppressionV4, 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number');
}

  const {backend, inputs, attrs} = args;
  const {iouThreshold, maxOutputSize, scoreThreshold, padToMaxOutputSize} = inputs;
  const boxesId = backend.dataIdMap.get(boxes.dataId).id;
  const scoresId = backend.dataIdMap.get(scores.dataId).id;
  const resOffset = wasmFunc(boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold, padToMaxOutputSize);
  const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} = parseResultStruct(backend, resOffset);
  // Since we are not using scores for V4, we have to delete it from the heap.
  backend.wasm._free(pSelectedScores);
  const selectedIndicesTensor = backend.makeOutput([selectedSize], 'int32', pSelectedIndices);
  const validOutputsTensor = backend.makeOutput([], 'int32', pValidOutputs);
  return [selectedIndicesTensor, validOutputsTensor];
}

export const nonMaxSuppressionV4Config: KernelConfig = {
  kernelName: NonMaxSuppressionV4,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: nonMaxSuppressionV4
};

import {TensorInfo} from '@tensorflow/tfjs-core';

let wasmFunc: Function = backend.wasm.cwrap(NonMaxSuppressionV5, 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number');

function setup(backend: BackendWasm): void {
  wasmFunc = backend.wasm.cwrap(NonMaxSuppressionV5, 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number');
}

function kernelFunc(args: {backend: BackendWasm, inputs: NonMaxSuppressionV5Inputs, attrs: NonMaxSuppressionV5Attrs}): TensorInfo[] {
  const {backend, inputs, attrs} = args;
  const {iouThreshold, maxOutputSize, scoreThreshold, softNmsSigma} = attrs;
  const {boxes, scores} = inputs;
  const boxesId = backend.dataIdMap.get(boxes.dataId).id;
  const scoresId = backend.dataIdMap.get(scores.dataId).id;
  const resOffset = wasmFunc(boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold, softNmsSigma);
  const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} = parseResultStruct(backend, resOffset);
  // Since we are not using validOutputs for V5, we have to delete it from the heap.
  backend.wasm._free(pValidOutputs);
  const selectedIndicesTensor = backend.makeOutput([selectedSize], 'int32', pSelectedIndices);
  const selectedScoresTensor = backend.makeOutput([selectedSize], 'float32', pSelectedScores);
  return [selectedIndicesTensor, selectedScoresTensor];
}

export const nonMaxSuppressionV5Config: KernelConfig = {
  kernelName: NonMaxSuppressionV5,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: kernelFunc
};
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=============================================================================

*/
import {KernelConfig, NotEqual} from '@tensorflow/tfjs-core';

import {createBinaryKernelConfig} from './binary_kernel';

const supportsFullBroadcast = false;
export const notEqualConfig: KernelConfig =
createBinaryKernelConfig(NotEqual, supportsFullBroadcast, 'bool');

/*=============================================================================

import {KernelConfig, KernelFunc, OneHot, OneHotAttrs, OneHotInputs} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmOneHot: (indicesId: number, depth: number, onValue: number, offValue: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmOneHot = backend.wasm.cwrap(OneHot, null /* void */, 
    ['number',  // indices_id
     'number',  // depth,
     'number',  // onValue
     'number',  // offValue
     'number'   // out_id
    ]);
}

function oneHot(
    args: {inputs: OneHotInputs, attrs: OneHotAttrs, backend: BackendWasm}) {
  const {inputs, backend, attrs} = args;
  const {indices} = inputs;
  const {depth, onValue, offValue} = attrs;

  const out = backend.makeOutput(
  [...indices.shape, depth], 'int32');
  const outId = backend.dataIdMap.get(out.dataId).id;

  const indicesData = backend.dataIdMap.get(indices.dataId);
  const indicesId = indicesData.id;

  wasmOneHot(indicesId, depth, onValue, offValue, outId);

  return out;
}

export const oneHotConfig:
KernelConfig = {
  kernelName: OneHot,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: oneHot as {} as KernelFunc,
};

/*=============================================================================

import {KernelConfig, KernelFunc, OnesLike, OnesLikeInputs} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

function onesLike(args: {inputs: OnesLikeInputs, backend: BackendWasm}) {
  const {inputs: {x}, backend} = args;
  const out = backend.makeOutput(x.shape, x.dtype);

  const outVals = backend.typedArrayFromHeap(out);
  outVals.fill(1);
  return out;
}

export const onesLikeConfig: KernelConfig = {
  kernelName: OnesLike,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: onesLike as {} as KernelFunc,
};

/*=============================================================================
import {KernelConfig, KernelFunc, Pack, PackAttrs, PackInputs, TensorInfo, util} from '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';
import {expandDims} from '../ExpandDims';

export function pack(
    args: {inputs: PackInputs, backend: BackendWasm, attrs: PackAttrs}): TensorInfo {
  const {inputs, backend, attrs} = args;
  const {axis} = attrs;

  if (inputs.length === 1) {
    return expandDims(
        {inputs: {input: inputs[0]}, backend, attrs: {dim: axis}});
  }

  const shape = inputs[0].shape;
  const dtype = inputs[0].dtype;

  inputs.forEach(t => {
    util.assertShapesMatch(
        shape, t.shape,
        'All tensors passed to stack must have matching shapes');
    util.assert(
        dtype === t.dtype,
        () => 'All tensors passed to stack must have matching dtypes');
  });

  const intermediateTensorInfos: TensorInfo[] = [];
  const expandedTensors = inputs.map(t => {
    const expandedT =
        expandDims({inputs: {input: t}, backend, attrs: {dim: axis}});
    intermediateTensorInfos.push(expandedT);
    return expandedT;
  });

  const result = concat({inputs: expandedTensors, backend, attrs: {axis}});
  intermediateTensorInfos.forEach(t =>
    backend.disposeData(t.dataId));
  return result;
}

export const packConfig: KernelConfig = {
  kernelName: Pack,
  backendName: 'wasm',
  kernelFunc: pack as {} as KernelFunc
};

import {KernelConfig, KernelFunc, PadV2, PadV2Attrs, PadV2Inputs, util} from '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';
import {Fill} from './Fill';
import {CppDType} from './types';

let wasmPadV2: (xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype: number,
    prePaddingsBytes: Uint8Array, postPaddingsBytes: Uint8Array,
    constantValue: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmPadV2 = backend.wasm.cwrap(PadV2, null /* void */, 
      ['number', // xId
       'array', // xShapeBytes
       'number', // xShapeLength
       'number', // xDtype
       'array', // prePaddingsBytes
       'array', // postPaddingsBytes
       'number', // constantValue
       'number']);
}

function pad(
    args: {inputs: PadV2Inputs, backend: BackendWasm, attrs: PadV2Attrs}) {
  const {inputs: {x}, backend, attrs: {paddings, constantValue}} = args;
  const outShape = paddings.map((p, i) =>
      x.shape[i] + p[0] /* beforePad */ + p[1] /* afterPad */);
  const xId = backend.dataIdMap.get(x.dataId).id;
  const out = backend.makeOutput(outShape, x.dtype);
  const outTensorData = backend.dataIdMap.get(out.dataId);
  const outId = outTensorData.id;
  const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);
  const prePaddingsFlat = paddings.map((p, i) => p[i]);
  const postPaddingsFlat = paddings.map((p, i) => p[i]);
  wasmPadV2(xId, xShapeBytes, x.shape.length, CppDType[x.dtype], prePaddingsFlat, postPaddingsFlat, constantValue, outId);
  return out;
}

export const padV2Config: KernelConfig = {
  kernelName: PadV2,
  backendName: 'wasm',
  kernelFunc: pad as {} as KernelFunc,
  setupFunc: setup
};

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============================================================================
*/
import {KernelConfig, Pow} from '@tensorflow/tfjs-core';

import {createBinaryKernelConfig} from
'binary_kernel';
const supportsFullBroadcast = false;

export const powConfig: KernelConfig =
createBinaryKernelConfig(Pow, supportsFullBroadcast);

*/

import {KernelConfig, KernelFunc, Prelu, PreluInputs} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {cast} from './Cast';

let wasmPrelu: (xId: number,
weightsId: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmPrelu =
backend.wasm.cwrap(Prelu, null /*void*/,
['number', 'number', 'number']);
}

function prelu(args: {
  inputs: PreluInputs,
  backend: BackendWasm
}) {
  const {inputs, backend} = args;
  const {x, alpha} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  const weightsId =
backend.dataIdMap.get(alpha.dataId).id;
  let inputId = xId;
  let input = x;
  let castedInput = input;
  if (input.dtype !== 'float32') {
    castedInput = cast({backend, inputs: {x}, attrs: {dtype: 'float32'}});
    inputId =
backend.dataIdMap.get(castedInput.dataId).id;
  }
  const out = backend.makeOutput(x.shape, 'float32');
  const outId = backend.dataIdMap.get(out.dataId).id;
  wasmPrelu(inputId, weightsId, outId);
  if (input.dtype !== 'float32') {
    backend.disposeData(castedInput.dataId);
  }
  return out;
}

export const preluConfig:
KernelConfig = {
  kernelName: Prelu,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: prelu as {} as KernelFunc
};

*/

import {backend_util, KernelConfig, KernelFunc, Prod, ProdAttrs, ProdInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {permuteAxesAndTranspose} from './kernel_utils';

import {CppDType} from './types';

let wasmProd: (
  xId: number,
reduceSize: number,
dtype: number, outId: number) => void;

function setup(backend:
BackendWasm): void {
  wasmProd =
backend.wasm.cwrap(Prod, null /*void*/,
['number',
'number',
'number',
'number']);
}

function prod(args: {
  backend: BackendWasm,
  inputs: ProdInputs,
  attrs: ProdAttrs
}) {
  const {backend, inputs, attrs} = args;
  const {axis, keepDims} = attrs;
  const {x} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  let inputId = xId;
  let input = x;
  let transposed = false;
  const [transposedAxes, originalAxes] =
      permuteAxesAndTranspose(x, axis, backend);
  const reductionAxes = axes;
  if (inputWasTransposed) {
    input = transposed;
    inputId = transposedId;
  }
  if (inputWasTransposed) {
    // transpose was not a no-op. We will need to dispose of this
    // once we are done.
    backend_util.disposeData(x.dataId);
    const prod = backend.makeOutput(x.shape, 'float32');
    prodId = backend.dataIdMap.get(prod.dataId).id;
    if (prodId !== xId)
      // transpose was not a no-op. We will need to dispose of this
      // once we are done.
    input = transposed;
    inputId = transposedId;
  }

  const prod = backend.makeOutput(x.shape, 'float32');
  prodId = backend.dataIdMap.get(prod.dataId).id;
  if (prodId !== xId)
    // transpose was not a no-op. We will need to dispose of this
    // once we are done.
  input = transposed;
  inputId = transposedId;

  const reductionAxes = backend_util.getInnerMostAxes
  reductionAxes.length, input.shape.length);
  const prod = backend.makeOutput(outputShape, 'float32');
  const prodId = backend.dataIdMap.get(prod.dataId).id;
  if (prodId !== xId)
    // transpose was not a no-op. We will need to dispose of this
    // once we are done.
  input = transposed;
  inputId = transposedId;
(util.sizeFromShape(input.shape) !== 0) {
    const outId = backend.dataIdMap.get(out.dataId);
    wasmProd(inputId, reduceSize, CppDType[out.dtype], outId);
}

if (inputWasTransposed) {
    // dispose of the transposed tensor.
    backend.disposeData(transposed.dataId);
}

if (keepDims) {
    // reshape
    const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);
    out.shape = newShape;
}

return out;
}

export const prodConfig: KernelConfig = {
    kernelName: Prod,
    backendName: 'wasm',
    setupFunc: setup,
    kernelFunc: prod as {} as KernelFunc
};

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 *
 *=============================================================================
 */

import {KernelConfig, KernelFunc, Range, RangeAttrs, TensorInfo} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';
import {rangeImplCPU} from '../kernel_utils/shared';

export const range =
    (args: {backend: BackendWasm, attrs: RangeAttrs}): TensorInfo => {
        const {backend, attrs} = args;
        const {start, stop, step, dtype} = attrs;
        const values = rangeImplCPU(start, stop, step, dtype);

        const out = backend.makeOutput([values.length], dtype);
        const outVals = backend.typedArrayFromHeap(out);
        outVals.set(values);
        return out;
    };

export const rangeConfig:
    KernelConfig = {
        kernelName: Range,
        backendName: 'wasm',
        setupFunc: range as {} as KernelFunc
};

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 *
 *=============================================================================
 */
import { util } from '@tensorflow/tfjs-core';
export function rangeImpl(start, stop, step, dtype) {
    const sameStartStop = start === stop;
    const increasingRangeNegativeStep = start < stop && step < 0;
    const decreasingRangePositiveStep = stop < start && step > 0;
    if (sameStartStop || increasingRangeNegativeStep || decreasingRangePositiveStep) {
        return util.makeZerosTypedArray(0, dtype);
    }
    const numElements = Math.abs(Math.ceil((stop - start) / step));
    const values = util.makeZerosTypedArray(numElements, dtype);

    if (stop < start && step === 1) {
        // Adjust if step's sign hasn't been set (or was set to 1)
        step = -1;
    }
    values[0] = start;
    for (let i = 1; i < values.length; i++) {
        values[i] = values[i - 1] + step;
    }
    return values;
}

sourceMappingURL=data:application/json;base64,eyJ2ZXJzaW9uIjozLCJmaWxlIjoiUmFuZ2VfaW1wb3J0aWNhbW5ja2VuZC50cyIsInNvdXJjZVJvb3QiOiIiLCJzb3VyY2VzIjoiVmhvdGVfZm9ybDB0IiwiaWQiOiJlZGluZ3V0cyIsImZpdCI6WyJzdGFibGUuMC5zLmFkZGFuZ3V0cy50cyJdLCJuYW1lcyI6Iiwib3BcIjoiZ2VuZ3V0cyJ9

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 *
=============================================================================
*/

import {KernelConfig, RealDiv} from '@tensorflow/tfjs-core';

import {createBinaryKernelConfig} from './binary_kernel';
supportsFullBroadcast = true;
export const realDivConfig: KernelConfig = createBinaryKernelConfig(RealDiv, supportsFullBroadcast);
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=============================================================================

*/

import {KernelConfig, Relu} from '@tensorflow/tfjs-core';

export const reluConfig: KernelConfig = createUnaryKernelConfig(Relu);

/*=============================================================================

*/

import {KernelConfig, Relu6} from '@tensorflow/tfjs-core';

export const relu6Config: KernelConfig = createUnaryKernelConfig(Relu6);

/*=============================================================================

*/

import {KernelConfig, KernelFunc, ResizeBilinear, ResizeBilinearAttrs, ResizeBilinearInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {cast} from './Cast';

function setup(backend: BackendWasm): void {
  wasmResizeBilinear = backend.wasm.cwrap(ResizeBilinear, null /*void*/, [
    'number',  // xId
    'number',  // batch
    'number',  // oldHeight
    'number',  // oldWidth
    'number',  // numChannels
    'number',  // newHeight
    'number',  // newWidth
    'number',  // alignCorners
    'number',  // halfPixelCenters
    'number'   // outId
  ]);
}

function resizeBilinear(args: {
  backend: BackendWasm,
  inputs: ResizeBilinearInputs,
  attrs: ResizeBilinearAttrs
}): TensorInfo {
  const {backend, inputs, attrs} = args;

  const {images} = inputs;
  const {alignCorners, halfPixelCenters, size} = attrs;
  const [newHeight, newWidth] = size;

  const [batch, oldHeight, oldWidth, numChannels] = images.shape;
  const outShape = [batch, newHeight, newWidth, numChannels];

  let xData = backend.dataIdMap.get(images.dataId);
  let castedData;
  if (xData.dtype !== 'float32') {
    castedData =
      cast({backend: BackendWasm, inputs: {x: images}, attrs: {dtype: 'float32'}});
    xData = backend.dataIdMap.get(castedData.dataId);
  }
  const xId = xData.id;

  const out = backend.makeOutput(outShape, 'float32');
  if (util.sizeFromShape(images.shape) === 0) {
    return out;
  }

  const outId = backend.dataIdMap.get(out.dataId).id;
  const wasmResizeBilinear = backend.wasm.cwrap(ResizeBilinear, null /*void*/, [
    'number',  // xId
    'number',  // batch
    'number',  // oldHeight
    'number',  // oldWidth
    'number',  // numChannels
    'number',  // newHeight
    'number',  // newWidth
    'number',  // alignCorners
    'number',  // halfPixelCenters
    'number'   // outId
  ]);

  wasmResizeBilinear(xId, batch, oldHeight, oldWidth, numChannels, newHeight, newWidth, alignCorners ? 1 : 0, halfPixelCenters ? 1 : 0, outId);

  if (castedData != null) {
    backend.disposeData(castedData.dataId);
  }

  return out;
}

export const resizeBilinearConfig: KernelConfig = {
  kernelName: ResizeBilinear,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: resizeBilinear
};
import {KernelConfig, KernelFunc, Reverse, ReverseAttrs, ReverseInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {identity} from './Identity';
import {reshape} from './Reshape';

let wasmReverse: (xId: number, axes: Uint8Array, axesLength: number, outShape: Uint8Array, outShapeLength: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmReverse = backend.wasm.cwrap(Reverse, null, ['number', // x_id
    'array', // axes
    'number', // axes_length
    'array', // out_shape
    'number', // out_shape_length
    'number' // out_id
  ]);}

export function reverse(args: {inputs: ReverseInputs, backend: BackendWasm, attrs: ReverseAttrs}):
    TensorInfo {
  const {inputs, backend, attrs} = args;
  const {x} = inputs;
  const {dims} = attrs;

  const axes = util.parseAxisParam(dims, x.shape);

  if (x.shape.length === 0) {
    return identity({inputs: {x}, backend});
  }

  const out = backend.makeOutput(x.shape, x.dtype);
  const xId = backend.dataIdMap.get(x.dataId).id;
  const outId = backend.dataIdMap.get(out.dataId).id;

  const axesBytes = new Uint8Array(new Int32Array(axes).buffer);
  const outShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);

  wasmReverse(
      xId, axesBytes, axes.length, outShapeBytes, x.shape.length,
      outId);
  const reshaped =
      reshape({inputs: {x: out}, attrs: {shape: x.shape}, backend});

  backend.disposeData(out.dataId);
  return reshaped;
}

export const reverseConfig: KernelConfig = {
  kernelName: Reverse,
  backendName: 'wasm',
  kernelFunc: reverse as {} as KernelFunc,
  setupFunc: setup
};

import {KernelConfig, KernelFunc, RotateWithOffset, RotateWithOffsetAttrs, RotateWithOffsetInputs, TensorInfo} from '@tensorflow/tfjs-core';
import {backend_util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmRotate: (xId: number, batch: number, imageHeight: number, imageWidth: number, numChannels: number, radians: number, centerX: number, centerY: number, fillBytes: Uint8Array, fillLength: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmRotate = backend.wasm.cwrap(RotateWithOffset, null /* void */, ['number', // xId
    'number', // batch
    'number', // imageHeight
    'number', // imageWidth
    'number', // numChannels
    'number', // radians
    'number', // centerX
    'number', // centerY
    'array', // fillBytes
    'number', // fillLength
    'number' // outId
  ]);}

export function rotateWithOffset(args: {
  inputs: RotateWithOffsetInputs,
  backend: BackendWasm,
  attrs: RotateWithOffsetAttrs
}): TensorInfo {
  const {inputs, backend, attrs} = args;
  const {image} = inputs;
  const {radians, fillValue, center} = attrs;

  const out = backend.makeOutput(image.shape, image.dtype);
  const imageId = backend.dataIdMap.get(image.dataId).id;
  const xId = backend.dataIdMap.get(x.dataId).id;

  const [batch, imageHeight, imageWidth, numChannels] = image.shape;
  const [centerX, centerY] = backend_util.getImageCenter(center, imageHeight, imageWidth);
  const fillIsBlack = fillValue === 0;
  const fullOpacityValue = 255;

  const fillValues = typeof fillValue === 'number' ?
    [fillValue, fillValue, fillValue, fillIsBlack ? 0 : fullOpacityValue] :
    [...fillValue, fullOpacityValue];

  wasmRotate(imageId, batch, imageHeight, imageWidth, numChannels, radians, centerX, centerY, fillBytes, fillValues.length, outId);

  return out;
}

export const rotateWithOffsetConfig: KernelConfig = {
  kernelName: RotateWithOffset,
  backendName: 'wasm',
  kernelFunc: rotateWithOffset as {} as KernelFunc,
  setupFunc: setup
};
```javascript
import {KernelConfig, KernelFunc, Select, SelectInputs, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmSelect: (conditionId: number, tId: number, eId: number, offset: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmSelect = backend.wasm.cwrap('SelectV2', null, ['number', 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number']);
}

function select(args: {inputs: SelectInputs, backend: BackendWasm}) {
  const {inputs, backend} = args;
  const {condition, t, e} = inputs;

  const conditionId = backend.dataIdMap.get(condition.dataId).id;
  const tId = backend.dataIdMap.get(t.dataId).id;
  const eId = backend.dataIdMap.get(e.dataId).id;
  const out = backend.makeOutput(t.shape, t.dtype);
  const outId = backend.dataIdMap.get(out.dataId).id;

  const cRank = condition.shape.length;
  const tRank = t.shape.length;
  const offset = cRank === 0 || cRank > 1 || tRank === 1 ? 1 : util.sizeFromShape(t.shape.slice(1));

  wasmSelect(conditionId, tId, eId, offset, outId);
  return out;
}

export const selectConfig: KernelConfig = {
  kernelName: Select,
  backendName: 'wasm',
  kernelFunc: select as {} as KernelFunc,
  setupFunc: setup
};

import {KernelConfig, Sigmoid, SigmoidInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmFunc: (xId: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmFunc = backend.wasm.cwrap(Sigmoid, null, ['number', 'number']);
}

function sigmoid(args: {backend: BackendWasm, inputs: SigmoidInputs}: TensorInfo) {
  const {backend, inputs: {x}} = args;
  const xId = backend.dataIdMap.get(x.dataId).id;
  const out = backend.dataIdMap.get(x.dataId).id;

  // Short-circuit zero-sized tensors.
  if (util.sizeFromShape(out.shape) === 0) {
    return out;
  }

  wasmFunc(xId, outId);
  return out;
}

export const sigmoidConfig: KernelConfig = {
  kernelName: 'Sigmoid',
  backendName: 'wasm',
  setupFunc: setup as {} as KernelFunc,
  kernelFunc: sigmoid as {} as KernelFunc
};

import {KernelConfig, Sin} from '@tensorflow/tfjs-core';

export const sinConfig: KernelConfig = createUnaryKernelConfig(Sin);

import {KernelConfig, KernelFunc, Softmax, SoftmaxAttrs, SoftmaxInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmFunc: (xId: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmFunc = backend.wasm.cwrap('Softmax', null, ['number', 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number']);
}

function softmax(args: {inputs: SoftmaxInputs, backend: BackendWasm}) {
  const {inputs, backend} = args;
  const {x, t} = inputs;

  const xId = backend.dataIdMap.get(x.dataId).id;
  const tId = backend.dataIdMap.get(t.dataId).id;

  const const outId = backend.dataIdMap.get(out.dataId).id;

  const cRank = x.shape.length;
  const tRank = t.shape.length;
  const offset = cRank === 0 || cRank > 1 || tRank === 1 ? 1 : util.sizeFromShape(x.shape.slice(1));

  wasmFunc(xId, tId, outId);
  return out;
}

export const softmaxConfig: KernelConfig = {
  kernelName: 'Softmax',
  backendName: 'wasm',
  setupFunc: setup as {} as KernelFunc,
  kernelFunc: softmax as {} as KernelFunc
};
```

---

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*
number, channels: number, batch: number) =>
    void;

function setup(backend: BackendWasm): void {

  wasmFunc = backend.wasm.cwrap(Softmax, null /* void */ , [v`number`, // xId
    `number`, // outId
    `number`, // channels
    `number` // batch]
  );
  TensorFlow {v`const` backend, inputs: [logits], attrs: [dim]} =
  args;
  const xId = backend.dataIdMap.get(logits.dataId).id;
  const outId = backend.dataIdMap.get(out.dataId).id;
  const channels = logits.shape[dim];
  const batch = util.sizeFromShape(logits.shape) / channels;

  if (util.sizeFromShape(out.shape) === 0) {
    return out;
  }
  wasmFunc(xId, outId, channels, batch);
  return out;
}

export const softmaxConfig: KernelConfig = {
  kernelName: Softmax,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: softmax as {} as KernelFunc
};

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 */

import {backend_util, KernelConfig, KernelFunc, ReshapeAttrs, ReshapeInputs, SpaceToBatchND, SpaceToBatchNDAttrs, SpaceToBatchNDInputs, TensorInfo, TransposeAttrs, TransposeInputs, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {padV2Config} from './PadV2';
import {reshape} from './Reshape';
import {transpose} from './Transpose';

function spaceToBatchND(args: {
  inputs: SpaceToBatchNDInputs,
  backend: BackendWasm,
  attrs: SpaceToBatchNDAttrs
}) {
  const {inputs, backend, attrs} = args;
  const {x} = inputs;
  const {blockShape, paddings} = attrs;

  const prod = util.sizeFromShape(blockShape);

  const completePaddings: Array<[number, number]> = [[0, 0]];
  completePaddings.push(...(paddings as Array<[number, number]>));
  for (let i = 1 + blockShape.length; i < x.shape.length; ++i) {
    completePaddings.push([0, 0]);
  }

  const paddedX = padV2Config.kernelFunc({
    inputs: {x},
    backend,
    attrs: {paddings: completePaddings, constantValue: 0}
  }) as TensorInfo;

  const reshaapedPaddedShape = backend_util.getReshaped(paddedX.shape, blockShape, prod, false);
  const permutedReshapedPermutation = backend_util.getPermuted(reshapedPaddedShape.length, blockShape.length, false);
  const reshapeInputs: ReshapeInputs = {x: paddedX};
  const reshapeAttrs: ReshapeAttrs = {shape: reshapedPaddedShape};
  const permutedReshapedPaddedPermutation = backend_util.getPermuted(reshapedPaddedShape, blockShape, prod, false);
  const reshapeInputs: ReshapeInputs = {x: paddedX};
  const reshapeAttrs: ReshapeAttrs = {shape: flattenShape};
  const resultReshapeInputs: ReshapeInputs = {x: paddedXT};
  const resultReshapeAttrs: ReshapeAttrs = {shape: flattenShape};

  backend.disposeData(paddedX.dataId);
  backend.disposeData(reshapedPaddedData(paddedX, blockShape, prod, false));
  backend.disposeData(reshapedPaddedData(paddedX, blockShape, prod, false));
  backend.disposeData(paddedXT.dataId);
  return result;
}

export const spaceToBatchNDConfig: KernelConfig = {
  kernelName: SpaceToBatchND,
  backendName: 'wasm',
  kernelFunc: spaceToBatchND as {} as KernelFunc
};

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 */

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---
import {KernelConfig, KernelFunc, SplitV, SplitVAttrs, SplitVInputs, util} from '@tensorflow/tfjs-core';
import {backend_util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {slice} from './Slice';

export function splitV(
    args: {inputs: SplitVInputs, attrs: SplitVAttrs, backend: BackendWasm}) {
  const {inputs, attrs, backend} = args;
  const {x} = inputs;
  const {numOrSizeSplits, axis} = attrs;
  const $axis = util.parseAxisParam(axis, x.shape)[0];
  const splitSizes = backend_util.prepareSplitSize(x, numOrSizeSplits, $axis);
  const begin = new Array(x.shape.length).fill(0);
  const size = x.shape.slice();
  return splitSizes.map(s => {
    const xSliceSize = [...size];
    xSliceSize[$axis] = s;
    const xSlice = slice({inputs: {x}, attrs: {begin, size: xSliceSize}, backend});
    begin[$axis] += s;
    return xSlice;
  });
}

export const splitVConfig: KernelConfig = {
  kernelName: SplitV,
  backendName: 'wasm',
  kernelFunc: splitV as {} as KernelFunc
};

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 */

import {KernelConfig, Sqrt} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';
export const sqrtConfig: KernelConfig = createUnaryKernelConfig(Sqrt);

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 */

import {KernelConfig, Square} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';
export const squareConfig: KernelConfig = createUnaryKernelConfig(Square);

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 */

import {KernelConfig, SquaredDifference} from '@tensorflow/tfjs-core';
import {createBinaryKernelConfig} from './binary_kernel';
const supportsFullBroadcast = true;
export const squaredDifferenceConfig: KernelConfig =
    createBinaryKernelConfig(SquaredDifference, supportsFullBroadcast);

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 */

import {KernelConfig, KernelFunc, Step, StepAttrs, StepInputs, TensorInfo} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {CppDType} from './types';

let wasmStep:
(xId: number, alpha: number, dtype: number, outId: number) =>
    void;

function setup(backend:
voidisoftwasm.cwrap(Step, null /*void*/, ['number', 'number', 'number', 'number', 'number'], null);\n\nTensorInfo void {
  wasmStep = backend.wasm.cwrap(Step, null /*void*/, ['number', 'number', 'number', 'number', 'number'], null);\n\nconst {alpha} = attrs;\nconst {x} = inputs;\nconst xId = backend.dataIdMap.get(x.dataId).id;\nconst outId = backend.dataIdMap.get(out.dataId).id;\nresult = wasmStep(xId, alpha, CppDType[x.dtype], outId);\n}\n\nreturn out;\n}\n\n
export const stepConfig: KernelConfig = {
  kernelName: Step,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: step as {} as KernelFunc
};

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import {KernelConfig, KernelFunc, slice_util, StridedSlice, StridedSliceAttrs, StridedSliceInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';
import {reshape} from './Reshape';
import {slice} from './Slice';

let wasmStridedSlice: (\n  xId: number, xStridesBytes: Uint8Array,\n  xRank: number,\n  beginBytes: Uint8Array, endBytes: Uint8Array, stridesBytes: Uint8Array,\n  outShapeBytes: Uint8Array, outStridesBytes: Uint8Array,\n  outShapeLength: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmStridedSlice = backend.wasm.cwrap(StridedSlice, null /*void*/, [\n    'number', // xId
    'array',   // xStrides
    'number',  // xRank
    'array',   // begin
    'array',   // end
    'array',   // strides
    'array',   // outShape
    'array',   // outStrides
    'number',  // outShapeLength
    'number',  // outId
  ]);\n}

export function stridedSlice(args: {
  backend: BackendWasm,
  inputs: StridedSliceInputs,
  attrs: StridedSliceAttrs
}): TensorInfo {
  const {backend, inputs, attrs} = args;

  const {x} = inputs;

  const {
    begin,
    end,
    strides,
    beginMask,
    endMask,
    ellipsisMask,
    newAxisMask,
    shrinkAxisMask
  } = attrs;

  const {
    finalShapeSparse,
    finalShape,
    isIdentity,
    sliceDim0,
    isSimpleSlice,
    begin: $begin,
    end: $end,
    strides: $strides
  } =
      slice_util.sliceInfo(
          x.shape, begin, end, strides, beginMask, endMask, ellipsisMask,
          newAxisMask, shrinkAxisMask);

  let result;\n  if (isIdentity) {
    // Optimization #1, slice is a no-op plus reshape\n    result = reshape({inputs: {x},
      backend, attrs: {shape: finalShape}});
  } else if (sliceDim0 || isSimpleSlice) {
    // Optimization #2, slice is memory contiguous (only occurs in dim 0)\n    util.assert(
        x.shape.length >= 1,
        () => `Input must have rank at least 1, got: ${x.shape.length}`);

    const size = slice_util.computeOutShape($begin, $end, $strides);
    // 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}});
    result =
        reshape({inputs: {x: sliced}, backend, attrs: {shape: finalShape}});
    backend.disposeData(sliced.dataId);
  } else {
    const out = backend.makeOutput(finalShapeSparse, 'float32');\n    backend.disposeData(out.dataId);\n
    result =\n      reshape({inputs: {x: out},
      backend, attrs: {shape: finalShape}});
  }

  return result;
}

export const stridedSliceConfig: KernelConfig = {
  kernelName: StridedSlice,
  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: stridedSlice as {} as KernelFunc
};

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=====================================================================

*/

import {KernelConfig, Sub} from '@tensorflow/tfjs-core';
import {createBinaryKernelConfig} from
  './binary_kernel';
const supportsFullBroadcast = true;
export const subConfig: KernelConfig =
  createBinaryKernelConfig(Sub, supportsFullBroadcast);

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 */

import {backend_util, KernelConfig, KernelFunc, Sum, SumAttrs, SumInputs, TensorInfo, util} from
  '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';
import {permuteAxesAndTranspose} from './kernel_utils';
import {CppDType} from './types';
let wasmSum: (xId: number, reduceSize: number, dtype: number, outId: number) =>
  void;
function setup(backend: BackendWasm): void {
  wasmSum = backend.wasm.cwrap(Sum, null /*void*/, 
    ['number',  // input_id
    'number',  // reduce_size
    'number',  // dtype
    'number',  // out_id
  ]);}
function sum(args: {backend: BackendWasm, inputs: SumInputs, attrs: SumAttrs}):
    TensorInfo {
  const {backend, inputs, attrs} = args;
  const {axis, keepDims} = attrs;
  const {x} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;

  let
    inputId = xId;
    input = x;

  const {transposed, axes, originalAxes, inputWasTransposed} =
  permuteAxesAndTranspose(x, axis, backend);

  let reductionAxes = axes;
  if (inputWasTransposed) {
    const
      transposedId = backend.dataIdMap.get(transposed.dataId).id;
    if (transposedId !== xId) {
      // transpose was
      // not a no-op. We will need to dispose of this
      // once we are done.
      input = transposed;
      inputId = transposedId;
      reductionAxes = backend_util.getInnerMostAxes(
          reductionAxes.length,
          input.shape.length);
    }
  }

  backend_util.assertAxesAreInnerMostDims(
      'sum', reductionAxes,
      input.shape.length);
  const 
  reductionAxes.length,
  outShape, reductionAxes, input.shape.length);
  const [outShape, reduceShape] =
backdoorutil.computerOutAndReduceShapes(input.shape, reductionAxes);
  const reduceSize =
util.sizeFromShape(reduceShape);
  const out = backend.makeOutput(outShape, input.dtype);
  if
  wasmSum(inputId, reduceSize, CppDType[input.dtype], outId);
}

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 */

import {KernelConfig, Tan} from '@tensorflow/tfjs-core';
import {createUnaryKernelConfig} from
  './unary_kernel';
export const tanConfig: KernelConfig = createUnaryKernelConfig(Tan);

```
const outValuesId = backend.dataIdMap.get(outValues.dataId).id;
const outIndicesId = backend.dataIdMap.get(outIndices.dataId).id;
const outValuesId = backend.dataIdMap.get(outValues.dataId).id;
const outIndicesId = backend.dataIdMap.get(outIndices.dataId).id;

wasmTopK(xId, xShapeBytes, x.shape.length, CppDType[x.dtype], k, sorted, outValuesId, outIndicesId);

return [outValues, outIndices];

export const topKConfig: KernelConfig = {
  kernelName: TopK,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: topk as {} as KernelFunc
};

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 */

import {KernelConfig, KernelFunc, TensorInfo, Transform, TransformAttrs, TransformInputs, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmTransform: (
    imageId: number, transformsId: number, isBatchTransform: boolean,
    batch: number, outHeight: number, outWidth: number, numChannels: number,
    imageWidth: number, imageHeight: number, strides: Uint8Array,
    stridesLength: number, interpolationModeId: number, fillModeId: number, fillValue: number, outId: number)
=> void;

function setup(backend: BackendWasm): void {
  wasmTransform = backend.wasm.cwrap(Transform,
      null /*void*/, [
          'number',  // imageId
          'number',  // transformsId
          'bool',    // isBatchTransform
          'number',  // batch
          'number',  // outHeight
          'number',  // outWidth
          'number',  // numChannels
          'number',  // imageWidth
          'number',  // imageHeight
          'array',   // strides
          'number',  // stridesLength
          'number',  // interpolationModeId
          'number',  // fillModeId
          'number',  // fillValue
          'number'   // outId
      ]);
}

function transform(
    args:
        {backend: BackendWasm, inputs: TransformInputs, attrs:
          TransformAttrs}):
    TensorInfo {
  const {backend, inputs, attrs} = args;
  const {image, transforms} = inputs;
  const {interpolation, fillMode, fillValue, outputShape} = attrs;

  const [batch, imageHeight, imageWidth, numChannels] = image.shape;
  const [outHeight, outWidth] = outputShape != null ? outputShape : [imageHeight, imageWidth];
  const outShape = [batch, outHeight, outWidth, numChannels] as [number, number, number, number];
  const strides = new Uint8Array(new Int32Array(util.computeStrides(image.shape)).buffer);

  const out = backend.makeOutput(outShape, image.dtype);
  const outId = backend.dataIdMap.get(out.dataId).id;

  const imageData = backend.dataIdMap.get(image.dataId);
  const imageId = imageData.id;

  const transformsData = backend.dataIdMap.get(transforms.dataId);
  const transformsId = transformsData.id;
  const interpolationModelId = interpolation === 'nearest' ? 1 : 2;
  let fillModelId = fillModeId;

  switch (fillModelId) {
    case 1:
      fillModelId = 2;
      break;
    case 2:
      fillModelId = 3;
      break;
    case 3:
      fillModelId = 4;
      break;
  }

  const wasmTransform = backend.wasm.cwrap(Transform,
      null /*void*/, [
          'number',  // imageId
          'number',  // transformsId
          'number',  // batch
          'number',  // outHeight
          'number',  // outWidth
          'number',  // numChannels
          'number',  // imageHeight
          'number',  // imageWidth
          'number',  // strides
          'number',  // stridesLength
          'number',  // interpolationModeId
          'number',  // fillModeId
          'number',  // fillValue
          'number'   // outId
      ]);

  return out;
}

export const transformConfig: KernelConfig = {
  kernelName: Transform,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: transform as {} as KernelFunc
};

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import {KernelConfig, KernelFunc, TensorFlow, unpack, UnpackAttrs, UnpackInputs} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {slice} from './Slice';

function unpack(args: {inputs: UnpackInputs, backend: BackendWasm, attrs: UnpackAttrs}): TensorInfo[] {
  const {inputs, backend, attrs} = args;
  const {value} = inputs;
  let {axis} = attrs;

  if (axis < 0) {
    axis += value.shape.length;
  }

  const numOutputs = value.shape[axis];
  const rank = value.shape.length;
  const outShape = number[] = new Array(rank - 1);

  let outIndex = 0;
  for (let i = 0; i < rank; i++) {
    if (i !== axis) {
      outShape[outIndex++] = value.shape[i];
    }
  }

  const outs = new Array(numOutputs);
  const begin = new Array(rank).fill(0);
  const size = value.shape.slice();
  size[axis] = 1;

  for (let i = 0; i < outs.length; i++) {
    begin[axis] = i;
    outs[i] = slice({inputs: {x: value}, attrs: {begin, size}, backend});
  }
  return outs.map(({dataId, dtype}) => ({dataId, dtype, shape: outShape}));
}

export const unpackConfig: KernelConfig = {
  kernelName: Unpack,
  backendName: 'wasm',
  kernelFunc: unpack as {} as KernelFunc,
};

import {KernelConfig, KernelFunc, TensorFlow, ZerosLike, ZerosLikeInputs} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

function zerosLike(args: {inputs: ZerosLikeInputs, backend: BackendWasm}) {
  const {inputs: {x}, backend} = args;
  const out = backend.makeOutput(x.shape, x.dtype);

  const outVals = backend.typedArrayFromHeap(out);
  outVals.fill(0);
  return out;
}

export const zerosLikeConfig: KernelConfig = {
  kernelName: ZerosLike,
  backendName: 'wasm',
  kernelFunc: zerosLike as {} as KernelFunc,
};

 We explicitly import the modular kernels so they get registered in the tf.js global registry when we compile the library. A modular build would replace the contents of this file and import only the kernels that are needed.

import {KernelConfig, registerKernel} from '@tensorflow/tfjs-core';

import {fusedMatMulConfig} from './kernels/_FusedMatMul';
import {absConfig} from './kernels/Abs';
import {addConfig} from './kernels/Add';
import {addNConfig} from './kernels/AddN';
import {allConfig} from './kernels/All';
import {anyConfig} from './kernels/Any';
import {argMaxConfig} from './kernels/ArgMax';
import {argPoolConfig} from './kernels/ArgPool';
import {batchMatMulConfig} from './kernels/BatchMatMul';
import {batchToSpaceNDConfig} from './kernels/BatchToSpaceND';
import {batchConv2DConfig} from './kernels/BatchConv2D';
import {batchConv2DBackpropInputConfig} from './kernels/BatchConv2DBackpropInput';
import {ceilConfig} from './kernels/Ceil';
import {clipByValueConfig} from './kernels/ClipByValue';
import {concatConfig} from './kernels/Concat';
import {conv2DConfig} from './kernels/Conv2D';
import {conv2DBackpropInputConfig} from './kernels/Conv2DBackpropInput';
import {cosConfig} from './kernels/Cos';
import {coshConfig} from './kernels/Cosh';
import {cropAndResizeConfig} from './kernels/CropAndResize';
import {cumsumConfig} from './kernels/Cumsum';
import {depthToSpaceConfig} from './kernels/DepthToSpace';
import {depthwiseConv2dNativeConfig} from './kernels/DepthwiseConv2dNative';
import {eluConfig} from './kernels/Elu';
import {equalConfig} from './kernels/Equal';
import {expConfig} from './kernels/Exp';
import {expandDimsConfig} from './kernels/Expand';
realDivConfig,
reluConfig,
relu6Config,
reshapeConfig,
resizeBilinearConfig,
reverseConfig,
rotateWithOffsetConfig,
rsqrtConfig,
roundConfig,
scatterNdConfig,
selectConfig,
sigmoidConfig,
softmaxConfig,
sinConfig,
sliceConfig,
spaceToBatchNDConfig,
splitVConfig,
sqrtConfig,
squareConfig,
squaredDifferenceConfig,
stepConfig,
subConfig,
sumConfig,
tanConfig,
tanHConfig,
tileConfig,
topKConfig,
transposeConfig,
unpackConfig,
zerosLikeConfig];

for (const kernelConfig of kernelConfigs) {
  registerKernel(kernelConfig);
}

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=============================================================================

import {env} from '@tensorflow/tfjs-core';

const ENV = env();

/**
 * True if SIMD is supported.
 */
// From: https://github.com/GoogleChromeLabs/wasm-feature-detect
ENV.registerFlag('WASM_HAS_SIMD_SUPPORT', async () => WebAssembly.validate(new Uint8Array([0, 97, 115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3, 2, 1, 0, 10, 9, 1, 7, 0, 65, 0, 253, 15, 26, 11])));

/**
 * True if threads are supported.
 */
// From: https://github.com/GoogleChromeLabs/wasm-feature-detect
ENV.registerFlag('WASM_HAS_MULTITHREAD_SUPPORT', async () => {
  // TODO(annxingyuan): Enable node support once this is resolved:
  // https://github.com/tensorflow/tfjs/issues/3830
  if (ENV.get('IS_NODE')) {
    return false;
  }

  try {
    // Test for transferability of SABs (needed for Firefox)
    // https://groups.google.com/forum/#!msg/mozilla.dev.platform/IHkBZlHETpA/dwsMNchWEQAJ
    new MessageChannel().port1.postMessage(new SharedArrayBuffer(1));
    // This typed array is a WebAssembly program containing threaded
    // instructions.
    return WebAssembly.validate(new Uint8Array([0, 97, 115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3, 2, 1, 0, 10, 9, 1, 7, 0, 65, 0, 254, 16, 2, 0, 26, 11]));
  } catch (e) {
    return false;
  }
});

var WasmBackendModuleThreadedSimd = (function() {
  if (typeof __filename !== 'undefined') _scriptDir = _scriptDir || __filename;
  return function(WasmBackendModuleThreadedSimd) {
    WasmBackendModuleThreadedSimd = WasmBackendModuleThreadedSimd || {};

    function GROWABLE_HEAP_I8() {
      if (wasmMemory.buffer !== buffer) { updateGlobalBufferAndViews(wasmMemory.buffer) }
      return HEAP8;
    }

    function GROWABLE_HEAP_U8() {
      if (wasmMemory.buffer !== buffer) { updateGlobalBufferAndViews(wasmMemory.buffer) }
      return HEAPU8;
    }

    function GROWABLE_HEAP_I32() {
      if (wasmMemory.buffer !== buffer) { updateGlobalBufferAndViews(wasmMemory.buffer) }
      return HEAP32;
    }

    function GROWABLE_HEAP_U32() {
      if (wasmMemory.buffer !== buffer) { updateGlobalBufferAndViews(wasmMemory.buffer) }
      return HEAPU32;
    }

    function GROWABLE_HEAP_F64() {
      if (wasmMemory.buffer !== buffer) { updateGlobalBufferAndViews(wasmMemory.buffer) }
      return HEAPF64;
    }

    var Module = typeof

    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 = '';
    var quit_ = function(status, toThrow) {
      throw toThrow;
    }

    // ...
  }

  // ...

  return WasmBackendModuleThreadedSimd;
})();
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 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,HEAP16,HEAPU8,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)}

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)runtimeInitialized=true;function preRun(){if(ENVIRONMENT_IS_PTHREAD)return;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)runtimeExited=true;function postRun(){if(ENVIRONMENT_IS_PTHREAD)return;Module["postRun"]()}function __ATPRERUN__(){if(typeof Module["onAbort"])Module["onAbort"]()}function __ATPOSTRUN__(){if(typeof Module["onAbort"])Module["onAbort"]()}function addRunDependency(id){var runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function addRunDependency(id){assert(!ENVIRONMENT_IS_PTHREAD,"addRunDependency cannot be used in a pthread")runDependencies++;if(Module["monitorRunDependencies"])Module["monitorRunDependencies"][runDependencies].function removeRunDependency(id){runDependencies--}if(Module["monitorRunDependencies"])Module["monitorRunDependencies"][runDependencies].function clearInterval(intervalId){intervalId=null}if(Module["onAbort"])Module["onAbort"](what)if(ENVIRONMENT_IS_PTHREAD)console.error("Pthread aborting at \"+new Error("bad memory")}if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATMAIN__);function new Int32Array(buf)
```javascript
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; }
return _emscripten_run_in_main_runtime_thread_js(index,serializedNumCallArgs,bsync); stackRestore(stack); return readAsmConstArgs(spi,bsuf); }

func _emscripten_receive_on_main_thread_js_callArgs(index,serializedNumCallArgs,bsuf) { var b=args>>3; for(var i=0;i<numCallArgs;i++) { var arg=arguments[2+i]; GROWABLE_HEAP_F64()[b+i]=arg; } return _emscripten_run_in_main_runtime_thread_js(index,serializedNumCallArgs,bsuf);

func _emscripten_get_heap_size() { return GROWABLE_HEAP_U8().length; }

func _emscripten_realloc_buffer(size) { try { wasmMemory.grow(size - buffer.byteLength+65535)); updateGlobalBufferAndViews(wasmMemory.buffer); return 1 } catch(e) {} }

func _emscripten_resize_heap(requestedSize) { var oldSize=_emscripten_get_heap_size(); if(requestedSize<=oldSize) { return false; }
var maxHeapSize=2147483648; if(requestedSize>maxHeapSize) { return false; }
var cutDown=1; while(cutDown<=4) { 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; }

func JSEvents.removeAllEventListeners() { for(var i=JSEvents.eventHandlers.length-1;i>=0;--i) { JSEvents._removeHandler(i); }
JSEvents.deferredCalls=[]; JSEvents.deferredCalls.push({ targetFunction:function() { for(var i=0;i<JSEvents.deferredCalls.length;++i) { JSEvents.deferredCalls[i].targetFunction(); JSEvents.deferredCalls.splice(i,1); } }, precedence:1, handler:JSEvents.removeDeferredCalls }); JSEvents.removeDeferredCalls(function(x,y) { return x.precedence<y.precedence }); JSEvents.removeDeferredCalls(function(targetFunction){
for(var i=0;i<JSEvents.deferredCalls.length;++i) { if(JSEvents.deferredCalls[i].targetFunction==targetFunction) { JSEvents.deferredCalls.splice(i,1); } } }, precedence:1, handler:JSEvents.removeDeferredCalls });
```

erredCalls();eventHandler.handlerFunc(event);JSEvents.runDeferredCalls();--
JSEvents.inEventHandler()&&eventHandler.eventListenerFunc=JSEventHandler;eventH
andler.target.addEventListener(eventHandler.eventTypeString,JSEventHandler.useCapture);JSEvents.e
ventHandlers.push(eventHandler);JSEvents.queueRemoveEventListeners();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_iii:function(targetThread,eventHandlerFunc,eventTypeId,eventData,userData)
{var stackTop=stackSave();var
varargs=stackAlloc(12);GROWABLE_HEAP_I32()=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:
fuction(targetThread){switch(targetThread){case 1:return 0;case 2:return
PTread.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()=vararg
s+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=target
Canvas?UTF8ToString(targetCanvas):"\";_emscripten_set_offscreencanvas_size_on_target_thread_js(targetThr
ead,targetCanvas,width,height):function maybeCSTRINGtoJsString(cString){return
stringToNewUTF8(cString)>2?UTF8ToString(cString)+1:var cString=_malloc(length);stringToUTF8(cString,cString.length);return

cString}function
findEventTarget(target){target=maybeCStringToJsString(target);var
domElement=specialHTMLTargets[target]||((typeof
document!="undefined"?document:0).typeof window!="undefined"?window:0);function
findCanvasEventTarget(target){target=maybeCSTRINGtoJsString(target);var
domElement=specialHTMLTargets[target]||((typeof
document!="undefined"?document:0).querySelector(target):undefined);return domElement
}function
findCanvasEventTarget(target){return findEventTarget(target)}function
_emscripten_set_canvas_element_size_calling_thread(target,width,height){var
canvas=CanvasEventTarget(target);if(!canvas)return-
4;if(canvas.canvasSharedPtr)GROWABLE_HEAP_I32(canvas.canvasSharedPtr>>2)=width;GROWABLE_HEAP
P_I32(canvas.canvasSharedPtr+4>>2)=height;canvas.canvas=offscreencanvas;canvas.controlTransferredOffscreen=if
canvas.offscreencanvas=offscreencanvas;var
canvas=offscreencanvas;autoResizeViewport=false;if(canvas.GLctxObject&canvas.GLctxObject.GLctx){var
prevViewport=canvas.GLctxObject.GLctx.getParameter(2978);autoResizeViewport=prevViewport[0]==0&&&prev
_emscripten_set_canvas_element_size_main_thread(target,width,height){if(ENVIRONMENT_IS_PTHREAD)return
false};
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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+(104>>2),threadParams.stackBase);Atomics.store(GROWABLE_HEAP_U32(),tis+(104+8>>2),threadParams.stackHigh);Atom ics.store(GROWABLE_HEAP_U32(),tis+(104+12>>2),threadParams.detached);

global_libc=_emscripten_get_global_libc();

global_locale=global_libc+40;Atomsic.store(GROWABLE_HEAP_U32(),tis+(172>>2),global_locale);worker.pthread=pthread;var


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){threadParams.cmd="spawnThread";postMessage(threadParams,transferList)}else{spawnThread(threadParams);return 0}function __pthread_testcancel_is(){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_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_check_blocking_allowed(){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_check_blocking_allowed(){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_check_blocking_allowed(){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_check_blocking_allowed(){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_check_blocking_allowed(){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_check_blocking_allowed(){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_check_blocking_allowed(){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_check_blocking_allowed(){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_check_blocking_allowed(){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_check_blocking_allowed(){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_check_blocking_allowed(){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_check_blocking_allowed(){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_check_blocking_allowed(){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_check_blocking_allowed(){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_check_blocking_allowed(){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_check_blocking_allowed(){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_check_blocking_allowed(){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_check_blocking_allowed(){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_check_blocking_allowed(){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_check_blocking_allowed(){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-bro
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```
module.exports = WasmBackendModuleThreadedSimd;
```

WasmBackendModuleThreadedSimd;\n","\nvar WasmBackendModule = (function() {\n var _scriptDir = typeof
document !== 'undefined' && document.currentScript ? document.currentScript.src : undefined;\n if (typeof
__filename !== 'undefined') _scriptDir = _scriptDir || __filename;\n return (\nfunction(WasmBackendModule) {\n
WasmBackendModule = WasmBackendModule || {};\n\nvar Module=typeof
WasmBackendModule!==\"undefined\"?WasmBackendModule:{};var
readyPromiseResolve,readyPromiseReject;Module[\"ready\"]=new
Promise(function(resolve,reject){readyPromiseResolve=resolve;readyPromiseReject=reject});var
moduleOverrides={};var key;for(key in
Module){if(Module.hasOwnProperty(key)){moduleOverrides[key]=Module[key]}}var arguments_=[];var
thisProgram=\"./this.program\";var quit_=function(status,toThrow){throw toThrow};var
ENVIRONMENT_IS_WEB=false;var ENVIRONMENT_IS_WORKER=false;var
ENVIRONMENT_IS_NODE=false;var ENVIRONMENT_IS_SHELL=false;ENVIRONMENT_IS_WEB=typeof
window===\"object\";ENVIRONMENT_IS_WORKER=typeof
importScripts===\"function\";ENVIRONMENT_IS_NODE=typeof process===\"object\"&&typeof
process.versions===\"object\"&&typeof
process.versions.node===\"string\";ENVIRONMENT_IS_SHELL=!ENVIRONMENT_IS_WEB&&!ENVIRONM
ENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var scriptDirectory=\"\";function
locateFile(path){if(Module[\"locateFile\"]){return Module[\"locateFile\"](path,scriptDirectory)}return
scriptDirectory+path}var read_,readAsync,readBinary,setWindowTitle;var nodeFS;var
nodePath;if(ENVIRONMENT_IS_NODE){if(ENVIRONMENT_IS_WORKER){scriptDirectory=require(\"path\").
dirname(scriptDirectory)+\"/\"}else{scriptDirectory=__dirname+\"/\"}read_=function
shell_read(filename,binary){if(!nodeFS)nodeFS=require(\"fs\");if(!nodePath)nodePath=require(\"path\");filename=n
odePath[\"normalize\"](filename);return
nodeFS[\"readFileSync\"](filename,binary?null:\"utf8\")};readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret};if(process[\"argv\"].length>1){thisProgram=process[\"argv\"][1].replace(/\\\\/g,\"/\")}arguments_=process[\"arg
v\"].slice(2);process[\"on\"](\"uncaughtException\",function(ex){if(!(ex instanceof ExitStatus)){throw
ex}});process[\"on\"](\"unhandledRejection\",abort);quit_=function(status){process[\"exit\"](status)};Module[\"insp
ect\"]=function(){return\"[Emscripten Module object]\"}}else if(ENVIRONMENT_IS_SHELL){if(typeof
read!=\"undefined\"){read_=function shell_read(f){return read(f)}}readBinary=function readBinary(f){var
data;if(typeof readbuffer===\"function\"){return new
Uint8Array(readbuffer(f))}data=read(f,\"binary\");assert(typeof data===\"object\");return data};if(typeof
scriptArgs!=\"undefined\"){arguments_=scriptArgs}else if(typeof
arguments!=\"undefined\"){arguments_=arguments}if(typeof
quit===\"function\"){quit_=function(status){quit(status)}}if(typeof print!==\"undefined\"){if(typeof
console===\"undefined\")console={};console.log=print;console.warn=console.error=typeof
printErr!==\"undefined\"?printErr:print}}else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire
ctory=self.location.href}else if(typeof
document!==\"undefined\"&&document.currentScript){scriptDirectory=document.currentScript.src}if(_scriptDir){s
criptDirectory=_scriptDir}if(scriptDirectory.indexOf(\"blob:\")!==0){scriptDirectory=scriptDirectory.substr(0,script
Directory.lastIndexOf(\"/\")+1)}else{scriptDirectory=\"\"}{read_=function(url){var xhr=new
XMLHttpRequest;xhr.open(\"GET\",url,false);xhr.send(null);return
xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new
XMLHttpRequest;xhr.open(\"GET\",url,false);xhr.responseType=\"arraybuffer\";xhr.send(null);return new
Uint8Array(xhr.response)}}readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open(\"GET\",url,true);xhr.responseType=\"arraybuffer\";xhr.onload=function(){if(xhr.status
==200||xhr.status==0&&xhr.response){onload(xhr.response);return}onerror()};xhr.onerror=onerror;xhr.send(null)}

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updateGlobalBufferAndViews(buf) { buffer=buf; Module["HEAP8"] = HEAP8=new Uint8Array(buf); Module["HEAP16"] = HEAP16=new Uint16Array(buf); Module["HEAP32"] = HEAP32=new Uint32Array(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 __ATMAIN__ = []; var __ATPOSTRUN__ = []; var runtimeInitialized = false; __ATINIT__.push({func:function() {___wasm_call_ctors()}}); function preRun() {if(Module["preRun"] != undefined) {Module["preRun"]();}} function initRuntime() {runtimeInitialized = true; callRuntimeCallbacks(__ATINIT__); function preMain() {callRuntimeCallbacks(__ATMAIN__); function postRun() {if(Module["postRun"] != undefined) {Module["postRun"]();}} callRuntimeCallbacks(__ATPOSTRUN__); function addOnPreRun(cb) {__ATPRERUN__.unshift(cb)} function addOnPostRun(cb) {__ATPOSTRUN__.unshift(cb)} runDependencies = 0; 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 += "; what=\"v\". Build with -s ASSERTIONS=1 for more info.\"; var e = new WebAssembly.RuntimeError(what); readyPromiseReject(e); ABORT = true; ABORT = ABORT; return String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0; dataURIPrefix = "data:application/octet-stream;base64,"; function isDataURI(filename) {return hasPrefix(filename, dataURIPrefix)} 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) {var response = new XMLHttpRequest(); response.open("GET", file, false); response.send(); var wasmBinary = response.response); wasmBinaryFile = "tfjs-backend-wasm.wasm"; if(isDataURI(wasmBinaryFile)) {wasmBinaryFile = locateFile(wasmBinaryFile); getBinary(file); return file; if(new Uint8Array(wasmBinary)) {if(readBinary) {return readBinary(file);} else {throw new Error(\"both async and sync fetching of the wasm failed\"));}}}} else {getBinaryPromise(file); getBinary(file); return file; if(new Uint8Array(wasmBinaryFile)) {if(readAsync) {return new Promise(function(resolve, reject) {readAsync(wasmBinaryFile, function(response) {resolve(new Uint8Array(response))})});}}}}}} else {getBinary(file); return wasmBinaryFile;}} else {Promise(function(resolve, reject) {readAsync(wasmBinaryFile, function(response) {resolve(new Uint8Array(response))})}).then(function(file) {return getBinary(file);});} function createWasm() {var info = {a: asmLibraryArg}; function receiveInstance(instance, module) {var exports = instance.exports; Module["asm"] = exports; wasmMemory = Module["asm"];"]updateGlobalBufferAndViews(wasmMemory.buffer); wasmTable = Module["asm"];} function createWasm() {var info = {a: asmLibraryArg}; function receiveInstance(instance, module) {var exports = instance.exports; Module["asm"] = exports; wasmMemory = Module["asm"]; updateGlobalBufferAndViews(wasmMemory.buffer); wasmTable = Module["asm"]; removeRunDependency("wasm-instantiate"); addRunDependency("wasm-instantiate");}}
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```javascript
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,"fd_seeke:"f
"_fd_write","h":_pthread_create,"i":_pthread_join,"ix":"_sysconf"};var asm=createWasm();var
___wasm_call_ctors=Module["___wasm_call_ctors"]=function(){return(___wasm_call_ctors=Module["___wasm
call_ctors"]=Module["asm"]["k"]).apply(null,arguments)};var
_init=Module["_init"]=function(){return(_init=Module["_init"]=Module["asm"]["l"]).apply(null,arguments)};
var
_init_with_threads_count=Module["_init_with_threads_count"]=function(){return(_init_with_threads_count=Mod
ule["_init_with_threads_count"]=Module["asm"]["m"]).apply(null,arguments)};var
_get_threads_count=Module["_get_threads_count"]=function(){return(_get_threads_count=Module["_get_threads
count"]=Module["asm"]["n"]).apply(null,arguments)};var
_register_tensor=Module["_register_tensor"]=function(){return(_register_tensor=Module["_register_tensor"]=M
odule["asm"]["o"]).apply(null,arguments)};var
DisposeData=Module["DisposeData"]=function(){return(DisposeData=Module["DisposeData"]=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"]=Modu
le["asm"]["z"]).apply(null,arguments)};var
_Ceil=Module["Ceil"]=function(){return(_Ceil=Module["Ceil"]=Module["asm"]
["A"]).apply(null,arguments)};var
_ClipByValue=Module["ClipByValue"]=function(){return(_ClipByValue=Module["ClipByValue"]=Module["asm"]
["BV"]).apply(null,arguments)};var
_Conv2D=Module["Conv2D"]=function(){return(_Conv2D=Module["Conv2D"]=Module["asm"]
["CV"]).apply(null,arguments)};var
_Conv2DBackpropInput=Module["Conv2DBackpropInput"]=function(){return(_Conv2DBackpropInput=Modu
le["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"]
["FV"]).apply(null,arguments)};var
_CropAndResize=Module["CropAndResize"]=function(){return(_CropAndResize=Module["CropAndRezise"]

```
```javascript
// Initialize TensorFlow backend
import './flags_wasm';

import {backend_util, BackendTimingInfo, DataStorage, DataType, deprecationWarn, engine, env, KernelBackend, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasmModule, WasmFactoryConfig} from '../wasm-out/tfjs-backend-wasm';
import {BackendWasmThreadedSimdModule} from '../wasm-out/tfjs-backend-wasm-threaded-simd';
import wasmFactoryThreadedSimd from '../wasm-out/tfjs-backend-wasm-threaded-simd.js';
// @ts-ignore
import {wasmWorkerContents} from '../wasm-out/tfjs-backend-wasm-threaded-simd.worker.js';
import wasmFactory from '../wasm-out/tfjs-backend-wasm.js';

interface TensorData {
  id: number;
  memoryOffset: number;
  shape: number[];
  dtype: DataType;
  refCount: number;
  /** Only used for string tensors, storing encoded bytes. */
  stringBytes?: Uint8Array[];
}

export type DataId = object;  // object instead of {} to force non-primitive.

export class BackendWasm extends KernelBackend {
  // 0 is reserved for null data ids.
  private dataIdNextNumber = 1;
  dataIdMap: DataStorage<TensorData>;

  constructor(public wasm: BackendWasmModule|BackendWasmThreadedSimdModule) {
    super();
    this.wasm.tfjs.initWithThreadsCount(1);
    actualThreadsCount = this.wasm.tfjs.getThreadsCount();
    this.dataIdMap = new DataStorage(this, engine());
  }

  write(values: backend_util.BackendValues, shape: number[], dtype: DataType): DataId {
    const dataId = {id: this.dataIdNextNumber++};
    this.move(dataId, values, shape, dtype, 1);
    return dataId;
  }

  numDataIds(): number {
    return this.dataIdMap.numDataIds();
  }

  async time(f: () => void): Promise<BackendTimingInfo> {
    const start = util.now();
    f();
    const kernelMs = util.now() - start;
    return {kernelMs};
  }

  move(dataId: DataId, values: backend_util.BackendValues, shape: number[], dtype: DataType, refCount: number): void {
    const id = this.dataIdNextNumber++;
    if (dtype === 'string') {
      const stringBytes = values as Uint8Array[];
      this.dataIdMap.set(dataId, {id, stringBytes, shape, dtype, refCount: refCount});
    } else {
      const size = util.sizeFromShape(shape);
      const numBytes = size * util.bytesPerElement(dtype);
      if (memoryOffset == null) {
        this.wasm.tfjs.registerTensor(id, size, memoryOffset);
        this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype, refCount});
      } else {
        this.wasm.HEAPU8.set(values as backend_util.TypedArray).buffer.slice(memoryOffset, memoryOffset + numBytes);
      }
    }
  }

  async read(dataId: DataId): Promise<backend_util.BackendValues> {
    return
  }
}
```

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this.readSync(dataId); 
  } else { 
    // If no refCount, just delete.
    disposeData(dataId: DataId, force = false): boolean {
      if (dataIdMap.has(dataId)) {
        const tensorData = 
          this.dataIdMap.get(dataId); 
        if (dataIdMap.get(dataId).refCount > 0) {
          return false;
        }
        this.wasm._free(dataIdMap.get(dataId).memoryOffset); 
        this.wasm.tfjs.disposeData(dataId);
        this.dataIdMap.delete(dataId);
      }
    }
  }

  incRef(dataId: DataId) {
    const tensorData = this.dataIdMap.get(dataId);
    if (tensorData != null) {
      tensorData.refCount++;
    }
  }

  floatPrecision(): number {
    return 32;
  }

  getMemoryOffset(dataId: DataId): number {
    return this.dataIdMap.get(dataId).memoryOffset;
  }

  dispose() {
    this.wasm.tfjs.dispose();
    if ('PThread' in this.wasm) {
      this.wasm.PThread.terminateAllThreads();
    }
    this.wasm = null;
  }

  /**
   * Returns the path of the WASM binary.
   * @param simdSupported whether SIMD is supported
   * @param threadsSupported whether multithreading is supported
   * @param wasmModuleFolder the directory containing the WASM binaries.
   */
  function getPathToWasmBinary(
    simdSupported: boolean, threadsSupported: boolean,
    wasmModuleFolder: string) {
    if (wasmPath != null) {
      // If wasmPath is defined, the user has supplied a full path to
      // the vanilla .wasm binary.
      return wasmPath;
    }
    let path: WasmBinaryName = 'tfjs-backend-wasm.wasm';
    if (simdSupported && threadsSupported) {
      path = 'tfjs-backend-wasm-threaded-simd.wasm';
    } else if (simdSupported) {
      path = 'tfjs-backend-wasm-simd.wasm';
    }
    if (wasmFileMap != null) {
      return wasmFileMap[path];
    }
    return wasmModuleFolder + path;
  }

  /**
   * Initializes the wasm module and creates the js <-> wasm bridge.
   * @param simdSupported whether SIMD is supported
   * @param threadsSupported whether multithreading is supported
   * @param wasmModuleFolder the directory containing the WASM binaries.
   */
  async function init(): Promise<{wasm: BackendWasmModule}> {
    const [simdSupported, threadsSupported] = await Promise.all([
      env().getAsync('WASM_HAS_SIMD_SUPPORT'),
      env().getAsync('WASM_THREADS_SUPPORT');
    ]);
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/emscriptencore/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-backendwasm.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

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"setWasmPath() before you call `tf.setBackend()` or `tf.ready()`

```javascript
const wasmPath = path;

/**
 * Configures the locations of the WASM binaries.

```
GACnDO, EACFnC, EAaKBsB, GACtB, GAuA, MAaNBa, EACF, MAAM, IAaIvb, MACN, GAAGG, uEAIT, MAAMc, EAAuB, EAaAn, EAEaKB, MAAM, GAAKb, EAaEB, MAAM, GACSC, EAaWb, EAaAN, EEAeIB, MAAM, GAAKjB, EAAeIB, MAAM, GAC7CM, EAaWxB, EAAeKB, MAAM, GAEbBO, EAEaB, EACEbC, EAAIQC, WAAW, CAACF, EAAuUF, EAAsc, GAAWb, EAAeI, OAC1DufB, EAACQIC, EAAQKB, UAAUC, IAaAIa, EAAIz, QAACQ, GAE1Cc, EAAeI, IAACIC, WAAWd, IAIAc, WAaW9B, EAaEB, OAAoA, QAChDC, EAAc, IAaIhhB, WAAW, IAIAc, WAaW7B, EAAeIB, OAAoA, QAQoA, QAChAC, EAAcIuB, EAAkB, EAAaS5B, EAAeIB, MAAM, OAAQI, EAAKb, EAAa/B, EAAeIB, MAAMC, OAC5DbE, EAAcIuB, EAAcYuB, EAAAN, EAAEiB, MAAM, GAAKlB, EAAEiB, MAAM, GAC5CK, EAAWHb, EAAaN, EAAEiB, MAAM, GAAKjB, EAAEiB, MAAM, GAC7CM, EAAWHb, EAAaN, EAAEiB, MAAM, GAAKlB, EAAEiB, MAAM, OAC5DlC, EAASe, EAAEiB, OAAOa, QAQoA, GAG1D, OAAQ7D, QAAcB, IAaIb, IAACIC, EAAIyB, EAAIyB, EAAS5D, OAAQoC, IAaICyB, EAASeZb, GAAK0B, EAAQr, EAAKIB, IAE7B, OAA
Open Source Used In Cisco Meeting Server (formerly Acano Server) 3.4
Open Source Used In Cisco Meeting Server (formerly Acano Server) 3.4  4971
Open Source Used In Cisco Meeting Server (formerly Acano Server) 3.4 4981

e,EAAC,EAAC,SAAS,CAAC,MAAM,CAA C,CAAC,QAQ,C,OAAB,CAAC,WAAC,WAAW,CAAC,WAAC,WAAW,CAAC,MAAM,CAAC,CAAC,KACxC,IACD,OAAB,G AAG,CAAC;AACb,CAAC,AAED,MAAM,CAAC,MAAM,YAAY,GAAY,G;IACxG,UAAB,EAAC,MAAM,IAAC,CB,WAAW,EAAC,MAAM;IAACb,SBAS,EAAC,KAAC;IAACb,UAAB,EAAC,MAAM;B;CAAC,CV,CAAC,"sourcesContent":"/*!
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const Cumsum = import('tfjs-backend-wasm').Cumsum;
const x = import('tfjs-backend-wasm').importData('input data');
const output = Cumsum([x], {exclusive: true});

e = Cumsum.run(x, {exclusive: true});

export const cumsumConfig = {kernelName: 'Cumsum', backendName: 'webAssembly', setupFunc: () => {}};

"version":3,"file":"Slice.js","sourceRoot":","sources":[]};

Found in path(s):
*/opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Cumsum.js.map

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 */

import {backend_util, KernelConfig, KernelFunc, Slice, slice_util, SliceInputs, TypedArray, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';
import {sliceImplCPU} from '../kernel_utils/shared';

export function slice(
    args: {inputs: SliceInputs, attrs: SliceAttrs, backend: BackendWasm}) {
  const {inputs: {x}, attrs: {begin, size}, backend} = args;

  const [begin_, size_] = slice_util.parseSliceParams(x, begin, size);

  const isContinous = slice_util.isSliceContinous(x.shape, begin_, size_);
  const xVals = backend.readSync(x.dataId);
  const out = backend.makeOutput(size_, x.dtype);
  const xStrides = util.computeStrides(x.shape);
  const outData = backend.dataIdMap.get(out.dataId);

  if (isContinous) {
    const flatOffset = slice_util.computeFlatOffset(begin_, xStrides);

    if (x.dtype === 'string') {
      outData.stringBytes = (xVals as Uint8Array[]) .slice(flatOffset, flatOffset + util.sizeFromShape(size_));
    } else {
      const outVals = backend.typedArrayFromHeap(out);
      outVals.set((xVals as TypedArray).subarray(flatOffset, flatOffset + util.sizeFromShape(size_)), 0);
    }

    return out;
  }

  if (x.dtype === 'string') {
    const res = sliceImplCPU(xVals, begin_, size_, x.shape, x.dtype);
    outData.stringBytes = res as Uint8Array[];
    return out;
  }

  const outData = backend.dataIdMap.get(out.dataId);
  if (isContinous) {
    const flatOffset = slice_util.computeFlatOffset(begin_, xStrides);
    outData.stringBytes = (xVals as Uint8Array[])
                   .slice(flatOffset, flatOffset + util.sizeFromShape(size_));
    return out;
  }

  const outVals = backend.typedArrayFromHeap(out);
  outVals.set((xVals as TypedArray).subarray(flatOffset, flatOffset + util.sizeFromShape(size_)), 0);
  return out;
}

function slice2d(
    xVals: backend_util.TypedArray, xStride: number,
    outVals: backend_util.TypedArray, begin: [number, number],
    size: [number, number]): void {
  let outOffset = 0;
  const beginI = begin[0];
  const beginJ = begin[1];
  const endI = beginI + size[0];
  const endJ = beginJ + size[1];
  for (let i = beginI; i < endI; i++) {
    const xOffset = i * xStride + beginJ;
    outVals.set(xVals.subarray(xOffset, xOffset + size[1]), outOffset);
    outOffset += size[1];
  }
}

function slice3d(
    xVals: backend_util.TypedArray, xStride1: number,
    xStride2: number,
    outVals: backend_util.TypedArray, begin: [number, number, number],
    size: [number, number, number]): void {
  let outOffset = 0;
  const beginI = begin[0];
  const beginJ = begin[1];
  const beginK = begin[2];
  const endI = beginI + size[0];
  const endJ = beginJ + size[1];
  const endK = beginK + size[2];
  for (let i = beginI; i < endI; i++) {
    for (let j = beginJ; j < endJ; j++) {
      const xOffset = i * xStride1 + j * xStride2 + beginK;
      outVals.set(xVals.subarray(xOffset, xOffset + size[2]), outOffset);
      outOffset += size[2];
    }
  }
}

function slice4d(
    xVals: backend_util.TypedArray, xStride1: number,
    xStride2: number,
    xStride3: number,
    outVals: backend_util.TypedArray, begin: [number, number, number, number],
    size: [number, number, number, number]): void {
  let outOffset = 0;
  const beginI = begin[0];
  const beginJ = begin[1];
  const beginK = begin[2];
  const beginL = begin[3];
  const endI = beginI + size[0];
  const endJ = beginJ + size[1];
  const endK = beginK + size[2];
  const endL = beginL + size[3];
  for (let i = beginI; i < endI; i++) {
    for (let j = beginJ; j < endJ; j++) {
      for (let k = beginK; k < endK; k++) {
        const xOffset = i * xStride1 + j * xStride2 + k * xStride3 +
      

---

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import {KernelConfig, KernelFunc, scatter_util, ScatterNd, ScatterNdAttrs, ScatterNdInputs, TensorInfo, util} from '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';
import {CppDType} from './types';

let wasmScatterNd: (indicesId: number, updatesId: number, dtype: CppDType, sliceRank: number, numUpdates: number, sliceSize: number, strides: Uint8Array, outputSize: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmScatterNd = backend.wasm.cwrap(ScatterNd, null /*void*/, [
    'number',  // indicesId
    'number',  // updatesId
    'number',  // dtype
    'number',  // sliceRank
    'number',  // numUpdates
    'number',  // sliceSize
    'array',   // strides
    'number',  // outputSize
    'number'   // outId
  ]);
}

function scatterNd(args: {backend: BackendWasm, inputs: ScatterNdInputs, attrs: ScatterNdAttrs}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {indices, updates} = inputs;
  const {shape} = attrs;

  const out = backend.makeOutput(shape, updates.dtype);
  if (util.sizeFromShape(shape) === 0) {
    return out;
  }

  const {sliceRank, numUpdates, sliceSize, strides, outputSize} = inputs;

  if (util.sizeFromShape(shape) === 0) {
    return out;
  }

  return out;
}
outputSize} = \nscatter_util.calculateShapes(updates, indices, shape);\n\nconst indicesData = backend.dataIdMap.get(indices.dataId);\nconst indicesId = indicesData.id;\nconst updatesData = backend.dataIdMap.get(updates.dataId);\nconst updatesId = updatesData.id;\nconst stridesBytes = new Uint8Array(new Int32Array(strides).buffer);\n\nconst indicesData = backend.dataIdMap.get(indices.dataId);\nconst indicesId = indicesData.id;\nconst updatesData = backend.dataIdMap.get(updates.dataId);\nconst updatesId = updatesData.id;\nconst stridesBytes = new Uint8Array(new Int32Array(strides).buffer);\n\nconst outId = backend.dataIdMap.get(out.dataId).id;

wasmScatterNd(indicesId, updatesId, CppDType[updates.dtype], sliceRank, numUpdates, \nstridesBytes, outputSize, outId);

return out;

export const scatterNdConfig: KernelConfig = \n{\n  kernelName: ScatterNd,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: scatterNd as {} as KernelFunc\n};

'Register All Kernels'

import {Add, KernelConfig} from '@tensorflow/tfjs-core';\n
import {createBinaryKernelConfig} from '../binary_kernel';\n
const supportsFullBroadcast = true;

export const addConfig: KernelConfig = createBinaryKernelConfig(Add, supportsFullBroadcast);
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M, wBAwB, CAAC, AAC1D, OAEO, EAAC, 2BA2B, EAAC, MAAM, iCAAC, CAAC, AAC5E, OAEO, EAAC, SA
AS, EAAC, MAAM, eAAe, CAAC, AACxC, OAEO, EAAC, WAAW, EAAC, MAAM, iBAAIB, CAAC, AAC5C, OAEO,
EAAC, SAAS, EAAC, MAAM, eAAe, CAAC, AACxC, OAEO, EAAC, gBAgB, EAAC, MAAM, sBAAsB, CAAC, AA
CtD, OAEO, EAAC, UAAU, EAAC, MAAM, gBAgB, CAAC, AAC1C, OAEO, EAAC, mBAmB, EAAC, MAAM, yB
AAyB, CAAC, AAC5D, OAEO, EAAC, WAAW, EAAC, MAAM, iBAAIB, CAAC, AAC5C, OAEO, EAAC, eAAe, CAAC,
MAAM, oBAoB, CAAC, AACD, OAEO, EAAC, oBAoB, EAAC, MAAM, 0BAoB, CAAC, AAC9D, OAEO, EAAC,
iBAAIB, EAAC, mBAuB, CAAC, AACxD, OAEO, EAAC, 0BAoB, EAAC, MAAM, gCAgC, CAAC, AAC1E, OAEO,
EAAC, CAAc, EAAC, MAAM, oBAoB, CAAC, AACD, OAEO, EAAC, eAAe, EAAC, MAAM, gBAgB, CAAC, AAC1C,
0BAoB, CAAC, AACD, OAEO, EAAC, aAAa, EAAC, MAAM, mBAmB, CAAC, AACChD, OAEO, EAAC, aAAa, EAAC,
MAAM, mBAmB, CAAC, AACD, OAEO, EAAC, UAAU, EAAC, MAAM, gBAgB, CAAC, AAC1C, OAEO, EAAC,
AAE, EAAC, MAAM, gBAgB, CAAC, AAC1D, OAEO, EAAC, SAAE, EAAC, MAAM, eAAe, CAAC, AAC1E, OAEO,
EAAC, eAAe, EAAC, MAAM, gBAgB, CAAC, AAC1C, OAEO, EAAC, sBAAsB, CAAC, AACD, OAEO, EAAC,
hBAkB, EAAC, AAC, AACD, OAEO, EAAC, tBAkB, EAAC, AAC, AACD, OAEO, EAAC, hBAkB, EAAC, AAC, AAC
CtD, OAEO, EAAC, WAAW, EAAC, MAAM, gBAgB, CAAC, AAC1C, OAEO, EAAC, eAAe, EAAC, MAAM, gBAgB,
We explicitly import the modular kernels so they get registered in the global registry when we compile the library. A modular build would replace the contents of this file and import only the kernels that are needed.

```javascript
import {KernelConfig, registerKernel} from '@tensorflow/tfjs-core';
import {fusedMatMulConfig} from './kernels/_FusedMatMul';
import {absConfig} from './kernels/Abs';
import {addConfig} from './kernels/Add';
import {addNConfig} from './kernels/AddN';
import {allConfig} from './kernels/All';
import {anyConfig} from './kernels/Any';
import {argMaxConfig} from './kernels/ArgMax';
import {avgPoolConfig} from './kernels/AvgPool';
import {batchMatMulConfig} from './kernels/BatchMatMul';
import {batchToSpaceNDConfig} from './kernels/BatchToSpaceND';
import {castConfig} from './kernels/Cast';
import {ceilConfig} from './kernels/Ceil';
import {clipByValueConfig} from './kernels/ClipByValue';
import {concatConfig} from './kernels/Concat';
import {conv2DConfig} from './kernels/Conv2D';
import {conv2DBackpropInputConfig} from './kernels/Conv2DBackpropInput';
import {cosConfig} from './kernels/Cos';
import {coshConfig} from './kernels/Cosh';
import {cropAndResizeConfig} from './kernels/CropAndResize';
import {cumsumConfig} from './kernels/Cumsum';
import {depthToSpaceConfig} from './kernels/DepthToSpace';
import {depthwiseConv2dNativeConfig} from './kernels/DepthwiseConv2dNative';
import {eluConfig} from './kernels/Elu';
import {expConfig} from './kernels/Exp';
import {expandDimsConfig} from './kernels/ExpandDims';
import {fillConfig} from './kernels/Fill';
import {flipLeftRightConfig} from './kernels/Floor';
import {floorConfig} from './kernels/FloorDiv';
import {fusedBatchNormConfig} from './kernels/FusedBatchNorm';
import {fusedConv2DConfig} from './kernels/FusedConv2D';
import {fusedDepthwiseConv2DConfig} from './kernels/FusedDepthwiseConv2D';
import {gatherNdConfig} from './kernels/GatherNd';
import {gatherV2Config} from './kernels/GatherV2';
import {greaterConfig} from './kernels/Greater';
import {greaterEqualConfig} from './kernels/GreaterEqual';
import {identityConfig} from './kernels/Identity';
import {leakyReluConfig} from './kernels/LeakyRelu';
import {logConfig} from './kernels/Log';
import {logicalAndConfig} from './kernels/LogicalAnd';
import {maximumConfig} from './kernels/Maximum';
import {meanConfig} from './kernels/MaxPool';
import {minConfig} from './kernels/Minimum';
import {mirrorPadConfig} from './kernels/MirrorPad';
import {multiplyConfig} from './kernels/Multiply';
import {negConfig} from './kernels/NonMaxSuppressionV3';
import {nonMaxSuppressionV4Config} from './kernels/NonMaxSuppressionV4';
import {nonMaxSuppressionV5Config} from './kernels/NonMaxSuppressionV5';
import {padConfig} from './kernels/Pad';
import {padV2Config} from './kernels/PadV2';
import {powConfig} from './kernels/Pow';
import {reduceMaxConfig} from './kernels/ReduceMax';
import {reduceMeanConfig} from './kernels/ReduceMean';
import {reduceMinConfig} from './kernels/ReduceMin';
import {reduceProdConfig} from './kernels/ReduceProd';
import {reluConfig} from './kernels/Relu';
import {relu6Config} from './kernels/Relu6';
import {roundConfig} from './kernels/Round';
import {seluConfig} from './kernels/Selu';
import {sigmoidConfig} from './kernels/Sigmoid';
import {softsignConfig} from './kernels/Softsign';
import {spaceToDepthConfig} from './kernels/SpaceToDepth';
import {sqrtConfig} from './kernels/Sqrt';
import {squareConfig} from './kernels/Square';
import {squeezeConfig} from './kernels/Squeeze';
import {subtractConfig} from './kernels/Subtract';
import {sumConfig} from './kernels/Sum';
import {tanConfig} from './kernels/Tan';
import {tanhConfig} from './kernels/Tanh';
import {topkConfig} from './kernels/Topk';
import {trilConfig} from './kernels/Tril';
import {triuConfig} from './kernels/Triu';
import {unaryWindowedMinConfig} from './kernels/UnaryWindowedMin';
import {varianceConfig} from './kernels/Variance';
import {whereConfig} from './kernels/Where';
```

We explicitly import the modular kernels so they get registered in the global registry when we compile the library. A modular build would replace the contents of this file and import only the kernels that are needed.

```
import {KernelConfig, registerKernel} from '@tensorflow/tfjs-core';
import {fusedMatMulConfig} from './kernels/_FusedMatMul';
import {absConfig} from './kernels/Abs';
import {addConfig} from './kernels/Add';
import {addNConfig} from './kernels/AddN';
import {allConfig} from './kernels/All';
import {anyConfig} from './kernels/Any';
import {argMaxConfig} from './kernels/ArgMax';
import {avgPoolConfig} from './kernels/AvgPool';
import {batchMatMulConfig} from './kernels/BatchMatMul';
import {batchToSpaceNDConfig} from './kernels/BatchToSpaceND';
import {castConfig} from './kernels/Cast';
import {ceilConfig} from './kernels/Ceil';
import {clipByValueConfig} from './kernels/ClipByValue';
import {concatConfig} from './kernels/Concat';
import {conv2DConfig} from './kernels/Conv2D';
import {conv2DBackpropInputConfig} from './kernels/Conv2DBackpropInput';
import {cosConfig} from './kernels/Cos';
import {coshConfig} from './kernels/Cosh';
import {cropAndResizeConfig} from './kernels/CropAndResize';
import {cumsumConfig} from './kernels/Cumsum';
import {depthToSpaceConfig} from './kernels/DepthToSpace';
import {depthwiseConv2dNativeConfig} from './kernels/DepthwiseConv2dNative';
import {eluConfig} from './kernels/Elu';
import {expConfig} from './kernels/Exp';
import {expandDimsConfig} from './kernels/ExpandDims';
import {fillConfig} from './kernels/Fill';
import {flipLeftRightConfig} from './kernels/Floor';
import {floorConfig} from './kernels/FloorDiv';
import {fusedBatchNormConfig} from './kernels/FusedBatchNorm';
import {fusedConv2DConfig} from './kernels/FusedConv2D';
import {fusedDepthwiseConv2DConfig} from './kernels/FusedDepthwiseConv2D';
import {gatherNdConfig} from './kernels/GatherNd';
import {gatherV2Config} from './kernels/GatherV2';
import {greaterConfig} from './kernels/Greater';
import {greaterEqualConfig} from './kernels/GreaterEqual';
import {identityConfig} from './kernels/Identity';
import {leakyReluConfig} from './kernels/LeakyRelu';
import {logConfig} from './kernels/Log';
import {logicalAndConfig} from './kernels/LogicalAnd';
import {maximumConfig} from './kernels/Maximum';
import {meanConfig} from './kernels/MaxPool';
import {minConfig} from './kernels/Minimum';
import {mirrorPadConfig} from './kernels/MirrorPad';
import {multiplyConfig} from './kernels/Multiply';
import {negConfig} from './kernels/NonMaxSuppressionV3';
import {nonMaxSuppressionV4Config} from './kernels/NonMaxSuppressionV4';
import {nonMaxSuppressionV5Config} from './kernels/NonMaxSuppressionV5';
import {padConfig} from './kernels/Pad';
import {padV2Config} from './kernels/PadV2';
import {powConfig} from './kernels/Pow';
import {reduceMaxConfig} from './kernels/ReduceMax';
import {reduceMeanConfig} from './kernels/ReduceMean';
import {reduceMinConfig} from './kernels/ReduceMin';
import {reduceProdConfig} from './kernels/ReduceProd';
import {reluConfig} from './kernels/Relu';
import {relu6Config} from './kernels/Relu6';
import {roundConfig} from './kernels/Round';
import {seluConfig} from './kernels/Selu';
import {sigmoidConfig} from './kernels/Sigmoid';
import {softsignConfig} from './kernels/Softsign';
import {spaceToDepthConfig} from './kernels/SpaceToDepth';
import {sqrtConfig} from './kernels/Sqrt';
import {squareConfig} from './kernels/Square';
import {squeezeConfig} from './kernels/Squeeze';
import {subtractConfig} from './kernels/Subtract';
import {sumConfig} from './kernels/Sum';
import {tanConfig} from './kernels/Tan';
import {tanhConfig} from './kernels/Tanh';
import {topkConfig} from './kernels/Topk';
import {trilConfig} from './kernels/Tril';
import {triuConfig} from './kernels/Triu';
import {unaryWindowedMinConfig} from './kernels/UnaryWindowedMin';
import {varianceConfig} from './kernels/Variance';
import {whereConfig} from './kernels/Where';
```
import {onesLikeConfig} from './kernels/OnesLike';
import {packConfig} from './kernels/Pack';
import {padV2Config} from './kernels/PadV2';
import {powConfig} from './kernels/Pow';
import {preluConfig} from './kernels/Prelu';
import {prodConfig} from './kernels/Prod';
import {rangeConfig} from './kernels/Range';
import {realDivConfig} from './kernels/RealDiv';
import {reluConfig} from './kernels/Relu';
import {relu6Config} from './kernels/Relu6';
import {reshapeConfig} from './kernels/Reshape';
import {reverseConfig} from './kernels/Reverse';
import {selectConfig} from './kernels/Select';
import {sigmoidConfig} from './kernels/Sigmoid';
import {softmaxConfig} from './kernels/Softmax';
import {tileConfig} from './kernels/Tile';
import {topKConfig} from './kernels/TopK';
import {transformConfig} from './kernels/Transform';
import {transposeConfig} from './kernels/Transpose';
import {unpackConfig} from './kernels/Unpack';
import {zerosLikeConfig} from './kernels/ZerosLike';

// List all kernel configs here
const kernelConfigs: KernelConfig[] = [
  absConfig,
  addConfig,
  addNConfig,
  allConfig,
  anyConfig,
  argMaxConfig,
  avgPoolConfig,
  batchMatMulConfig,
  batchToSpaceNDConfig,
  castConfig,
  ceilConfig,
  clipByValueConfig,
  concatConfig,
  conv2DConfig,
  conv2DBackpropInputConfig,
  conv2DTransposeConfig,
  cumsumConfig,
  depthToSpaceConfig,
  depthwiseConv2dNativeConfig,
  eluConfig,
  equalConfig,
  expConfig,
  expandDimsConfig,
  floorConfig,
  floorDivConfig,
  fusedMatMulConfig,
  fusedBatchNormConfig,
  fusedConv2DConfig,
  fusedDepthwiseConv2DConfig,
  gatherNdConfig,
  gatherV2Config,
  greaterEqualConfig,
  identityConfig,
  leakyReluConfig,
  lessConfig,
  lessEqualConfig,
  logConfig,
  logicalAndConfig,
  maxConfig,
  minimumConfig,
  mirrorPadConfig,
  multiplyConfig,
  negConfig,
  nonMaxSuppressionV3Config,
  nonMaxSuppressionV4Config,
  nonsaturatingExponentialConfig,
  notEqualConfig,
  oneHotConfig,
  onesLikeConfig,
  packConfig,
  padV2Config,
  powConfig,
  preluConfig,
  prodConfig,
  rangeConfig,
  realDivConfig,
  reluConfig,
  reshapeConfig,
  resizeBilinearConfig,
  reverseConfig,
  rotateWithOffsetConfig,
  roundConfig,
  scatterNdConfig,
  selectConfig,
  sigmoidConfig,
  sinConfig,
  sliceConfig,
  softmaxConfig,
  spaceToBatchNDConfig,
  splitVConfig,
  sqrtConfig,
  squareConfig,
  squaredDifferenceConfig,
  stepConfig,
  stridedSliceConfig,
  subConfig,
  sumConfig,
  tanConfig,
  tanhConfig,
  tileConfig,
  topKConfig,
  transformConfig,
  transposeConfig,
  unpackConfig,
  zerosLikeConfig];

for (const kernelConfig of kernelConfigs) {
  registerKernel(kernelConfig);
}
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import {Floor, KernelConfig} from '@tensorflow/tfjs-core';

export const floorConfig: KernelConfig = createUnaryKernelConfig(Floor);

No license file was found, but licenses were detected in source scan.
import {BackendWasm} from '../backend_wasm';

import {permuteAxesAndTranspose} from './kernel_utils';

let wasmAll: (xId: number, reduceSize: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmAll = backend.wasm.cwrap(All, null /*void*/, 
    ['number, number, number'])
}

function all(args: {backend: BackendWasm, inputs: AllInputs, attrs: AllAttrs}:
    TensorInfo {
  const {backend, inputs, attrs} = args;
  const {axis, keepDims} = attrs;
  const {x} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  // let inputId = xId;
  const transposed = permuteAxesAndTranspose(x, axis, backend);
  if (inputWasTransposed) {
    const transposedId = backend.dataIdMap.get(transposed.dataId).id;
    inputId = transposedId;
  }
  const inputRank = input.shape.length;
  // backend_util.assertAxesAreInnerMostDims('all', axes, inputRank);
  const [outShape, reduceShape] = backend_util.computeOutAndReduceShapes(input.shape, axes);
  const reduceSize = util.sizeFromShape(reduceShape);

  const out = backend.makeOutput(outShape, x.dtype);
  if (util.sizeFromShape(input.shape) !== 0) {
    const outId = backend.dataIdMap.get(out.dataId).id;
    wasmAll(inputId, reduceSize, outId);
  }

  if (inputWasTransposed) {
    // dispose of the transposed tensor.
    backend.disposeData(transposed.dataId);
  }

  if (keepDims) {
    // reshape
    const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);
    out.shape = newShape;
  }

  return out;
}

export const allConfig: KernelConfig = {
  kernelName: All,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: all as {} as KernelFunc
};

import {backend_util, Conv2D, Conv2DAttrs, Conv2DInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmConv2d: (
    xId: number, batchSize: number, inputHeight: number, inputWidth: number,
    filterId: number, filterHeight: number,
    filterWidth: number, padTop: number,
    padRight: number, padBottom: number, padLeft: number, isSamePad: number,
    dilationHeight: number, dilationWidth: number, strideHeight: number, strideWidth: number,
    inputChannels: number, outputChannels: number,
    outId: number) => void;

function setup(backend: BackendWasm) {
  wasmConv2d = backend.wasm.cwrap(Conv2D, null /* void */, [
    'number',  // xId
    'number',  // batchSize
    'number',  // inputHeight
    'number',  // inputWidth
    'number',  // filterId
    'number',  // filterHeight
    'number',  // filterWidth
    'number',  // padTop
    'number',  // padRight
    'number',  // padBottom
    'number',  // padLeft
    'number',  // isSamePad
    'number',  // dilationHeight
    'number',  // dilationWidth
    'number',  // strideHeight
    'number',  // strideWidth
    'number',  // inputChannels
    'number',  // outputChannels
    'number',  // outId
  ]);
}

function conv2d(
    args: {inputs: Conv2DInputs, backend: BackendWasm, attrs: Conv2DAttrs}) {
  const {inputs, attrs, backend} = args;

  const {x, filter} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  const filterId = backend.dataIdMap.get(filter.dataId).id;

  const {strides, dilations, pad, dimRoundingMode, dataFormat} = attrs;
  const $dataFormat = backend_util.convertConv2DDataFormat(dataFormat);
  const convInfo = backend_util.computeConv2DInfo((x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,
      pad, dimRoundingMode, false,
      $dataFormat);

  const filterHeight = convInfo.filterHeight;
  const filterWidth = convInfo.filterWidth;
  const padTop = convInfo.padInfo.top;
  const padRight = convInfo.padInfo.right;
  const padBottom = convInfo.padInfo.bottom;
  const padLeft = convInfo.padInfo.left;
  const dilationHeight = convInfo.dilationHeight;
  const dilationWidth = convInfo.dilationWidth;
  const strideHeight = convInfo.strideHeight;
  const strideWidth = convInfo.strideWidth;
  const inputChannels = convInfo.inChannels;
  const outputChannels = convInfo.outChannels;
  const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;
  if (isSamePad) {
    return new Error('wasm backend Conv2D does not support dataFormat: "SAME". Please use "channelsLast."');
  }

  const out = backend.makeOutput(convInfo.outShape, 'float32');
  const outId = backend.dataIdMap.get(out.dataId).id;
  wasmConv2d(xId, x.shape[0], x.shape[1], x.shape[2], filterId,
      filterHeight, filterWidth, padTop, padRight, padBottom, padLeft, isSamePad,
      dilationHeight, dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels, outId);
  return out;
}

export const conv2DConfig: KernelConfig = {
  kernelName: Conv2D,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: conv2d as {} as KernelFunc
};
Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-dist/kernels/Conv2D.js.map

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

```javascript
```

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---

This enum must align with the enum defined in cc/backend.h.

export enum CppDType {
  float32 = 0,
  int32 = 1,
  bool = 2,
  string = 3,
  complex64 = 4,
}

Must match enum in cc/fusable_activations.h.

export enum FusibleActivation {
  linear = 0,
  relu = 1,
  relu6 = 2,
  prelu = 3,
  leakyrelu = 4,
  sigmoid = 5,
  elu = 6,
}

---

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=============================================================================

import {_FusedMatMul, _FusedMatMulAttrs, _FusedMatMulInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {FusableActivation} from './types';

let wasmFusedMatMul:
    (aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,
     bShape: Uint8Array, bShapeSize: number, transposeA: boolean,
     transposeB: boolean, activation: number, biasId: number,
     preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>
     void;

function setup(backend: BackendWasm) {
  wasmFusedMatMul = backend.wasm.cwrap(_FusedMatMul,
    null /* void */, 
    ['number',  // a_id
     'array',   // a_shape
     'number',  // a_shape.length
    'number',  // b_id
     'array',   // b_shape.length
     'number',   // transpose_a
     'number',   // number
     'number',  // number
    'number',  // number
     'number',  // number
     'number',  // number
     'number',  // number
     'number',  // number
     'number',  // number
    'number',  // number
     'number']   // number
  );
}

function fusedBatchMatMul(args: {
  inputs: _FusedMatMulInputs,
  backend: BackendWasm,
  attrs: _FusedMatMulAttrs
}) {
  const {inputs, backend, attrs} = args;
  const {a, b, bias, preluActivationWeights} = inputs;

  if (a.dtype !== 'float32' || b.dtype !== 'float32') {
    throw new Error(`_FusedMatMul for non non-float32 tensors not yet supported.`);
  }

  const {transposeA, transposeB, activation, leakyreluAlpha} = attrs;
  const aId = backend.dataIdMap.get(a.dataId).id;
  const bId = backend.dataIdMap.get(b.dataId).id;

  let biasId = 0;
  if (bias != null) {
    const biasData = backend.dataIdMap.get(bias.dataId);
    if (biasData.shape.length !== 1) {
      throw new Error(`_FusedMatMul only supports rank-1 bias but got rank ${biasData.shape.length}.`);
    }
    biasId = biasData.id;
  }
  const preluActivationWeightsId = preluActivationWeights == null?
      0 :
      backend.dataIdMap.get(preluActivationWeights.dataId).id;
  const fusedActivation =
      FusableActivation[activation as {} as keyof typeof FusableActivation];
  if (fusedActivation == null) {
    throw new Error(`${activation} activation not yet supported for FusedConv2D`);
  }

  const batchDim = a.shape[0];

  const out = backend.makeOutput([batchDim, leftDim, rightDim], a.dtype);
  const outId = backend.dataIdMap.get(out.dataId).id;

  const aShapeBytes = new Uint8Array(new Int32Array(a.shape).buffer);
  const bShapeBytes = new Uint8Array(new Int32Array(b.shape).buffer);

  wasmFusedMatMul(aId, aShapeBytes, aShapeSize, bId, bShapeBytes, bShapeSize, transposeA,
   transposeB, fusedActivation, biasId, preluActivationWeightsId, leakyreluAlpha || 0, outId);

  return out;
}

export const fusedMatMulConfig: KernelConfig = {
  kernelName: _FusedMatMul,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: fusedBatchMatMul as {} as KernelFunc
};
TensorInfo {
  const {backend, inputs: {x}} = args;
  const xId = backend.dataIdMap.get(x.dataId).id;
  const out = backend.makeOutput(x.shape, outType || x.dtype);
  const outId = backend.dataIdMap.get(out.dataId).id;
  if (util.sizeFromShape(out.shape) === 0) {
    return out;
  }
  wasmFunc(xId, CppDType[x.dtype], outId);
  return out;
}

export function createUnaryKernelConfig(kernelName: string, supportsFullBroadcast: boolean, dtype?: DataType): KernelConfig {
  let wasmFunc:
      (aId: number, aShape: Uint8Array, aShapeLen: number, dtype: number, outId: number) =>
          void;

  function setupFunc(backend: BackendWasm): void {
    wasmFunc = backend.wasm.cwrap(kernelName, null /* void */, 
      'number',  // a_id,
      'array'    // a_shape
    );
  }

  function kernelFunc(args: {backend: BackendWasm, inputs: BinaryInputs}):
      TensorInfo {
    const {backend, inputs} = args;
    const {a, b} = inputs;
    const aId = backend.dataIdMap.get(a.dataId).id;
    const bId = backend.dataIdMap.get(b.dataId).id;

    const outputType = dtype != null ? dtype : a.dtype;
    const newShape = backend_util.assertAndGetBroadcastShape(a.shape, b.shape);
    const out = backend.makeOutput(newShape, outputType);

    // Short-circuit zero-sized tensors.
    if (util.sizeFromShape(newShape) === 0) {
      return out;
    }

    const aShapeBytes = new Uint8Array(new Int32Array(a.shape).buffer);
    const bShapeBytes = new Uint8Array(new Int32Array(b.shape).buffer);
    const outId = backend.dataIdMap.get(out.dataId).id;

    const kernelFunc = () => wasmFunc(
        aId, aShapeBytes, aShape.length, bId, bShapeBytes, bShape.length,
        CppDType[a.dtype], outId);

    // Currently only some float operations support full broadcast.
    if (supportsFullBroadcast && a.dtype === 'float32') {
      const newShape = backend_util.assertAndGetBroadcastShape(a.shape, b.shape);
      const out = backend.makeOutput(newShape, outputType);
      wasmFunc(aId, aShapeBytes, aShape.length, bId, bShapeBytes, bShape.length,
        CppDType[a.dtype], outId);
    } else {
      throw new Error('Unsupported broadcasting along outer dims is not yet supported');
    }
  }
}

export function createBinaryKernelConfig(kernelName: string, supportsFullBroadcast: boolean, dtype?: DataType): KernelConfig {
  let wasmFunc:
      (aId: number, aShape: Uint8Array, aShapeLen: number, bId: number,
       bShape: Uint8Array, bShapeLen: number, dtype: number, outId: number) =>
          void;

  function setupFunc(backend: BackendWasm): void {
    wasmFunc = backend.wasm.cwrap(kernelName, null /* void */, 
      'number',  // a_id,
      'array'    // a_shape
    );
  }

  function kernelFunc(args: {backend: BackendWasm, inputs: BinaryInputs}):
      TensorInfo {
    const {backend, inputs} = args;
    const {a, b} = inputs;
    const aId = backend.dataIdMap.get(a.dataId).id;
    const bId = backend.dataIdMap.get(b.dataId).id;

    const outputType = dtype != null ? dtype : a.dtype;
    const newShape = backend_util.assertAndGetBroadcastShape(a.shape, b.shape);
    const out = backend.makeOutput(newShape, outputType);

    // Short-circuit zero-sized tensors.
    if (util.sizeFromShape(newShape) === 0) {
      return out;
    }

    const aShapeBytes = new Uint8Array(new Int32Array(a.shape).buffer);
    const bShapeBytes = new Uint8Array(new Int32Array(b.shape).buffer);
    const outId = backend.dataIdMap.get(out.dataId).id;

    const kernelFunc = () => wasmFunc(
        aId, aShapeBytes, aShape.length, bId, bShapeBytes, bShape.length,
        CppDType[a.dtype], outId);

    // Currently only some float operations support full broadcast.
    if (supportsFullBroadcast && a.dtype === 'float32') {
      const newShape = backend_util.assertAndGetBroadcastShape(a.shape, b.shape);
      const out = backend.makeOutput(newShape, outputType);
      wasmFunc(aId, aShapeBytes, aShape.length, bId, bShapeBytes, bShape.length,
        CppDType[a.dtype], outId);
    } else {
      throw new Error('Unsupported broadcasting along outer dims is not yet supported');
    }
  }
}
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=============================================================================

import {Add, KernelConfig} from '@tensorflow/tfjs-core';

const supportsFullBroadcast = true;

export const addConfig: KernelConfig =
  createBinaryKernelConfig(Add, supportsFullBroadcast);

export const addNConfig: KernelConfig = {
  kernelName: AddN,
  backendName: 'wasm',
  setupFunc,
  kernelFunc: addn as {} as KernelFunc,
};

export const identityConfig: KernelConfig = {
  kernelName: Identity,
  backendName: 'wasm',
  kernelFunc: identity as {} as KernelFunc,
};

=============================================================================

import {Transp} from '@tensorflow/tfjs-core';

export const transposeConfig: KernelConfig = {
  kernelName: Transpose,
  backendName: 'wasm',
  kernelFunc: transpose as {} as KernelFunc,
};

=============================================================================

import {Identity, IdentityInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';

export function identity(args: {inputs: IdentityInputs, backend: BackendWasm}):
    TensorInfo {
  const {inputs: {x}, backend} = args;
  const out = backend.makeOutput(x.shape, x.dtype);
  const inVals = backend.typedArrayFromHeap(x);
  const outVals = backend.typedArrayFromHeap(out);
  outVals.set(inVals);
  return out;
}

export const identityConfig: KernelConfig = {
  kernelName: Identity,
  backendName: 'wasm',
  kernelFunc: identity as {} as KernelFunc,
};

=============================================================================

import {Identity, IdentityInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';

export function identity(args: {inputs: IdentityInputs, backend: BackendWasm}):
    TensorInfo {
  const {inputs: {x}, backend} = args;
  const out = backend.makeOutput(x.shape, x.dtype);
  const inVals = backend.typedArrayFromHeap(x);
  const outVals = backend.typedArrayFromHeap(out);
  outVals.set(inVals);
  return out;
}

export const identityConfig: KernelConfig = {
  kernelName: Identity,
  backendName: 'wasm',
  kernelFunc: identity as {} as KernelFunc,
};

=============================================================================

import {Identity, IdentityInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';

export function identity(args: {inputs: IdentityInputs, backend: BackendWasm}):
    TensorInfo {
  const {inputs: {x}, backend} = args;
  const out = backend.makeOutput(x.shape, x.dtype);
  const inVals = backend.typedArrayFromHeap(x);
  const outVals = backend.typedArrayFromHeap(out);
  outVals.set(inVals);
  return out;
}

export const identityConfig: KernelConfig = {
  kernelName: Identity,
  backendName: 'wasm',
  kernelFunc: identity as {} as KernelFunc,
};

=============================================================================
import {BackendWasm} from '@tensorflow/tfjs-core';

import {BackendWasm} from '@tensorflow/tfjs-core';

import {CppDType} from '@types';

let wasmTranspose: (xId: number, xShape: Uint8Array, xShapeLength: number, dtype: CppDType, outId: number, perm: Uint8Array, permLength: number) => void;

function setup(backend: BackendWasm) {
  wasmTranspose = backend.wasm.cwrap(Transpose, null /* void */, ['number', // xId
    'array', // x.shape
    'number', // x.shape.length
    'number', // dtype
    'number', // outId
    'array', // perm
    'number', // perm.length
  ]);}

function transpose(
    inputs: TransposeInputs,
    backend: BackendWasm,
    attrs: TransposeAttrs) {
  const {inputs, backend, attrs} = args;
  const reducedShape_x = reduceDim(inputs.x.shape, 1, attrs.perm);
  let permIsNoOp = true;
  for (let i = 0; i < perm.length; i++) {
    if (perm[i] !== i) {
      permIsNoOp = false;
    }
  }
  const outShape = computeOutShape(inputs.x.shape, attrs.perm);
  const x = {
    dataId: inputs.x.dataId,
    shape: reducedShape_x,
    dtype: inputs.x.dtype,
  };
  let out = backend.makeOutput(outShape, x.dtype);
  let xId = backend.dataIdMap.get(x.dataId).id;
  let outId = backend.dataIdMap.get(out.dataId).id;
  let permBytes = new Uint8Array(new Int32Array(perm).buffer);
  let xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);
  wasmTranspose(
      xId,
      xShapeBytes, x.shape.length, CppDType[x.dtype], outId, permBytes,
      perm.length);
  return out;
}

function computeOutShape(inShape: number[], perm: number[]) {
  const outShape = new Array(inShape.length);
  for (let i = 0; i < outShape.length; i++) {
    outShape[i] = inShape[perm[i]];
  }
  return outShape;
}

function removeOneSizeDims(shape: number[], perm: number[]) {
  const newShape: number[] = new Array(shape.length);
  for (let i = 0; i < newShape.length; ++i) {
    newShape[i] = shape[perm[i]];
  }
  const newPerm: number[] = new Array(perm.length);
  for (let i = 0; i < newPerm.length; ++i) {
    newPerm[i] = perm[i] - i &
        (newPerm[i] > 0 ? newPerm[i] : -newPerm[i] + 1);
  }
  return newShape,
  newPerm;
}

export const transposeConfig: KernelConfig = {
  kernelName: Transpose,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: transpose as {} as KernelFunc,
};

 function permuteAxesAndTranspose(
    x: TensorInfo,
    axis: number|number[],
    backend: BackendWasm
) {
  const xShape = x.shape;
  const xRank = x.shape.length;
  const x = TensorInfo
  const originalAxes = util.parseAxisParam(axis, x.shape);
  const permutedAxes = backend_util.getAxesPermutation(axes, xRank);
  const newPerm = backend_util.getInnerMostAxes(axes.length, xRank);
  const minValIdx = -1;
  const inputWasTransposed = false;
  if (permutedAxes.length !== axes.length) {
    inputWasTransposed = true;
  }
  const xId = backend.dataIdMap.get(x.dataId).id;
  const x = xId;
  const x = xId;
  return x;
}
import {All, AllAttrs, AllInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {permuteAxesAndTranspose} from './kernel_utils';

let wasmAll: (xId: number, reduceSize: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmAll = backend.wasm.cwrap(All, null /*void*/, ['number, number, number']);
}

function all(args: {backend: BackendWasm, inputs: AllInputs, attrs: AllAttrs}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {axis, keepDims} = attrs;
  const {x} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  let inputId = xId;
  let input = x;

  const {transposed, axes, originalAxes, inputWasTransposed} = permuteAxesAndTranspose(x, axis, backend);

  if (inputWasTransposed) {
    const transposedId = backend.dataIdMap.get(transposed.dataId).id;
    input = transposed;
    inputId = transposedId;
  }

  const inputRank = input.shape.length;

  backend_util.assertAxesAreInnerMostDims('all', axes, backend);
  const [outShape, reduceShape] = backend_util.computeOutAndReduceShapes(input.shape, axes);
  const reduceSize = util.sizeFromShape(reduceShape);

  const out = backend.makeOutput(outShape, x.dtype);
  if (util.sizeFromShape(input.shape) !== 0) {
    const outId = backend.dataIdMap.get(out.dataId).id;
    wasmAll(inputId, reduceSize, outId);
  }

  if (inputWasTransposed) {
    backend.disposeData(transposed.dataId);
  }

  if (keepDims) {
    const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);
    out.shape = newShape;
  }

  return out;
}

export const allConfig: KernelConfig = {
  kernelName: All,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: all as {} as KernelFunc
};

import {Any, AnyAttrs, AnyInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {permuteAxesAndTranspose} from './kernel_utils';

let wasmAny: (xId: number, reduceSize: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmAny = backend.wasm.cwrap(Any, null /*void*/, ['number, number, number']);
}

function any(args: {backend: BackendWasm, inputs: AnyInputs, attrs: AnyAttrs}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {axis, keepDims} = attrs;
  const {x} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  let inputId = xId;
  let input = x;

  const {transposed, axes, originalAxes, inputWasTransposed} = permuteAxesAndTranspose(x, axis, backend);

  if (inputWasTransposed) {
    const transposedId = backend.dataIdMap.get(transposed.dataId).id;
    input = transposed;
    inputId = transposedId;
  }

  const inputRank = input.shape.length;

  backend_util.assertAxesAreInnerMostDims('any', axes, backend);
  const [outShape, reduceShape] = backend_util.computeOutAndReduceShapes(input.shape, axes);
  const reduceSize = util.sizeFromShape(reduceShape);

  const out = backend.makeOutput(outShape, x.dtype);
  if (util.sizeFromShape(input.shape) !== 0) {
    const outId = backend.dataIdMap.get(out.dataId).id;
    wasmAny(inputId, reduceSize, outId);
  }

  if (inputWasTransposed) {
    backend.disposeData(transposed.dataId);
  }

  return out;
}

export const anyConfig: KernelConfig = {
  kernelName: Any,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: any as {} as KernelFunc
};
```javascript
backend.disposeData(transposed.dataId);

} else {
  // reshape
  const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);
  out.shape = newShape;
}

return out;

export const anyConfig: KernelConfig = {
  kernelName: Any,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: any as {} as KernelFunc
};

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=============================================================================
*/

import {ArgMax, ArgMaxAttrs, ArgMaxInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {permuteAxesAndTranspose} from './kernel_utils';
import {CppDType} from './types';

let wasmFunc: (xId: number, dtype: number, outerSize: number, innerSize: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmFunc = backend.wasm.cwrap(ArgMax, null /* void */, [
    'number',  // x_id
    'number',  // dtype
    'number',  // outer_size
    'number',  // inner_size
    'number'   // out_id
  ]);}

function argmax(
    args: {inputs: ArgMaxInputs, backend: BackendWasm, attrs: ArgMaxAttrs}) {
  const {backend, inputs, attrs} = args;

  const {axis} = attrs as {} as ArgMaxAttrs;
  const {x} = inputs as {} as ArgMaxInputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  let inputId = xId;
  let input = x;

  const {transposed, axes, inputWasTransposed} = permuteAxesAndTranspose(x, axis, backend);

  if (inputWasTransposed) {
    const transposedId = backend.dataIdMap.get(transposed.dataId).id;
    if (transposedId !== xId) {
      // transpose was not a no-op. We will need to dispose of this
      // once we are done.
      input = transposed;
      inputId = transposedId;
    }
  }

  const outShape = input.shape.slice(0, -1);
  const out = backend.makeOutput(outShape, 'int32');
  const outId = backend.dataIdMap.get(out.dataId).id;
  const outerSize = util.sizeFromShape(out.shape);
  const innerSize = input.shape[axes[0]];
  wasmFunc(inputId, CppDType[input.dtype], outerSize, innerSize, outId);

  if (inputWasTransposed) {
    // dispose of the transposed tensor.
    backend.disposeData(transposed.dataId);
  }

  return out;
}

export const argMaxConfig: KernelConfig = {
  kernelName: ArgMax,
  backendName: 'wasm',
  kernelFunc: argmax as {} as KernelFunc,
  setupFunc: setup
};

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=============================================================================
*/

import {AvgPool, AvgPoolAttrs, AvgPoolInputs, backend_util, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmAvgPool: (xId: number, batchSize: number, inputHeight: number, inputWidth: number, filterHeight: number, filterWidth: number, padTop: number, padRight: number, padBottom: number, padLeft: number, strideHeight: number, strideWidth: number, channels: number, outputId: number) => void;

function setup(backend: BackendWasm) {
  wasmAvgPool = backend.wasm.cwrap(AvgPool, null /* void */, [
    'number',  // x_id
    'number',  // batch_size
    'number',  // input_height
    'number',  // input_width
    'number',  // filter_height
    'number',  // filter_width
    'number',  // pad_top
    'number',  // pad_right
    'number',  // pad_bottom
    'number',  // pad_left
    'number',  // stride_height
    'number',  // stride_width
    'number',  // channels
    'number',  // output_id
  ]);}

function avgPool(
    args: {inputs: AvgPoolInputs, backend: BackendWasm, attrs: AvgPoolAttrs}) {
  const {inputs, backend, attrs} = args;
  const x = inputs.x as Tensor4D;
  const xId = backend.dataIdMap.get(x.dataId);

  const argMaxConfig: KernelConfig = {
  kernelName: ArgMax,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: argmax as {} as KernelFunc
};
```
const convInfo = backend_util.computePool2DInfo(x.shape, filterSize, strides, 1 /* dilations */, pad, dimRoundingMode);
const filterHeight = convInfo.filterHeight;
const filterWidth = convInfo.filterWidth;
const padTop = convInfo.padInfo.top;
const padRight = convInfo.padInfo.right;
const padBottom = convInfo.padInfo.bottom;
const padLeft = convInfo.padInfo.left;
const strideHeight = convInfo.strideHeight;
const strideWidth = convInfo.strideWidth;
const channels = convInfo.inChannels;
if (convInfo.dataFormat !== 'channelsLast') {
  throw new Error('wasm backend does not support dataFormat: ' + '{convInfo.dataFormat}'. Please use 'channelsLast'.');
}
if (convInfo.dilationWidth !== 1 || convInfo.dilationHeight !== 1) {
  throw new Error('wasm backend only supports average pooling with dilation = [1, 1], got ' + '{$[convInfo.dilationHeight],
$[convInfo.dilationWidth]}.');
}

const out = backend.makeOutput(convInfo.outShape, 'float32');
const outId = backend.dataIdMap.get(out.dataId).id;

wasmAvgPool(xId, x.shape[0], x.shape[1], x.shape[2],
filterHeight, filterWidth, padTop, padRight, padBottom, padLeft, strideHeight, strideWidth, channels,
outId); return out;
}

export const avgPoolConfig: KernelConfig = {
  kernelName: AvgPool,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: avgPool as {} as KernelFunc
};

import {KernelConfig, KernelFunc, Reshape, ReshapeAttrs, ReshapeInputs, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

export function reshape(args: {inputs: ReshapeInputs, attrs: ReshapeAttrs, backend: BackendWasm}) {
  const {inputs, attrs} = args;
  const {x} = inputs;
  const {shape} = attrs;

  const xSize = util.sizeFromShape(x.shape);
  const $shape = util.inferFromImplicitShape(shape, xSize);

  util.assert(xSize === util.sizeFromShape($shape), () =>
    `new shape: ${$shape}, old shape: ${x.shape}. New shape and old shape must have the same number of elements.`);
  return {dataId: x.dataId, shape: $shape, dtype: x.dtype};
}

export const reshapeConfig: KernelConfig = {
  kernelName: Reshape,
  backendName: 'wasm',
  kernelFunc: reshape as {} as KernelFunc
};

import {BatchMatMul, BatchMatMulAttrs, BatchMatMulInputs, KernelConfig, KernelFunc, util} from
  '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmBatchMatMul: (aId: number, aShape: Uint8Array, aShapeSize: number, bId: number, bShape: Uint8Array, bShapeSize: number, transposeA: boolean, transposeB: boolean, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmBatchMatMul = backend.wasm.cwrap(BatchMatMul, null /* void */, [
    'number',  // a_id
    'array',   // a_shape
    'number',  // a_shape.length
    'number',  // b_id
    'array',   // b_shape
    'number',  // b_shape.length
    'boolean', // transpose_a
    'number',  // transpose_b
    'number',  // out_id
  ]);}

function batchMatMul(args: {
  inputs: BatchMatMulInputs,
  backend: BackendWasm,
  attrs: BatchMatMulAttrs
}) {
  const {inputs, backend, attrs} = args;
  const {a, b} = inputs;
  const {transposeA, transposeB} = attrs;
  const outId = backend.dataIdMap.get(outId).id;
  return {dataId: outId, shape: $shape, dtype: x.dtype};
}

export const batchMatMulConfig: KernelConfig = {
  kernelName: BatchMatMul,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: batchMatMul as {} as KernelFunc
};
const outerDimsA = a.shape.slice(0, -2); const outerDimsB = b.shape.slice(0, -2);
const batchDimA = util.sizeFromShape(outerDimsA);
const batchDimB = util.sizeFromShape(outerDimsB);
const batchDimsCompatible = batchDimA === batchDimB || batchDimA === 1 || batchDimB === 1;
util.assert(aRank >= 2 && bRank >= 2 && batchDimsCompatible, () => `Error in matMul: the input batch dimensions must either be the same or at least one input batch dimension must be 1. Got input batch dimensions of (${outerDimsA}) and (${outerDimsB}).`);
const outShapeOuterDims = batchDimA > batchDimB ? a.shape.slice(0, -2) : b.shape.slice(0, -2);
const a3dShape = transposeA ? [batchDimA, outerShapeA, innerShapeA] : [batchDimA, innerShapeA, outerShapeA];
const b3dShape = transposeB ? [batchDimB, innerShapeB, outerShapeB] : [batchDimB, outerShapeB, innerShapeB];
const a = reshape({inputs: {x: a}, backend, attrs: {shape: a3dShape}});
const b = reshape({inputs: {x: b}, backend, attrs: {shape: b3dShape}});
const aId = backend.dataIdMap.get(a.dataId).id;
const bId = backend.dataIdMap.get(b.dataId).id;
const out = backend.makeOutput([batchDimA, outerShapeA, innerShapeA], a.dtype);
const outId = backend.dataIdMap.get(out.dataId).id;
const aShapeBytes = new Uint8Array(new Int32Array(a3d.shape).buffer);
const bShapeBytes = new Uint8Array(new Int32Array(b3d.shape).buffer);
wasmBatchMatMul(aId, aShapeBytes, a3d.shape.length, bId, bShapeBytes, b3d.shape.length, transposeA, transposeB, outId);
backend.disposeData(a3dId, a3d.shape.length, transposeA, transposeB, outId);
backend.disposeData(b3dId, b3d.shape.length, transposeA, transposeB, outId);
export const batchMatMulConfig = {
  kernelName: BatchMatMul,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: batchMatMul as {} as KernelFunc
};

import { util } from '@tensorflow/tfjs-core';
export function rangeImpl(start, stop, step, dtype) {
    const sameStartStop = start === stop;
    const increasingRangeNegativeStep = start < stop && step < 0;
    const decreasingRangePositiveStep = stop < start && step > 0;
    if (sameStartStop || increasingRangeNegativeStep ||
        decreasingRangePositiveStep) {
        return util.makeZerosTypedArray(0, dtype);
    }
    const numElements = Math.abs(Math.ceil((stop - start) / step));
    const values = util.makeZerosTypedArray(numElements, dtype);
    if (stop < start && step === 1) {
        // Auto adjust the step’s sign if it hasn’t been set
        // (or was set to 1)
        step = -1;
    }
    values[0] = start;
    for (let i = 1; i < values.length; i++) {
        values[i] = values[i - 1] + step;
    }
    return values;
}
```javascript
import { backend_util, buffer, Slice, slice_util, util } from '@tensorflow/tfjs-core';
import { assertNotComplex } from '../cpu_util';
export function sliceImpl(vals, begin, size, shape, dtype) {
    const isContinous = slice_util.isSliceContinous(shape, begin, size);
    const length = util.sizeFromShape(size);
    const xStrides = util.computeStrides(shape);
    if (isContinous) {
        const flatOffset = slice_util.computeFlatOffset(begin, xStrides);
        if (dtype === 'string') {
            return vals.slice(flatOffset, flatOffset + length);
        }
        return vals.subarray(flatOffset, flatOffset + length);
    }
    const decodedData = dtype === 'string' ?
        backend_util.fromUint8ToStringArray(vals) :
        vals;
    const inBuf = buffer(shape, dtype, decodedData);
    const outBuf = buffer(size, dtype);
    for (let i = 0; i < outBuf.size; ++i) {
        const outLoc = outBuf.indexToLoc(i);
        const inLoc = outLoc.map((idx, j) => idx + begin[j]);
        outBuf.set(inBuf.get(...inLoc), ...outLoc);
    }
    if (dtype === 'string') {
        return backend_util.fromStringArrayToUint8(outBuf.values);
    }
    return outBuf.values;
}
export function slice(args) {
    const { inputs, backend, attrs } = args;
    const { x } = inputs;
    const { begin, size } = attrs;
    assertNotComplex(x, 'slice');
    const \[$begin, $size\] = slice_util.parseSliceParams(x, begin, size);
    slice_util.assertParamsValid(x, $begin, $size);
    const vals = backend.data.get(x.dataId).values;
    const outVals = sliceImpl(vals, $begin, $size, x.shape, x.dtype);
    return backend.makeTensorInfo($size, x.dtype, outVals);
}
export const sliceConfig = {
    kernelName: Slice,
    backendName: 'cpu',
    kernelFunc: slice
};
```

xStrides = util.computeStrides(x.shape);
const outData = backend.dataIdMap.get(out.dataId);
if (isContinuous) {
  const flatOffset = slice_util.computeFlatOffset(begin, xStrides);
  const outData.stringBytes =
      (xVals as Uint8Array[])
          .slice(flatOffset, flatOffset +
util.sizeFromShape(size_));
} else {
  const outVals = backend.typedArrayFromHeap(out);
  outVals.set(
      (xVals as TypedArray)
          .subarray(flatOffset, flatOffset +
util.sizeFromShape(size_)));
}
return out;

if (x.dtype === 'string') {
  const res =
sliceImplCPU(xVals, begin, size, shape, x.dtype);
  outData.stringBytes = res as Uint8Array[];
  return out;
}
return out;

if (x.dtype === 'string') {
  const res =
sliceImplCPU(xVals, begin, size, shape, x.dtype);
  outData.stringBytes = res as Uint8Array[];
  return out;
}

if (x.dtype === 'string') {
  const res =
sliceImplCPU(xVals, begin, size, shape, x.dtype);
  outData.stringBytes = res as Uint8Array[];
  return out;
}

const out =
sliceImplCPU(xVals, begin, size, shape, x.dtype);
outData.stringBytes = out as Uint8Array[];
return out;

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 *
 *=============================================================================
 */

import {backend_util, BatchToSpaceND, BatchToSpaceNDAttrs, BatchToSpaceNDInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {reshape} from './Reshape';
import {slice} from './Slice';
import {transpose} from './Transpose';

function batchToSpaceND(args: {
  inputs: BatchToSpaceNDInputs,
  backend: BackendWasm,
  attrs: BatchToSpaceNDAttrs
}) {
  const {inputs, backend, attrs} = args;
  const {x} = inputs;
  const {blockShape, crops} = attrs;
  const {begin, end, size} = attrs;
  const prod = blockShape.reduce((a, b) => a * b);

  const reshaped = backend_util.getReshaped(x.shape, blockShape, prod);
  const permuted = backend_util.getPermuted(reshaped.length, blockShape.length);
  const reshapedPermuted =

backend_util.getReshapedPermuted(x.shape, blockShape, prod);
const sliceBeginCoords =
backend_util.getSliceBeginCoords(crops, blockShape.length);
const sliceSize =
backend_util.getSliceSize(reshapedPermuted, blockShape.length);
const xReshaped = reshape({inputs: [x], backend, attrs: {shape: reshaped}});
const xTransposed = transpose({inputs: [xReshaped], backend, attrs: {perm: permuted}});
const xTransposedReshaped = reshape({inputs: [xTransposed], backend, attrs: {shape: reshapedPermuted}});
const result = slice({inputs: [xTransposedReshaped], backend, attrs: {begin: sliceBeginCoords, size: sliceSize}});

backend.disposeData(xReshaped.dataId);
backend.disposeData(xTransposed.dataId);
backend.disposeData(xReshaped.dataId);
return result;
}

export const batchToSpaceNDConfig: KernelConfig = {
  kernelName: BatchToSpaceND,
  backendName: 'wasm',
  kernelFunc: batchToSpaceND as {} as KernelFunc
};

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 */

import {Cast, CastAttrs, CastInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';
import {TensorInfo} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

export function cast(
    args: {inputs: CastInputs, attrs: CastAttrs, backend: BackendWasm}):
    TensorInfo {
  const {inputs: {x}, attrs: {dtype}, backend} = args;
  const out = backend.makeOutput(x.shape, dtype);
  const inVals = backend.typedArrayFromHeap(x);
  const outVals = backend.typedArrayFromHeap(out);
  outVals.set(inVals);
  return out;
}

export const castConfig: KernelConfig = {
  kernelName: Cast,
  backendName: 'wasm',
  kernelFunc: cast as {} as KernelFunc,
};

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 */

import {ClipByValue, ClipByValueAttrs, ClipByValueInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';

export const ceilConfig: KernelConfig = createUnaryKernelConfig(Ceil);

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 */

import {ClipByValue, ClipByValueAttrs, ClipByValueInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';

export const ceilConfig: KernelConfig = createUnaryKernelConfig(Ceil);

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 */

import {ClipByValue, ClipByValueAttrs, ClipByValueInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';

export const ceilConfig: KernelConfig = createUnaryKernelConfig(Ceil);

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import {ClipByValue, ClipByValueAttrs, ClipByValueInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';

export const ceilConfig: KernelConfig = createUnaryKernelConfig(Ceil);

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 */

import {ClipByValue, ClipByValueAttrs, ClipByValueInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';

export const ceilConfig: KernelConfig = createUnaryKernelConfig(Ceil);

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 */

import {ClipByValue, ClipByValueAttrs, ClipByValueInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';

export const ceilConfig: KernelConfig = createUnaryKernelConfig(Ceil);
```javascript
clipValueMin, clipValueMax, outId); return out;
}
export const clipByValueConfig: KernelConfig = {
  kernelName: 'ClipByValue',
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: clip as {} as KernelFunc
};

export const clipByValueConfig: KernelConfig = {
  kernelName: 'ClipByValue',
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: clip as {} as KernelFunc
};

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 */

import {backend_util, Concat, ConcatAttrs, ConcatInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';
import {concatImplCPU} from '../kernel_utils/shared';
import {identity} from './Identity';
import {reshape} from './Reshape';

export function concat(
    args: {inputs: ConcatInputs, backend: BackendWasm, attrs: ConcatAttrs}) {
  const {inputs, backend} = args;
  const axis = util.parseAxisParam(args.attrs.axis, inputs[0].shape)
  let outShape = backend_util.computeOutShape(inputs.map(t => t.shape), axis);
  // Keep only non-empty tensors (ignore tensors with 0 in their shape).
  const $inputs = inputs.filter(t => util.sizeFromShape(t.shape) > 0);
  if ($inputs.length === 1) {
    return identity({inputs: $inputs[0], backend});
  }
  const out = backend.makeOutput(outShape, inputs[0].dtype);
  if (util.sizeFromShape(outShape) === 0) {
    return out;
  }
  const shapes = $inputs.map(t => t.shape);
  backend_util.assertParamsConsistent(shapes, axis);
  if ($inputs[0].dtype === 'string') {
    // Any concat of n-dimensional tensors across any axis can be reduced to
    // a concatenation of two-dimensional tensors across the axis 1 by first
    // partitioning the axes of the original tensors into those less than the
    // axis to be concatenated and the rest. Then reshape the tensors
    // into a two-dimensional tensor by collapsing these two sets of axes and
    // concatenate the resulting matrices across the axis 1, finally reshaping
    // the result to have the proper shape.
    const inputs2D = $inputs.map(t => {
      const innerSize = util.sizeFromShape(t.shape.slice(axis));
      const shape = [-1, innerSize];
      return reshape({inputs: {x: t}, backend, attrs: {shape}});
    });
    const inputsValShapes = inputs2D.map(t => {
      return {vals: backend.readSync(t.dataId), shape: t.shape};
    });
    const outShape = backend_util.computeOutShape(inputs2D.map(t => t.shape), 1 /* axis */);
    const simplyConcat = inputs2D[0].shape[0] === 1;
    const outVals = concatImplCPU(inputsValShapes, outShape, inputs[0].dtype === 'string' ? 'string' : 'number');
    const finalOutShape = backend_util.computeOutShape($inputs.map(t => t.shape), axis);
    const outData = backend.dataIdMap.get(out.dataId);
    outData.stringBytes = backend_util.getStringArrayFromUint8(outVals);
    outData.uint8Buffer = backend_util.getStringArrayFromUint8(outVals);
    return out;
  }
  const batchDim = util.sizeFromShape($inputs[0].shape.slice(0, axis));
  let sumInnerDims = 0;
  const innerDims = $inputs.map(input => {
    const innerDim = util.sizeFromShape(input.shape.slice(axis));
    sumInnerDims += innerDim;
    return innerDim;
  });
  const inVals = $inputs.map(input => backend.typedArrayFromHeap(input));
  const outVals = backend.typedArrayFromHeap(outVals);
  for (let b = 0; b < batchDim; b++) {
    const offset = b * sumInnerDims;
    const innerDim = innerDims[b];
    const inOffset = b * innerDim;
    const vals = inVals[inOffset + inOffset + offset => innerDim];
    const outOffset = vals.map(t => t.shape); return out;
  }
  return out;
}
```

---

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import {backend_util, Conv2D, Conv2DAttrs, Conv2DInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmConv2d: (
    xId: number, batchSize: number, inputHeight: number, inputWidth: number, filterId: number, filterHeight: number, filterWidth: number, padTop: number, padRight: number, padBottom: number, padLeft: number, isSamePad: number, dilationHeight: number, dilationWidth: number, strideHeight: number, strideWidth: number, inputChannels: number, outputChannels: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmConv2d = backend.wasm.cwrap(Conv2D, null /* void */,
    ['number',  // xId
    'number',  // batchSize
    'number',  // inputHeight
    'number',  // inputWidth
    'number',  // filterId
    'number',  // filterHeight
    'number',  // filterWidth
    'number',  // padTop
    'number',  // padRight
    'number',  // padBottom
    'number',  // padLeft
    'number',  // isSamePad
    'number',  // dilationHeight
    'number',  // dilationWidth
    'number',  // strideHeight
    'number',  // strideWidth
    'number',  // inputChannels
    'number',  // outputChannels
    'number']);
}

function conv2d(
    args: {inputs: Conv2DInputs, backend: BackendWasm, attrs: Conv2DAttrs}) {
  const {inputs, attrs, backend} = args;

  const {x, filter} = inputs;

  const xId = backend.dataIdMap.get(x.dataId).id;
  const filterId = backend.dataIdMap.get(filter.dataId).id;

  const {strides, dilations, pad, dimRoundingMode, dataFormat} = attrs;
  const $dataFormat = backend_util.convertConv2DDataFormat(dataFormat);
  const convInfo = backend_util.computeConv2DInfo((x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations, pad, dimRoundingMode, false, $dataFormat);

  const filterHeight = convInfo.filterHeight;
  const filterWidth = convInfo.filterWidth;
  const padTop = convInfo.padInfo.top;
  const padRight = convInfo.padInfo.right;
  const padBottom = convInfo.padInfo.bottom;
  const padLeft = convInfo.padInfo.left;
  const dilationHeight = convInfo.dilationHeight;
  const dilationWidth = convInfo.dilationWidth;
  const strideHeight = convInfo.strideHeight;
  const strideWidth = convInfo.strideWidth;
  const inputChannels = convInfo.inChannels;
  const outputChannels = convInfo.outChannels;
  const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;

  const out = backend.makeOutput(convInfo.outShape, 'float32');
  const outId = backend.dataIdMap.get(out.dataId).id;
  wasmConv2d(xId, x.shape[0], x.shape[1], x.shape[2], filterId, filterHeight, filterWidth, padTop, padRight, padBottom, padLeft, isSamePad, dilationHeight, dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels, outId);
  return out;
}

export const conv2DConfig: KernelConfig = {
  kernelName: Conv2D,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: conv2d as {} as KernelFunc
};

import {backend_util, Conv2DBackpropInput, Conv2DBackpropInputAttrs, Conv2DBackpropInputInputs, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmConv2DBackpropInput: (
    dyId: number, filterId: number, batchSize: number, filterHeight: number, filterWidth: number, inHeight: number, inWidth: number, inChannels: number, outHeight: number, outWidth: number, outChannels: number, strideHeight: number, strideWidth: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmConv2DBackpropInput = backend.wasm.cwrap(Conv2DBackpropInput, null /* void */,
    ['number',  // dyId
    'number',  // filterId
    'number',  // batchSize
    'number',  // inHeight
    'number',  // inWidth
    'number',  // inChannels
    'number',  // outHeight
    'number',  // outWidth
    'number',  // outChannels
    'number',  // strideHeight
    'number',  // strideWidth
    'number',  // outId
    'number',  // xRowStride
    'number',  // xColStride
    'number',  // xChannelStride
    'number',  // yBatchStride
    'number',  // yRowStride
    'number',  // yColStride
    'number',  // yChannelStride
    'number',  // outId
    'number']);
}
BackendWasm): void (\n  wasmConv2DBackpropInput = backend.wasm.cwrap(Conv2DBackpropInput, null, (\n    'number', 'dyId', 'number', 'filterId', 'number', 'batchSize', 'number', 'filterHeight', 'number',
    'filterWidth', 'number', 'inHeight', 'number', 'inWidth', 'number', 'inChannels', 'number', 'outHeight',
    'number', 'outWidth', 'number', 'outChannels', 'number', 'strideHeight', 'number', 'strideWidth',
    'number', 'topPad', 'number', 'leftPad', 'number', 'fltS0', 'number', 'fltS1', 'number', 'fltS2',
    'number', 'xBatchStride', 'number', 'xRowStride', 'number', 'xColStride', 'number', 'yBatchStride',
    'number', 'yRowStride', 'number', 'yColStride', 'number', 'outId');\n)\n\nfunction conv2DBackpropInput(args: {\n  backend: BackendWasm,\n  inputs: Conv2DBackpropInputInputs,\n  attrs: Conv2DBackpropInputAttrs\n}): TensorInfo {
  const {backend, inputs, attrs} = args;\n  const {dy, filter} = inputs;\n  const {strides, pad, dataFormat, dimRoundingMode, inputShape} = attrs;\n
  const {xBatchStride, xRowStride, xColStride, yBatchStride, yRowStride, yColStride} = util.computeStrides(dy.shape);\n  const topPad = filterHeight - 1 - convInfo.padInfo.top;\n  const leftPad = filterWidth - 1 - convInfo.padInfo.left;\n
cosConfig as KernelConfig = createUnaryKernelConfig(Cos);

import {Cos, KernelConfig} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from '@tensorflow/tfjs-core';

export const cosConfig: KernelConfig = createUnaryKernelConfig(Cos);

import {Cosh, KernelConfig} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from '@tensorflow/tfjs-core';

export const cosConfig: KernelConfig = createUnaryKernelConfig(Cos);

import {Cos, KernelConfig} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from '@tensorflow/tfjs-core';

export const cosConfig: KernelConfig = createUnaryKernelConfig(Cos);

import {Cos, KernelConfig} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from '@tensorflow/tfjs-core';

export const cosConfig: KernelConfig = createUnaryKernelConfig(Cos);
exclusive, reverse} = attrs;
const xRank = x.shape.length;
util.assert(x.dtype === 'float32' || x.dtype === 'int32', () => 'cunsum does not support $(x.dtype)$ tensors in the WASM backend');
const permutedXId = backend.dataIdMap.get(permutedReaderId).id;
const permutedReaderId = backend.dataIdMap.get(permutedReaderId).id;

// permute required axis
const permutation = backend_util.getAxesPermutation([axis], xRank);
const permutedAxis = backend_util.getInnerMostAxes(1, xRank)[0];

if (permutation !== null) {
    permutedX = transpose({inputs: {x}, attrs: {perm: permutation}, backend});
}

let permutedX = x;
const permutedOut = backend.makeOutput(permutedReaderId, permutedReader.x.shape, permutedReader.x.dtype);
const finalDim = permutedX.shape[permutedAxis];

const permutedXId = backend.dataIdMap.get(permutedX.dataId).id;
const permutedOutId = backend.dataIdMap.get(permutedOut.dataId).id;

wasmCunsum(permutedXId, exclusive ? 1 : 0, reverse ? 1 : 0, finalDim, permutedOutId, CppDType[x.dtype]);
// transpose data back if permuted
out = transpose({inputs: {x: permutedOut}, attrs: {perm: undoPermutation}, backend});
backend.disposeData(permutedX.dataId);
backend.disposeData(permutedOut.dataId);

return out;
}

export const cumsumConfig: KernelConfig = {
    kernelName: Cumsum,
    backendName: 'wasm',
    setupFunc: setup,
    kernelFunc: cumsum as {} as KernelFunc
};

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=================================================================================
*/

import {DepthToSpace, DepthToSpaceAttrs, DepthToSpaceInputs, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';

let wasmDepthToSpace:
    (xId: number, blockSize: number, channelsLast: number, xStrides: Uint8Array, xStridesLength: number, outputShape: Uint8Array, outputStrides: Uint8Array, outSize: number, outId: number) => void;

function setup(backend: BackendWasm): void {
    wasmDepthToSpace = backend.wasm.cwrap(DepthToSpace, null /*void*/, [
        'number',  // xId
        'number',  // blockSize
        'number',  // channelsLast
        'array',   // xStrides
        'number',  // xStridesLength
        'array',   // outputShape
        'array',   // outputStrides
        'number',  // outSize
        'number',  // outId
    ]);
}

export function depthToSpace(args: {
    backend: BackendWasm,
    inputs: DepthToSpaceInputs,
    attrs: DepthToSpaceAttrs
}): TensorInfo {
    const {backend, inputs, attrs} = args;
    const {x} = inputs;
    const {blockSize, dataFormat} = attrs;

    const batchSize = x.shape[0];
    const inputHeight = (dataFormat === 'NHWC') ? x.shape[1] : x.shape[2];
    const inputWidth = (dataFormat === 'NHWC') ? x.shape[2] : x.shape[3];
    const inputDepth = (dataFormat === 'NHWC') ? x.shape[3] : x.shape[1];

    const outputHeight = inputHeight * blockSize;
    const outputWidth = inputWidth * blockSize;
    const outputDepth = inputDepth / (blockSize * blockSize);

    const outputShape = (dataFormat === 'NHWC') ? [batchSize, outputHeight, outputWidth, outputDepth] : [batchSize, outputDepth, outputHeight, outputWidth];

    const xData = backend.dataIdMap.get(x.dataId);
    const xId = xData.id;
    const xStridesBytes = new Uint8Array(new Int32Array(x.computeStrides(x.shape)).buffer);

    const outputShapeBytes = new Uint8Array(new Int32Array(x.computeStrides(outputShape).buffer));
    const outputId = backend.dataIdMap.get(outputId).id;
    const channelsLast = dataFormat === 'NHWC' ? 1 : 0;
    const out = backend.makeOutput(outputShape, 'float32');

    const dataFormat = dataFormat === 'NHWC' ? x.shape[1] : x.shape[2];
    const inputHeight = inputHeight * blockSize;
    const outputHeight = inputHeight * blockSize;
    const outputWidth = inputWidth * blockSize;
    const outputDepth = inputDepth / (blockSize * blockSize);

    const outputShape = (dataFormat === 'NHWC') ? [batchSize, outputHeight, outputWidth, outputDepth] : [batchSize, outputDepth, outputHeight, outputWidth];

    const depthToSpaceConfig: KernelConfig = {
        kernelName: DepthToSpace,
        backendName: 'wasm',
        setupFunc: setup,
        kernelFunc: depthToSpace as {} as KernelFunc
    };

    backend.disposeData(x.dataId);
    backend.disposeData(outputShape.dataId);
    backend.disposeData(outputShapeBytes.dataId);

    return out;
}

export const depthToSpaceConfig: KernelConfig = {
    kernelName: DepthToSpace,
    backendName: 'wasm',
    setupFunc: setup,
    kernelFunc: depthToSpace as {} as KernelFunc
};

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import {backend_util, DepthwiseConv2dNative, DepthwiseConv2dNativeAttrs,\n DepthwiseConv2dNativeInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\n
import {BackendWasm} from '../backend_wasm';\n
let wasmDepthwiseConv2d: (\n xId: number, batchSize: number,\n 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, strideWidth: number, inputChannels: number,\n outputChannels: number, outId: number) => void;\n
function setup(backend: BackendWasm) {\n  wasmDepthwiseConv2d = 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}

function depthwiseConv2d(args: {\n  inputs: DepthwiseConv2dNativeInputs,\n  backend: BackendWasm,\n  attrs: DepthwiseConv2dNativeAttrs\n}) {\n  const {inputs, attrs, backend} = args;\n
  const {x, filter} = inputs;\n  const xId = backend.dataIdMap.get(x.dataId).id;\n  const filterId = backend.dataIdMap.get(filter.dataId).id;\n
  const {strides, dilations, pad, dimRoundingMode} = attrs;\n
  const $dilations = dilations == null ? [1, 1] : dilations;\n
  const convInfo = backend_util.computeConv2DInfo((x as Tensor4D).shape, (filter as Tensor4D).shape,\n    strides,\n    ($dilations as number | [number, number]), pad, dimRoundingMode,\n    true /* depthwise */);\n
  const filterHeight = convInfo.filterHeight;\n  const filterWidth = convInfo.filterWidth;\n  const padTop = convInfo.padInfo.top;\n  const padRight = convInfo.padInfo.right;\n  const padBottom = convInfo.padInfo.bottom;\n  const padLeft = convInfo.padInfo.left;\n
  const dilationHeight = convInfo.dilationHeight;\n  const dilationWidth = convInfo.dilationWidth;\n  const strideHeight = convInfo.strideHeight;\n  const strideWidth = convInfo.strideWidth;\n  const inputChannels = convInfo.inChannels;\n  const outputChannels = convInfo.outChannels;\n  const isSamePad = convInfo.padInfo.type === 'SAME';\n
  if (convInfo.dataFormat !== 'channelsLast') {\n    throw new Error('wasm backend DepthwiseConv2dNative does not support dataFormat: ' +\n      convInfo.dataFormat);\n  }\n
  const outId = backend.makeOutput(convInfo.outShape, 'float32');\n  const outId = backend.dataIdMap.get(outId.id);\n  const out = backend.wasm.ccall(DepthwiseConv2dNative, 'float32', [\n    'number',  // xId\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  ], outId);\n  const out = backend.wasm.ccall(DepthwiseConv2dNative, 'float32', [\n    'number',  // xId\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  ], outId);\n
  return out;
}

export const depthwiseConv2dNativeConfig: KernelConfig = {\n  fileName: DepthwiseConv2dNative,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: depthwiseConv2d as {} as KernelFunc,\n  kernelConfig: \n};

export const eluConfig: KernelConfig = createUnaryKernelConfig(Elu);

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=============================================================================

*/

import {Equal, KernelConfig} from '@tensorflow/tfjs-core';

import {createBinaryKernelConfig} from './binary_kernel';

const supportsFullBroadcast = false;
export const equalConfig: KernelConfig =
createBinaryKernelConfig(Equal, supportsFullBroadcast, 'bool');

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 *=============================================================================

*/
import {Exp, KernelConfig} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';

export const expConfig: KernelConfig = createUnaryKernelConfig(Exp, 'float32');

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 *=============================================================================

*/

import {ExpandDims, ExpandDimsAttrs, ExpandDimsInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';
import {reshape} from './Reshape';

export function expandDims(args: {
  inputs: ExpandDimsInputs,
  attrs: ExpandDimsAttrs,
  backend: BackendWasm
}) {
  const {inputs, attrs, backend} = args;
  const {input} = inputs;
  const {dim} = attrs;

  const inputRank = input.shape.length;
  const newShape = input.shape.slice();
  let $dim = dim;
  if (dim < 0) {
    // Negative value is counted from the tail of rank.
    util.assert(
        -(inputRank + 1) <= dim,
        () => `Axis must be in the interval \[${- (inputRank + 1)}, ${inputRank}\]`);
    $dim = inputRank + dim + 1;
  }
  newShape.splice($dim, 0, 1);

  return reshape({inputs: {x: input}, backend, attrs: {shape: newShape}});
}

export const expandDimsConfig: KernelConfig = {
  kernelName: ExpandDims,
  backendName: 'wasm',
  kernelFunc: expandDims as {} as KernelFunc,
};

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 *
 *=============================================================================

*/

import {KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';
import {Fill, FillAttrs} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

export function fill(args: {attrs: FillAttrs, backend: BackendWasm}) {
  const {attrs: {shape, value, dtype}, backend} = args;
  const out = backend.makeOutput(shape, dtype);
  backend.typedArrayFromHeap(out).fill(value as number);
  return out;
}

export const fillConfig: KernelConfig = {
  kernelName: Fill,
  backendName: 'wasm',
  attrs: FillAttrs,
  backend: BackendWasm,
  kernelFunc: fill as {} as KernelFunc,
};
'wasm',
  kernelFunc: fill as {} as KernelFunc,
};
  
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 */

import {FlipLeftRight, FlipLeftRightInputs, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmFlipLeftRight: (
    xId: number, batch: number, imageHeight: number, imageWidth: number,
    numChannels: number, outId: number) =>
    void;

function setup(backend: BackendWasm) {
  wasmFlipLeftRight = backend.wasm.cwrap(FlipLeftRight,
                  null /* void */, [
                    'number',  // xId
                    'number',  // batch
                    'number',  // imageHeight
                    'number',  // imageWidth
                    'number',  // numChannels
                    'number',  // outId
                  ]);}

export function flipLeftRight(
    args: {inputs: FlipLeftRightInputs, backend: BackendWasm}): TensorInfo {
  const {inputs, backend} = args;

  const {image} = inputs;

  const out = backend.makeOutput(image.shape, image.dtype);
  const imageId = backend.dataIdMap.get(image.dataId).id;
  const outId = backend.dataIdMap.get(out.dataId).id;
  const [batch, imageHeight, imageWidth, numChannels] = image.shape;

  wasmFlipLeftRight(
      imageId, batch,
      imageHeight, imageWidth, numChannels, outId);
  return out;
}

export const flipLeftRightConfig:
    KernelConfig = {
      kernelName: FlipLeftRight,
      backendName: 'wasm',
      kernelFunc: flipLeftRight as {} as KernelFunc,
      setupFunc: setup
    };

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 */

import {Floor, KernelConfig} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';
export const floorConfig: KernelConfig = createUnaryKernelConfig(Floor);

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 */

import {FloorDiv, KernelConfig} from '@tensorflow/tfjs-core';

import {createBinaryKernelConfig} from './binary_kernel';

const supportsFullBroadcast = false;
export const floorDivConfig: KernelConfig =
    createBinaryKernelConfig(FloorDiv, supportsFullBroadcast);

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 */
import {BackendWasm} from './backend_wasm';

wasmBatchNorm: (xId: number, meanId: number, varianceId: number, offsetId: number, scaleId: number, varianceEpsilon: number, outId: number) => void;

function setup(backend: BackendWasm) {
    wasmBatchNorm = backend.wasm.cwrap(FusedBatchNorm, null /* void */, ['number', 'number', 'number', 'number', 'number', 'number', 'number', 'number'])[0];
}

function fusedBatchNorm(args: {
    backend: BackendWasm,
    inputs: FusedBatchNormInputs,
    attrs: FusedBatchNormAttrs
}) {
    const {backend, inputs, attrs} = args;
    const {varianceEpsilon} = attrs;
    const {x, mean, variance, offset, scale} = inputs;
    const xId = backend.dataIdMap.get(x.dataId).id;
    const meanId = backend.dataIdMap.get(mean.dataId).id;
    const varianceId = backend.dataIdMap.get(variance.dataId).id;
    const offsetId = offset != null ? backend.dataIdMap.get(offset.dataId).id : 0;
    const scaleId = scale != null ? backend.dataIdMap.get(scale.dataId).id : 0;
    const outId = backend.dataIdMap.get(out.dataId).id;
    const varianceEpsilonId = backend.dataIdMap.get(varianceEpsilon.dataId).id;
    const ret = wasmBatchNorm(xId, meanId, varianceId, offsetId, scaleId, varianceEpsilonId, outId);
    return ret;
}

export const fusedBatchNormConfig: KernelConfig = {
    kernelName: FusedBatchNorm,
    backendName: 'wasm',
    setupFunc: setup,
    kernelFunc: fusedBatchNorm as {} as KernelFunc
};

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 */
throw new Error('FusedConv2D only supports rank-1 bias but got ' + rank
$\{biasData.shape.length\}');

if (biasData.shape[0] !== outputChannels) {
  throw new Error('FusedConv2D bias shape ($\{biasData.shape\}$) does not match the number of output channels ($\{outputChannels\}$));
  const biasId = biasData.id;
  const filterHeight = convInfo.filterHeight;
  const filterWidth = convInfo.filterWidth;
  const padTop = convInfo.padInfo.top;
  const padRight = convInfo.padInfo.right;
  const padBottom = convInfo.padInfo.bottom;
  const padLeft = convInfo.padInfo.left;
  const dilationHeight = convInfo.dilationHeight;
  const dilationWidth = convInfo.dilationWidth;
  const strideHeight = convInfo.strideHeight;
  const strideWidth = convInfo.strideWidth;
  const inputChannels = convInfo.inChannels;
  const outputChannels = convInfo.outShape.$\{dataFormat\}.' == 'NHWC') {
    throw new Error('FusedConv2D does not support data format: ' +
$\{dataFormat\}'. Please use 'NHWC'.');
  }

  const out = backend.makeOutput(convInfo.outShape, 'float32');
  const outId = backend.dataIdMap.get(out.dataId).id;
  const preluActivationWeightsId = preluActivationWeights == null ?
      0 :
  backend.dataIdMap.get(preluActivationWeights.dataId).id;

  wasmFusedConv2d(xId, batchSize, inHeight, inWidth, filterId, filterHeight, filterWidth, biasId, padTop, padRight, padBottom, padLeft, isSamePad, dilationHeight, dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels, fusedActivation, preluActivationWeightsId, leakyreluAlpha || 0, outId);

  return out;
}

export const fusedConv2DConfig:
  KernelConfig = {
    kernelName: FusedConv2D,
    backendName: 'wasm',
    setupFunc: setup,
    kernelFunc: fusedConv2d as {} as KernelFunc
  };
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```
  const fusedActivation = FusableActivation[activation as keyof typeof FusableActivation];

  wasmFusedDepthwiseConv2d(
      xId, batchSize, inHeight, inWidth, filterId, filterHeight, filterWidth, biasId, padTop, padRight, padBottom, isSamePad, dilationHeight, dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels, fusedActivation, leakyreluAlpha || 0, outId);

  return out;
}

export const fusedDepthwiseConv2DConfig: KernelConfig = {
  kernelName: FusedDepthwiseConv2D,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: fusedDepthwiseConv2d as {} as KernelFunc
};
```
```javascript
outId);

export const gatherNdConfig: KernelConfig = {
  kernelName: GatherNd,
  setupFunc: setupNd,
  kernelFunc: gatherNd,
};"/**
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 */

import {TensorInfo, Tensor, gatherNd, setup} from '@tensorflow/tfjs-core';

export const gatherNdConfig: KernelConfig = {
  kernelName: GatherNd,
  setupFunc: setupNd,
  kernelFunc: gatherNd,
};

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 */

import {TensorInfo, Tensor, gatherV2, setup} from '@tensorflow/tfjs-core';

export const gatherV2Config: KernelConfig = {
  kernelName: GatherV2,
  setupFunc: setup,
  kernelFunc: gatherV2,
};
```

`./binary_kernel';

const supportsFullBroadcast = false;

export const greaterConfig: KernelConfig =
createBinaryKernelConfig(Greater, supportsFullBroadcast, 'bool');

export const greaterEqualConfig: KernelConfig =
createBinaryKernelConfig(GreaterEqual, supportsFullBroadcast, 'bool');

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 */

import {GreaterEqual, KernelConfig} from '@tensorflow/tfjs-core';

import {createBinaryKernelConfig} from './binary_kernel';

const supportsFullBroadcast = false;

export const lessConfig: KernelConfig =
createBinaryKernelConfig(Less, supportsFullBroadcast, 'bool');

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 */

import {KernelConfig, LeakyRelu, LeakyReluAttrs, LeakyReluInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {CppDType} from './types';

let wasmFunc: (
    xId: number, dtype: number, leakyreluAlpha: number, outId: number) =>
    void;

function setupFunc(backend: BackendWasm): void {
  wasmFunc = backend.wasm.cwrap(LeakyRelu,
    null /* void */, 
    ['number',  // x_id
    'number',  // dtype
    'number',  // leakyrelu_alpha
    'number',  // out_id
  ]);  // void
}

export function leakyRelu(
    args:
        {inputs: LeakyReluInputs, attrs: LeakyReluAttrs, backend: BackendWasm}):
    TensorInfo {
  const {inputs: {x}, attrs: {alpha}, backend} = args;

  const xId = backend.dataIdMap.get(x.dataId).id;
  // According to TF API, LeakyRelu returns float32 when input is either
  // float32 or int32.
  const outId = backend.makeOutput(x.shape, 'float32').id;

  if (util.sizeFromShape(x.shape) !== 0) {
    const outId = backend.dataIdMap.get(outId).id;
    wasmFunc(xId, CppDType[x.dtype], alpha, outId);

    return out;
  }

  const leakyReluConfig: KernelConfig = {
    kernelName: LeakyRelu,
    backendName: 'wasm',
    setupFunc,
    kernelFunc: leakyRelu as {} as KernelFunc,
  };

  return backend.callKernel(x, leakyReluConfig);
}

export const leakyReluConfig: KernelConfig = {
  kernelName: LeakyRelu,
  backendName: 'wasm',
  setupFunc,
  kernelFunc: leakyRelu as {} as KernelFunc,
};

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 */

import {KernelConfig, Less} from '@tensorflow/tfjs-core';

import {createBinaryKernelConfig} from './binary_kernel';

const supportsFullBroadcast = false;

export const lessConfig: KernelConfig =
createBinaryKernelConfig(Less, supportsFullBroadcast, 'bool');

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 */
import {KernelConfig, LessEqual} from '@tensorflow/tfjs-core';

import {createBinaryKernelConfig} from './binary_kernel';

const supportsFullBroadcast = false;

export const lessEqualConfig: KernelConfig = createBinaryKernelConfig(LessEqual, supportsFullBroadcast, 'bool');

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 */

import {KernelConfig, LogicalAnd} from '@tensorflow/tfjs-core';

import {createBinaryKernelConfig} from './binary_kernel';

const supportsFullBroadcast = false;

export const logicalAndConfig: KernelConfig = createBinaryKernelConfig(LogicalAnd, supportsFullBroadcast, 'bool');

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 */

import {backend_util, KernelConfig, KernelFunc, Max, MaxAttrs, MaxInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {permuteAxesAndTranspose} from './kernel_utils';
import {CppDType} from './types';

let wasmMax: (xId: number, dtype: number, reduceSize: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmMax = backend.wasm.cwrap(Max, null /*void*/, [
    'number',  // x_id
    'number',  // dtype
    'number',  // reduce_size
    'number',  // out_id
  ],
  ['number', 'number', 'number', 'number'],
  'wasmMax', null /*void*/);
}

function max(args: {
  backend: BackendWasm,
  inputs: MaxInputs,
  attrs: MaxAttrs,
}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {reductionIndices: axis, keepDims} = attrs;
  const {x} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  let inputId = xId;
  let input = x;

  const {transposed, axes, originalAxes, inputWasTransposed} = permuteAxesAndTranspose(x, axis, backend);

  if (inputWasTransposed) {
    const transposedId = backend.dataIdMap.get(transposed.dataId).id;
    input = transposed;
    inputId = transposedId;
  }

  const inputRank = input.shape.length;
  backend_util.assertAxesAreInnerMostDims('max', axes, inputRank);
  const [outShape, reduceShape] = backend_util.computeOutAndReduceShapes(input.shape, axes);
  const reduceSize = util.sizeFromShape(reduceShape);
  const outId = backend.makeOutput(outShape, x.dtype);

  if (util.sizeFromShape(input.shape) !== 0) {
    const outId = backend.dataIdMap.get(out.dataId);
    wasmMax(inputId, CppDType[input.dtype], reduceSize, outId);
  }

  if (inputWasTransposed) {
    backend.disposeData(transposed.dataId);
  }

  if (keepDims) {
    const newShape = backend.util.expandShapeToKeepDim(outShape, originalAxes);
    out.shape = newShape;
  }

  return TensorInfo {
    outId,
    outShape,
    reduceShape,
  };
}
export const maxConfig: KernelConfig = {
  kernelName: Max,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: max as {} as KernelFunc
};

export const maxPoolConfig: KernelConfig =
createBinaryKernelConfig(Maximum, supportsFullBroadcast);

import {KernelConfig, Maximum} from '@tensorflow/tfjs-core';

import {createBinaryKernelConfig} from './binary_kernel';

let wasmMaxPool: (
    xId: number, batchSize: number, inputHeight: number, inputWidth: number,
    filterHeight: number, filterWidth: number, padTop: number, padRight: number,
    padBottom: number, padLeft: number, dilationHeight: number, dilationWidth: number, strideHeight: number, strideWidth: number,
    inputChannels: number, outputChannels: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmMaxPool =
    backend.wasm.cwrap(MaxPool, null /* void */, 
    [ 'number',  // xId
      'number',  // batchSize
      'number',  // inputHeight
      'number',  // inputWidth
      'number',  // filterHeight
      'number',  // filterWidth
      'number',  // padTop
      'number',  // padRight
      'number',  // padBottom
      'number',  // padLeft
      'number',  // dilationHeight
      'number',  // dilationWidth
      'number',  // strideHeight
      'number',  // strideWidth
      'number',  // inputChannels
      'number',  // outputChannels
      'number',  // outId
    ]);
}

function maxPool(
    args:
    {inputs: MaxPoolInputs, backend: BackendWasm, attrs: MaxPoolAttrs}) {
  const {inputs, attrs, backend} = args;

  const x = inputs.x as Tensor4D;
  const xId = backend.dataIdMap.get(x.dataId).id;

  util.assert(
    x.dtype === 'float32',
    () =>
        `Error in MaxPool: only float32 input is supported. Got ${x.dtype}.`);

  const {filterSize, strides, pad, dimRoundingMode} = attrs;
  const convInfo = backend_util.computePool2DInfo(
    x.shape, filterSize, strides, 1 /* dilations */, pad, dimRoundingMode);

  const out = backend.makeOutput(convInfo.outShape, 'float32');
  const outId =
    backend.dataIdMap.get(out.dataId).id;

  wasmMaxPool(xId, x.shape[0], x.shape[1], x.shape[2],
    convInfo.filterHeight, convInfo.filterWidth,
    convInfo.padTop, convInfo.padRight, convInfo.padBottom,
    convInfo.padLeft, convInfo.dilationHeight, convInfo.dilationWidth,
    convInfo.strideHeight, convInfo.strideWidth,
    convInfo.inputChannels, convInfo.inChannels,
    convInfo.outChannels,
    outId,
    convInfo.dataFormat !== 'channelsLast')
    .then(
      () =>
          `Error in MaxPool: only float32 input is supported. Got $({x.dtype}).`);
}
.strideHeight, strideWidth, inputChannels, outputChannels, outId);\n  return out;\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'); you may not use this file except in compliance with the License. You may obtain a copy of the License at http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software distributed under the License is distributed on an 'AS IS' BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, express or implied. See the License for the specific language governing permissions and limitations under the License.\n */\n
import {backend_util, KernelConfig, KernelFunc, MaxPool, MaxPoolAttrs, MaxPoolInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\n
import {BackendWasm} from '../backend_wasm';\n
import {permuteAxesAndTranspose} from './kernel_utils';\n
let wasmMax: (xId: number, reduceSize: number, outId: number) => void;\n
function setup(backend: BackendWasm): void {
  wasmMax = backend.wasm.cwrap(MaxPool, null /*void*/, ['number', 'number', 'number']);\n}

export function max(
  args: {backend: BackendWasm, inputs: MaxPoolInputs, attrs: MaxPoolAttrs}): TensorInfo {
  const {backend, inputs, attrs} = args;\n  const {ceil, keepdims} = attrs;\n  const {x} = inputs;\n  const xId = backend.dataIdMap.get(x.dataId).id;\n  let inputId = xId;\n  let input = x;\n  const {transposed, axes, originalAxes, inputWasTransposed} = permuteAxesAndTranspose(x, ceil, backend);\n  let reductionAxes = axes;\n  if (inputWasTransposed) {\n    const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n    if (transposedId !== xId) {\n      // transpose was not a no-op. We will need to dispose of this\n      // once we are done.\n      input = transposed;\n      inputId = transposedId;\n      reductionAxes = backend_util.getInnerMostAxes(reductionAxes.length, input.shape.length);\n    }\n  }\n  backend_util.assertAxesAreInnerMostDims('max', reductionAxes, input.shape.length);\n  const [outShape, reduceShape] = backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n  const reduceSize = util.sizeFromShape(reduceShape);\n  let castedInput = input;\n  if (input.dtype !== 'float32') {\n    castedInput = cast({backend, inputs: {x: input}, attrs: {dtype: 'float32'}});\n    inputId = backend.dataIdMap.get(castedInput.dataId).id;\n  }\n  const out = backend.makeOutput(outShape, 'float32');\n  if (util.sizeFromShape(input.shape) !== 0) {\n    const outId = backend.dataIdMap.get(out.dataId).id;\n    wasmMax(inputId, reduceSize, outId);\n  }\n  backend.disposeData(castedInput.dataId);\n}

export const maxPoolConfig: KernelConfig = {\n  kernelName: 'wasm',\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'); you may not use this file except in compliance with the License. You may obtain a copy of the License at http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software distributed under the License is distributed on an 'AS IS' BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, express or implied. See the License for the specific language governing permissions and limitations under the License.\n */\n
import {backend_util, KernelConfig, KernelFunc, Min, MinAttrs, MinInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\n
import {BackendWasm} from '../backend_wasm';\n
import {permuteAxesAndTranspose} from './kernel_utils';\n
let wasmMin: (xId: number, dtype: number, reduceSize: number, outId: number) => void;\n
function setup(backend: BackendWasm): void {
  wasmMin = backend.wasm.cwrap(Min, null /*void*/, ['number', 'number', 'number', 'number']);\n}

export function min(
  args: {backend: BackendWasm, inputs: MinInputs, attrs: MinAttrs}): TensorInfo {
  const {backend, inputs, attrs} = args;\n  const {axis, keepdims} = attrs;\n  const {x} = inputs;\n  const xId = backend.dataIdMap.get(x.dataId).id;\n  let inputId = xId;\n  let input = x;\n  const {transposed, axes, originalAxes, inputWasTransposed} = permuteAxesAndTranspose(x, axis, backend);\n  let reductionAxes = axes;\n  if (inputWasTransposed) {
    const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n    if (transposedId !== xId) {
      // 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(reductionAxes.length, input.shape.length);\n    }\n  }\n  backend_util.assertAxesAreInnerMostDims('min', reductionAxes, input.shape.length);\n  const [outShape, reduceShape] = backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n  const reduceSize = util.sizeFromShape(reduceShape);\n  let castedInput = input;\n  if (input.dtype !== 'float32') {\n    castedInput = cast({backend, inputs: {x: input}, attrs: {dtype: 'float32'}});\n    inputId = backend.dataIdMap.get(castedInput.dataId).id;\n  }\n  const out = backend.makeOutput(outShape, 'float32');\n  if (util.sizeFromShape(input.shape) !== 0) {\n    const outId = backend.dataIdMap.get(out.dataId).id;\n    wasmMin(inputId, castedInput.dtype, reduceSize, outId);\n  }\n  backend.disposeData(castedInput.dataId);\n}

export const minConfig: KernelConfig = {\n  kernelName: 'wasm',\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: min as {} as KernelFunc\n};\n"
BackendWasm, inputs: MinInputs, attrs: MinAttrs));

TensorInfo { const {backend, inputs, attrs} = args; const {axis, keepDims} = attrs; const {x} = inputs; const xId = backend.dataIdMap.get(x.dataId).id; let inputId = xId; let input = x; const {transposed, axes, originalAxes, inputWasTransposed} = permuteAxesAndTranspose(x, axis, backend); if (inputWasTransposed) { const transposedId = backend.dataIdMap.get(transposed.dataId).id; if (transposedId !== xId) { // transposed was not a no-op. We will need to dispose of this tensor once we are done. input = transposed; inputId = transposedId; } }

const {inputRank} = input.shape; const {backend_util, assertAxesAreInnerMostDims} = input; const {transposed, axes, originalAxes, inputWasTransposed} = permuteAxesAndTranspose(x, axis, backend);

if (inputWasTransposed) {
  const transposedId = backend.dataIdMap.get(transposed.dataId).id; wasmMin(inputId, CppDType[x.dtype], reduceSize, outId); if (inputWasTransposed) {
    if (util.sizeFromShape(input.shape) !== 0) {
      const outId = backend.dataIdMap.get(out.dataId).id;
      wasmMin(inputId, CppDType[x.dtype], reduceSize, outId); if (inputWasTransposed) {
        const transposedId = backend.dataIdMap.get(transposed.dataId).id; wasmMin(inputId, CppDType[x.dtype], reduceSize, outId);
      } else if (inputWasTransposed) {
        const transposedId = backend.dataIdMap.get(transposed.dataId).id; wasmMin(inputId, CppDType[x.dtype], reduceSize, outId);
      }
    }
  }
}

const {outShape, reduceShape} = backend_util.computeOutAndReduceShapes(input.shape, axes);
const reduceSize = util.sizeFromShape(reduceShape);
const out = backend.makeOutput(outShape, input.dtype);
if (util.sizeFromShape(input.shape) !== 0) {
  const outId = backend.dataIdMap.get(out.dataId).id;
  wasmMin(inputId, CppDType[x.dtype], reduceSize, outId);
  if (inputWasTransposed) {
    // dispose of the transposed tensor.
    backend.disposeData(transposed.dataId);
  }
}

if (keepDims) {
  const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);
  out.shape = newShape;
  return out;
}

export const minConfig: KernelConfig = {
  kernelName: Min,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: min as {} as KernelFunc
};

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 */

import {KernelConfig, Minimum} from '@tensorflow/tfjs-core';

import {createBinaryKernelConfig} from './binary_kernel';
const supportsFullBroadcast = false;
export const minimumConfig: KernelConfig = createBinaryKernelConfig(Minimum, supportsFullBroadcast);

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 */

import {KernelConfig, KernelFunc, MirrorPad, MirrorPadAttrs, MirrorPadInputs} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {CppDType} from './types';

// Must match enum in MirrorPad.cc
enum MirrorPaddingMode {
  reflect = 0,
  symmetric = 1
}

let wasmMirrorPad: (xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype: number, prePaddingsBytes: Uint8Array, postPaddingsBytes: Uint8Array, mode: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmMirrorPad = backend.wasm.cwrap(MirrorPad, null /* void */, ['number', // xId
    'array', // x.shapeLength
    'number', // x.dtype
    'array', // prePadLengths
    'array', // postPadLengths
    'number', // mode
    'number', // outId
  ]);}

function mirrorPad(args: {inputs: MirrorPadInputs, backend: BackendWasm, attrs: MirrorPadAttrs}) {
  const inputs = args.inputs;
  const backend = args.backend;
  const attrs = args.attrs;
  const {x, backend, attrs} = inputs;
  const paddings = mirrorPaddingMode(x, attrs); // Must match enum in MirrorPad.cc
  const xId = backend.dataIdMap.get(x.dataId).id;
  const outId = backend.dataIdMap.get(out.dataId).id;
  const xShapeBytes = new Uint8Array(x.shape, backend.buffer);
  const prePaddingsFlat = paddings.map(p => new Uint32Array(x.shape, backend.buffer));
  const prePaddingsBytes = new Uint8Array(x.shape, backend.buffer);
postPaddingsBytes = new Uint8Array(new Int32Array(postPaddingsFlat).buffer);

wasmMirrorPad(xId, xShapeBytes, x.shape.length, CppDType[x.dtype], prePaddingsBytes, MirrorPaddingMode[mode], outId); return out;

export const mirrorPadConfig: KernelConfig = {
  kernelName: MirrorPad,
  backendName: 'wasm',
  kernelFunc: mirrorPad as {} as KernelFunc,
  setupFunc: setup
};

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 */

import {KernelConfig, Multiply} from '@tensorflow/tfjs-core';

export const multiplyConfig: KernelConfig = createBinaryKernelConfig(Multiply, supportsFullBroadcast);

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 */

import {BackendWasm} from '../backend_wasm';

interface Result {
  pSelectedIndices: number;
  selectedSize: number;
  pSelectedScores: number;
  pValidOutputs: number;
}

export function parseResultStruct(backend: BackendWasm, resOffset: number): Result {
  const result = new Int32Array(backend.wasm.HEAPU8.buffer, resOffset, 4);
  const pSelectedIndices = result[0];
  const selectedSize = result[1];
  const pSelectedScores = result[2];
  const pValidOutputs = result[3];

  // Since the result was allocated on the heap, we have to delete it.
  backend.wasm._free(resOffset);
  return {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs};
}

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 */

import {KernelConfig, KernelFunc, NonMaxSuppressionV3, NonMaxSuppressionV3Attrs,
NonMaxSuppressionV3Inputs, TensorInfo} from '@tensorflow/tfjs-core';

import { parseResultStruct } from '@tensorflow/tfjs-util';

let wasmFunc: (a boxesId: number, scoresId: number, maxOutputSize: number, a iouThreshold: number, scoreThreshold: number) => number;

function setup(backend: BackendWasm): void {
  wasmFunc = backend.wasm.cwrap(NonMaxSuppressionV3, 'number', ['number', 'number', 'number', 'number', 'number'],)
}

function kernelFunc(args: {
  backend: BackendWasm,
  inputs: NonMaxSuppressionV3Inputs,
  attrs: NonMaxSuppressionV3Attrs
}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {iouThreshold, maxOutputSize, scoreThreshold} = attrs;
  const {boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold} = inputs;

  const boxesId = backend.dataIdMap.get(boxesId).id;
  const scoresId = backend.dataIdMap.get(scoresId).id;

  const resOffset = wasmFunc(boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold);

  const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} = parseResultStruct(backend, resOffset);

  // Since we are not using scores for V3, we have to delete it from the heap.
  backend.wasm._free(pSelectedScores);
  backend.wasm._free(pValidOutputs);

  const selectedIndicesTensor = backend.makeOutput([selectedSize], 'int32', pSelectedIndices);

  return selectedIndicesTensor;
}

export const nonMaxSuppressionV3Config: KernelConfig = {
  kernelName: NonMaxSuppressionV3,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: kernelFunc as {} as KernelFunc,
};

NonMaxSuppressionV4Inputs, TensorInfo} from '@tensorflow/tfjs-core';

import { parseResultStruct } from '@tensorflow/tfjs-util';

let wasmFunc: (a boxesId: number, scoresId: number, maxOutputSize: number, a iouThreshold: number, scoreThreshold: number, padToMaxOutputSize: boolean) => number;

function setup(backend: BackendWasm): void {
  wasmFunc = backend.wasm.cwrap(NonMaxSuppressionV4, 'number', ['number', 'number', 'number', 'number', 'number', 'bool'],)
}

function nonMaxSuppressionV4(args: {
  backend: BackendWasm,
  inputs: NonMaxSuppressionV4Inputs,
  attrs: NonMaxSuppressionV4Attrs
}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {iouThreshold, maxOutputSize, scoreThreshold, padToMaxOutputSize} = inputs;

  const boxesId = backend.dataIdMap.get(boxesId).id;
  const scoresId = backend.dataIdMap.get(scoresId).id;

  const resOffset = wasmFunc(boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold, padToMaxOutputSize);

  const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} = parseResultStruct(backend, resOffset);

  // Since we are not using scores for V4, we have to delete it from the heap.
  backend.wasm._free(pSelectedScores);
  backend.wasm._free(pValidOutputs);

  const selectedIndicesTensor = backend.makeOutput([selectedSize], 'int32', pSelectedIndices);

  return selectedIndicesTensor;
}

export const nonMaxSuppressionV4Config: KernelConfig = {
  kernelName: NonMaxSuppressionV4,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: nonMaxSuppressionV4 as {} as KernelFunc,
};
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============================================================================

import {KernelConfig, KernelFunc, NonMaxSuppressionV5, NonMaxSuppressionV5Attrs, NonMaxSuppressionV5Inputs, TensorInfo} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {parseResultStruct} from './NonMaxSuppression_util';

let wasmFunc:
    (boxesId: number, scoresId: number, maxOutputSize: number, iouThreshold: number, scoreThreshold: number, softNmsSigma: number) => number;

function setup(backend: BackendWasm): void {
  wasmFunc = backend.wasm.cwrap(NonMaxSuppressionV5, 'number', ['number', 'number', 'number', 'number', 'number', 'number'], []);
}

function kernelFunc(args: {
  backend: BackendWasm,
  inputs: NonMaxSuppressionV5Inputs,
  attrs: NonMaxSuppressionV5Attrs,
}): TensorInfo[] {
  const {backend, inputs, attrs} = args;
  const {iouThreshold, maxOutputSize, scoreThreshold, softNmsSigma} = attrs;
  const {boxes, scores} = inputs;

  const boxesId = backend.dataIdMap.get(boxes.dataId).id;
  const scoresId = backend.dataIdMap.get(scores.dataId).id;

  const resOffset = wasmFunc(boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold, softNmsSigma);

  const {pSelectedIndices, selectedSize,
        pSelectedScores, pValidOutputs} =
      parseResultStruct(backend, resOffset);

  // Since we are not using validOutputs for V5, we have to delete from the heap
  backend.wasm._free(pValidOutputs);

  const
    selectedIndicesTensor =
      backend.makeOutput([selectedSize], 'int32', pSelectedIndices);
  const
    selectedScoresTensor =
      backend.makeOutput([selectedSize], 'float32', pSelectedScores);

  return
    [selectedIndicesTensor, selectedScoresTensor];
}

export const nonMaxSuppressionV5Config: KernelConfig =
    {kernelName: NonMaxSuppressionV5, backendName: 'wasm', setupFunc: setup, kernelFunc: kernelFunc as {} as KernelFunc};

============================================================================

import {KernelConfig, NotEqual} from '@tensorflow/tfjs-core';

import {createBinaryKernelConfig} from './binary_kernel';

const supportsFullBroadcast = false;
export const notEqualConfig: KernelConfig =
    createBinaryKernelConfig(NotEqual, supportsFullBroadcast, 'bool');

============================================================================

import {KernelConfig, KernelFunc, OneHot, OneHotAttrs, OneHotInputs} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmOneHot: (indicesId: number, depth: number, onValue: number, offValue: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmOneHot = backend.wasm.cwrap(OneHot, null, ['number', 'number', 'number', 'number', 'number'], []);
}

function oneHot(
    args: {inputs: OneHotInputs, attrs: OneHotAttrs, backend: BackendWasm}) {

const {inputs,
```javascript
backend, attrs) = args;
const {indices} = inputs;
const {depth, onValue, offValue} = attrs;
const out = backend.makeOutput([...indices.shape, depth], 'int32');
const outId = backend.dataIdMap.get(out.dataId);
const indicesData = backend.dataIdMap.get(indices.dataId);
const indicesId = indicesData.id;

wasmOneHot(indicesId, depth, onValue, offValue, outId);

return out;
}

export const oneHotConfig:
    KernelConfig = {
        kernelName: OneHot,
        backendName: 'wasm',
        setupFunc: setup,
        kernelFunc: oneHot as {} as KernelFunc,
    };

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=============================================================================
*/

import {KernelConfig, KernelFunc, OnesLike, OnesLikeInputs} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

function onesLike(args: {inputs: OnesLikeInputs, backend: BackendWasm}) {
    const {inputs: {x}, backend} = args;
    const out = backend.makeOutput(x.shape, x.dtype);
    const outVals = backend.typedArrayFromHeap(out); outVals.fill(1);
    return out;
}

export const onesLikeConfig: KernelConfig = {
    kernelName: OnesLike,
    backendName: 'wasm',
    kernelFunc: onesLike as {} as KernelFunc,
};

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=============================================================================
*/

import {KernelConfig, KernelFunc, Pack, PackAttr, PackInputs, TensorInfo, util} from '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';

import {concat} from './Concat';
import {expandDims} from './ExpandDims';

export function pack(
    args: {inputs: PackInputs, backend: BackendWasm, attrs: PackAttr}):
    TensorInfo {
        const {inputs, backend, attrs} = args;
        const {axis} = attrs;

        if (inputs.length === 1) {
            return expandDims(
                {inputs: {input: inputs[0]}, backend, attrs: {dim: axis}},
                axis,
            );
        }

        const shape = inputs[0].shape;
        const dtype = inputs[0].dtype;

        inputs.forEach(t => {
            util.assertShapesMatch(
                    shape, t.shape,
                    'All tensors passed to stack must have matching shapes');
            util.assert(
                    dtype === t.dtype,
                    () => 'All tensors passed to stack must have matching dtypes');
        });

        const intermediateTensorInfos: TensorInfo[] = [];
        const expandedTensors = inputs.map(t => {
            const expandedT = expandDims({input: t, backend, attrs: {dim: axis}});
            intermediateTensorInfos.push(expandedT);
            return expandedT;
        });
        const result = concat([inputs
            expandedTensors, backend, attrs: {axis}]);
        intermediateTensorInfo.forEach(t =>
            backend.disposeData(t.dataId);
        )
        return result;
    }

export const packConfig: KernelConfig = {
    kernelName: Pack,
    backendName: 'wasm',
    kernelFunc: pack as {} as KernelFunc,
    setupFunc: setup,
    setupFunc: setup,
    kernelFunc: pack as {} as KernelFunc,
};

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=============================================================================
*/

import {KernelConfig, KernelFunc, PadV2, PadV2Attr, PadV2Inputs, util} from '@tensorflow/tfjs-core';
```
core\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { fill } from '../Fill';\n\nimport { CppDType } from '../types';\n\nlet wasmPadV2: (xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype: number, prePaddingsBytes: Uint8Array, postPaddingsBytes: Uint8Array, constantValue: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmPadV2 = backend.wasm.cwrap(PadV2, null /* void */);\n}\n\nfunction pad(args: {inputs: PadV2Inputs, backend: BackendWasm, attrs: PadV2Attrs}) {\n  const [inputs: {x}, backend, attrs: {paddings, constantValue}] = args;\n  const outShape = paddings.map((p, i) => p[0] + x.shape[i] + p[1] * (p[1] + 1));\n  const if (util.sizeFromShape(x.shape) === 0) {\n    return fill({\n      backend,\n      attrs: {shape: outShape, value: constantValue, dtype: x.dtype}\n    });\n  }\n  const xId = backend.dataIdMap.get(x.dataId).id;\n  const out = backend.makeOutput(outShape, x.dtype);\n  const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n  const prePaddingsFlat = paddings.map(padTuple => padTuple[0]);\n  const postPaddingsFlat = paddings.map(padTuple => padTuple[1]);\n  wasmPadV2(xId, xShapeBytes, x.shape.length, CppDType[x.dtype], new Uint8Array(new Int32Array(prePaddingsFlat).buffer), new Uint8Array(new Int32Array(postPaddingsFlat).buffer), constantValue, outId);\n  return out;
}\n\nexport const padV2Config: KernelConfig = {\n  kernelName: PadV2,\n  backendName: 'wasm',\n  kernelFunc: pad as {} as KernelFunc,\n  setupFunc: setup\n};

```javascript
KernelConfig = {
  kernelName: 'Prelu',
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: prelu as {} as KernelFunc
};

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 */

import {backend_util, KernelConfig, KernelFunc, Prod, ProdAttrs, ProdInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {permuteAxesAndTranspose} from './kernel_utils';

import {CppDType} from './types';

let wasmProd: (
  xId: number, reduceSize: number, dtype: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmProd = backend.wasm.cwrap(Prod, null /*void*/, 
    ['number',
    'number',
    'number',
    'number']);
}

function prod(args: {
  backend: BackendWasm,
  inputs: ProdInputs,
  attrs: ProdAttrs
}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {axis, keepDims} = attrs;
  const {x} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  let inputId = xId;
  let input = x;

  const {transposed, axes, originalAxes, inputWasTransposed} =
      permuteAxesAndTranspose(x, axis, backend);

  let reductionAxes = axes;
  if (inputWasTransposed) {
    const transposedId =
        backend.dataIdMap.get(transposed.dataId).id;
    if (transposedId !== xId) {
      // transpose was not a no-op. We will need to dispose of this tensor
      backend.disposeData(transposed.dataId);
      reductionAxes = backend_util.getInnerMostAxes(reductionAxes.length, input.shape.length);
    }
  }

  backend_util.assertAxesAreInnerMostDims('prod', reductionAxes, input.shape.length);
  const [outShape, reduceShape] =
      backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);
  const reduceSize = util.sizeFromShape(reduceShape);

  const out = backend.makeOutput(outShape, input.dtype);
  if (util.sizeFromShape(input.shape) !== 0) {
    const outId = backend.dataIdMap.get(out.dataId).id;
    wasmProd(inputId, reduceSize, CppDType[out.dtype], outId);
  }

  if (inputWasTransposed) {
    // dispose of the transposed tensor
    backend.disposeDataData(transposed.dataId);
  }

  if (keepDims) {
    // reshape
    const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);
    out.shape = newShape;
  }

  return out;
}

export const prodConfig: KernelConfig = {
  kernelName: 'Prod',
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: prod as {} as KernelFunc
};

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 */

import {KernelConfig, KernelFunc, Range, RangeAttrs, TensorInfo} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';
import {rangeImplCPU} from '../kernel_utils/shared';

export const range =
    (args: {backend: BackendWasm, attrs: RangeAttrs}): TensorInfo => {
      const {backend, attrs} = args;
      const {start, stop, step, dtype} = attrs;
      const values = rangeImplCPU(start, stop, step, dtype);

      const out = backend.makeOutput(outShape, input.dtype);
      out.shape = newShape;

      return out;
    };

export const rangeConfig: KernelConfig = {
  kernelName: 'Range',
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: range as {} as KernelFunc
};

```
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=============================================================================

*/

import {KernelConfig, RealDiv} from '@tensorflow/tfjs-core';

const supportsFullBroadcast = true;

export const realDivConfig: KernelConfig =
createBinaryKernelConfig(RealDiv, supportsFullBroadcast);

=============================================================================

*/

import {KernelConfig, Relu} from '@tensorflow/tfjs-core';

export const reluConfig: KernelConfig = createUnaryKernelConfig(Relu);

=============================================================================

*/

import {KernelConfig, Relu6} from '@tensorflow/tfjs-core';

export const relu6Config: KernelConfig = createUnaryKernelConfig(Relu6);

=============================================================================

*/

import {KernelConfig, KernelFunc, ResizeBilinear, ResizeBilinearAttrs, ResizeBilinearInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

function setup(backend: BackendWasm): void {
  const wasmResizeBilinear =
backend.wasm.cwrap(ResizeBilinear, null /*void*/, 
['number',  // xId
'number',  // batch
'number',  // oldHeight
'number',  // oldWidth
'number',  // numChannels
'number',  // newHeight
'number',  // newWidth
'number',  // alignCorners
'number',  // halfPixelCenters
'number'   // outId
]);

function resizeBilinear(args: {
  backend: BackendWasm,
  inputs: ResizeBilinearInputs,
  attrs: ResizeBilinearAttrs
}): TensorInfo {
  const {backend, inputs, attrs} = args;

  const {images} = inputs;
  const {alignCorners, halfPixelCenters, size} = attrs;
  const [newHeight, newWidth] = size;

  const [batch, oldHeight, oldWidth, numChannels] = images.shape;
  const outShape = [batch, newHeight, newWidth, numChannels];

  let xData = backend.dataIdMap.get(images.dataId);
  let castedData =
cast({backend, inputs: {x: images}, attrs: {dtype: 'float32'}});

  xData =
backend.dataIdMap.get(castedData.dataId);
  const outId = xData.id;

  return TensorFlowBackend

backend.makeOutput(outShape, 'float32');
  if (util.sizeFromShape(images.shape) === 0) {
    return out;
  }

const outId = backend.dataIdMap.get(out.dataId).id;

  if (util.sizeFromShape(images.shape) === 0) {
    return out;
  }

  wasmResizeBilinear(outId, xId, batch, oldHeight, oldWidth, numChannels, newHeight, newWidth, alignCorners ? 1 : 0, halfPixelCenters ? 1 : 0, outId);
  if (castedData != null) {
    backend.disposeData(castedData.dataId);
  }

  return out;
}

export const
castBilinearConfig: KernelConfig = {
  kernelName: CastBilinear,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: castBilinear as {} as KernelFunc
};

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 */

import {KernelConfig, KernelFunc, Reverse, ReverseAttrs, ReverseInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {identity} from './Identity';
import {reshape} from './Reshape';

let wasmReverse: (xId: number, axes: Uint8Array, axesLength: number, outShape: Uint8Array, outShapeLength: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmReverse = backend.wasm.cwrap(Reverse, null, [ 'number', // x_id
    'array',   // axes
    'number',  // axes_length
    'array',   // out_shape
    'number',  // out_shape_length
    'number'   // out_id
  ]);}

export function reverse(
    args: {inputs: ReverseInputs, backend: BackendWasm, attrs: ReverseAttrs}):
    TensorInfo {
  const {inputs, backend, attrs} = args;
  const {x} = inputs;
  const {dims} = attrs;

  const axes = util.parseAxisParam(dims, x.shape);

  if (x.shape.length === 0) {
    return identity({inputs: {x}, backend});
  }

  const out = backend.makeOutput(x.shape, x.dtype);
  const xId = backend.dataIdMap.get(x.dataId).id;
  const outId = backend.dataIdMap.get(out.dataId).id;

  const axesBytes = new Uint8Array(new Int32Array(axes).buffer);
  const outShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);

  wasmReverse(xId, axesBytes, axes.length, outShapeBytes, x.shape.length, outId);

  const reshaped =
      reshape({inputs: {x: out}, attrs: {shape: x.shape}, backend});

  backend.disposeData(out.dataId);
  return reshaped;
}

export const reverseConfig: KernelConfig = {
  kernelName: Reverse,
  backendName: 'wasm',
  kernelFunc: reverse as {} as KernelFunc,
  setupFunc: setup
};

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 */

import {KernelConfig, KernelFunc, RotateWithOffset, RotateWithOffsetAttrs, RotateWithOffsetInputs, TensorInfo} from '@tensorflow/tfjs-core';
import {backend_util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmRotate: (xId: number, batch: number, imageHeight: number, imageWidth: number, numChannels: number, radians: number, centerX: number, centerY: number, fillBytes: Uint8Array, fillLength: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmRotate = backend.wasm.cwrap(RotateWithOffset, null, [ 'number', // xId
    'number', // batch
    'number', // imageHeight
    'number', // imageWidth
    'number', // numChannels
    'number', // radians
    'number', // centerX
    'number', // centerY
    'array', // fillBytes
    'number', // fillLength
    'number', // outId
  ]);}

export function rotateWithOffset(args: {
  inputs: RotateWithOffsetInputs,
  backend: BackendWasm,
  attrs: RotateWithOffsetAttrs
}): TensorInfo {
  const {inputs, backend, attrs} = args;
  const {image} = inputs;
  const {radians, fillValue, center} = attrs;

  const out =
      backend.makeOutput(image.shape, 'float32');
  backend.disposeData(image.dataId);
  if (image.shape.length === 0) {
    return image;
  }

  const outId = backend.dataIdMap.get(out.dataId).id;

  const width = image.shape[1];
  const height = image.shape[0];
  const numChannels = image.shape[3];

  const xId = backend.dataIdMap.get(image.dataId).id;

  const widthId = backend.dataIdMap.get(width.dataId).id;
  const heightId = backend.dataIdMap.get(height.dataId).id;
  const numChannelsId = backend.dataIdMap.get(numChannels.dataId).id;

  const widthBytes = new Uint8Array(new Int32Array(width.shape).buffer);
  const heightBytes = new Uint8Array(new Int32Array(height.shape).buffer);
  const numChannelsBytes = new Uint8Array(new Int32Array(numChannels.shape).buffer);

  wasmRotate(xId, widthId, heightId, numChannelsId, radians, centerX, centerY, fillBytes, fillLength, outId);

  const reshaped =
      reshape({inputs: {image}, attrs: {shape: image.shape}, backend});

  backend.disposeData(image.dataId);
  return reshaped;
}

export const rotateWithOffsetConfig: KernelConfig = {
  kernelName: RotateWithOffset,
  backendName: 'wasm',
  kernelFunc: rotateWithOffset as {} as KernelFunc,
  setupFunc: setup
};
backend.makeOutput(image.shape, image.dtype);
  const imageId = backend.dataIdMap.get(image.dataId).id;
  const outId = backend.dataIdMap.get(out.dataId).id;
  const [batch, imageHeight, imageWidth, numChannels] = image.shape;
  const [centerX, centerY] = backend_util.getImageCenter(center, imageHeight, imageWidth);
  const fillsIsBlack = fillValue === 0;
  const fullOpacityValue = 255;

  const [batch, imageHeight, imageWidth, numChannels] = image.shape;
  const [centerX, centerY] = backend_util.getImageCenter(center, imageHeight, imageWidth);

  const [centerX, centerY] =
      backend_util.getImageCenter(center, imageHeight, imageWidth);

  const fillIsBlack = fillValue === 0;
  const fullOpacityValue = 255;

  const fillValues = typeof fillValue === 'number' ?
      [fillValue, fillValue, fillValue, fillIsBlack ? 0 : fullOpacityValue] :
      [...fillValue, fullOpacityValue];

  const fillBytes = new Uint8Array(new Int32Array(fillValues).buffer);

  wasmRotate(imageId, batch, imageHeight, imageWidth, numChannels, radians, centerX, centerY, fillBytes, fillValues.length, outId);
  return out;
}

export const rotateWithOffsetConfig: KernelConfig = {
  kernelName: RotateWithOffset,
  backendName: 'wasm',
  kernelFunc: rotateWithOffset as {} as KernelFunc,
  setupFunc: setup
};

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 */

import {KernelConfig, Round} from '@tensorflow/tfjs-core';

export const roundConfig: KernelConfig = createUnaryKernelConfig(Round);

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import {KernelConfig, Rsqrt} from '@tensorflow/tfjs-core';

export const rsqrtConfig: KernelConfig = createUnaryKernelConfig(Rsqrt);

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 */

import {KernelConfig, KernelFunc, scatter_util, ScatterNd, ScatterNdAttrs, ScatterNdInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {CppDType} from './types';

let wasmScatterNd: (
    indicesId: number, updatesId: number, dtype: CppDType, sliceRank: number,
    numUpdates: number, sliceSize: number, strides: Uint8Array, outputSize: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmScatterNd = backend.wasm.cwrap(ScatterNd,
      null /*void*/, [
          'number',  //_indicesId
          'number',  //_updatesId
          'number',  //_dtype
          'number',  //_sliceRank
          'number',  //_numUpdates
          'number',  //_sliceSize
          'array',   //_strides
          'number',  //_outputSize
          'number'   //_outId
      ]);}

function scatterNd(args: {
    backend: BackendWasm,
    inputs: ScatterNdInputs,
    attrs: ScatterNdAttrs
}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {indices, updates} = inputs;
  const {shape} = attrs;

  const outId = backend.dataIdMap.get(indices.dataId).id;
  const indicesData = backend.dataIdMap.get(indices.dataId).id;
  const updateData = backend.dataIdMap.get(updates.dataId).id;

  const index = util.sizeFromShape(shape) == 0);
```javascript
backend.dataIdMap.get(updates.dataId);
const updatesId = updates.dataId;
const stridesBytes = new Uint8Array(new Int32Array(strides).buffer);
const outId = backend.dataIdMap.get(out.dataId);
const stridesId = updates.dataId;
const updatesId = updates.dataId;
const sliceSize = outputSize;
const outId = return out;

export const scatterNdConfig: KernelConfig = {
  kernelName: ScatterNd,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: scatterNd as {} as KernelFunc
};

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 */

import {KernelConfig, KernelFunc, Select, SelectInputs, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmSelect: (conditionId: number, tId: number, eId: number, offset: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmSelect = backend.wasm.cwrap('SelectV2', null, ['number', 'number', 'number', 'number', 'number'],
      ['number', 'void', 'number', 
      'number', 'number', 'number', 'number']);
}

function select(args: {inputs: SelectInputs, backend: BackendWasm}) {
  const {inputs, backend} = args;
  const {condition, t, e} = inputs;

  const conditionId = backend.dataIdMap.get(condition.dataId).id;
  const tId = backend.dataIdMap.get(t.dataId).id;
  const eId = backend.dataIdMap.get(e.dataId).id;

  const out = backend.makeOutput(t.shape, t.dtype);
  const outId = backend.dataIdMap.get(out.dataId).id;

  const cRank = condition.shape.length;
  const tRank = t.shape.length;
  const offset = cRank === 0 || cRank > 1 || tRank === 1 ?
      1 :
  util.sizeFromShape(t.shape.slice(1));

  wasmSelect(conditionId, tId, eId, offset, outId);
  return out;
}

export const selectConfig: KernelConfig = {
  kernelName: Select,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: select as {} as KernelFunc
};

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 */

import {KernelConfig, KernelFunc, Sigmoid, SigmoidInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmFunc: (xId: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmFunc = backend.wasm.cwrap('Sigmoid', null, ['number', 'number']);
}

function sigmoid(args: {backend: BackendWasm, inputs: SigmoidInputs}) {
  const {backend, inputs: {x}} = args;
  const xId = backend.dataIdMap.get(x.dataId).id;
  const outId = backend.makeOutput(x.shape, x.dtype);

  const out = backend.dataIdMap.get(out.dataId).id;
  const cRank = condition.shape.length;
  const tRank = t.shape.length;
  const offset = cRank === 0 || cRank > 1 || tRank === 1 ?
      1 :
  util.sizeFromShape(t.shape.slice(1));

  wasmFunc(xId, outId);
  return out;
}

export const sigmoidConfig: KernelConfig = {
  kernelName: 'Sigmoid',
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: sigmoid as {} as KernelFunc
};

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 */
```
import {KernelConfig, Sin} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';

export const sinConfig: KernelConfig = createUnaryKernelConfig(Sin);

import {KernelConfig, KernelFunc, Softmax, SoftmaxAttrs, SoftmaxInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmFunc: (xId: number, outId: number, channels: number, batch: number) => void;

function setup(backend: BackendWasm): void {
  wasmFunc = backend.wasm.cwrap(Softmax, null /* void */, [
    'number',  // xId
    'number',  // outId
    'number'   // batch
  ]);}

function softmax(
    args: {backend: BackendWasm,
      inputs: SoftmaxInputs,
      attrs: SoftmaxAttrs}):
    TensorInfo {
  const {backend, inputs: {logits}, attrs: {dim}} = args;
  const xId = backend.dataIdMap.get(logits.dataId).id;
  const out = backend.makeOutput(logits.shape, logits.dtype);
  const outId = backend.dataIdMap.get(out.dataId).id;

  const channels = logits.shape[dim];
  const batch = util.sizeFromShape(logits.shape) / channels;

  if (util.sizeFromShape(out.shape) === 0) {
    return out;
  }

  wasmFunc(xId, outId, channels, batch);
  return out;
}

export const softmaxConfig: KernelConfig = {
  kernelName: Softmax,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: softmax as {} as KernelFunc
};

import {backend_util, KernelConfig, KernelFunc, ReshapeAttrs, ReshapeInputs, SpaceToBatchND, SpaceToBatchNDAttrs, SpaceToBatchNDInputs, TensorInfo, TransposeAttrs, TransposeInputs, util} from '@tensorflow/tfjs-core';

import {PadV2Config} from './PadV2';
import {reshape} from './Reshape';
import {transpose} from './Transpose';

function spaceToBatchND(args: {
  inputs: SpaceToBatchNDInputs,
  backend: BackendWasm,
  attrs: SpaceToBatchNDAttrs
}) {
  const {inputs, backend, attrs} = args;
  const {x} = inputs;
  const {blockShape, paddings} = attrs;

  const prod = util.sizeFromShape(blockShape);
  const completePaddings: Array<[number, number]> = [[0, 0]];
  completePaddings.push(...(paddings as Array<[number, number]>));

  for (let i = 1 + blockShape.length; i < x.shape.length; ++i) {
    completePaddings.push([0, 0]);
  }

  const paddedX = padV2Config.kernelFunc({
    inputs: {x},
    backend,
    attrs: {paddings: completePaddings, constantValue: 0}
  }) as TensorInfo;

  const reshapedPaddedShape = backend_util.getReshaped(paddedX.shape, blockShape, prod, false);
  const permutedReshapedPaddedPermutation = backend_util.getPermuted(reshapedPaddedShape.length, blockShape.length, false);

  const flattenShape = backend_util.getReshapedPermuted(paddedX.shape, blockShape, prod, false);

  const resspaceReshaped = transpose({inputs: reshapeInputs, backend, attrs: transposeAttrs});

  const permutedReshapedPaddedPermutation = transpose({inputs: transposeInputs, backend, attrs: transposeAttrs});

  return resspaceReshaped;
from './binary_kernel';

const supportsFullBroadcast = true;

export const squaredDifferenceConfig = createBinaryKernelConfig(SquaredDifference, supportsFullBroadcast);

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 */

import {KernelConfig, KernelFunc, Step, StepAttrs, StepInputs, TensorInfo} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {CppDType} from './types';

let wasmStep:
    (xId: number, alpha: number, dtype: number, outId: number) =>
    void;

function setup(backend:
    BackendWasm): void {
  wasmStep = backend.wasm.cwrap(Step, null /*void*/, 
  ['number',  // x_id
    'number',  // alpha
    'number',  // dtype
    'number',  // out_id
  ]);
}

function step(
    args: {backend:
      BackendWasm,
      inputs: StepInputs,
      attrs: StepAttrs}
): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {alpha} = attrs;
  const {x} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;

  const out = backend.makeOutput(x.shape, x.dtype);
  const outId = backend.dataIdMap.get(out.dataId).id;
  wasmStep(xId, alpha, CppDType[x.dtype], outId);
  return out;
}

export const stepConfig = {
  kernelName: Step,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: step as {} as KernelFunc
};

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 */

import {KernelConfig, KernelFunc, slice_util, StridedSlice, StridedSliceAttrs, StridedSliceInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';
import {reshape} from './Reshape';
import {slice} from './Slice';

let wasmStridedSlice: (
    xId: number, xStridesBytes: Uint8Array,
    xRank: number,
    beginBytes: Uint8Array, endBytes: Uint8Array, stridesBytes: Uint8Array,
    outShapeBytes: Uint8Array, outStridesBytes: Uint8Array,
    outShapeLength: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmStridedSlice = backend.wasm.cwrap(StridedSlice, null /*void*/, 
  ['number',  // xId
    'array',   // xStrides
    'number',  // xRank
    'array',   // begin
    'array',   // end
    'array',   // strides
    'array',   // outShape
    'array',   // outStrides
    'number',  // outShapeLength
    'number',  // outId
  ]);
}

export function stridedSlice(args: {
  backend: BackendWasm,
  inputs: StridedSliceInputs,
  attrs: StridedSliceAttrs
}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {x} = inputs;

  const {
    begin,
    end,
    strides,
    beginMask,
    endMask,
    ellipsisMask,
    newAxisMask,
    shrinkAxisMask
  } = attrs;

  const {
    finalShapeSparse,
    finalShape,
    isIdentity,
    sliceDim0,
    isSimpleSlice
  } =
      slice_util.sliceInfo(
          x.shape, begin, end, strides,
          beginMask, endMask, ellipsisMask,
          newAxisMask, shrinkAxisMask);

  let result;

  if (isIdentity) {
    // Optimization #1, slice is a no-op plus reshape
    result = reshape({inputs: [x],
                      backend, attrs: {shape: finalShape}});
  } else if (sliceDim0 || isSimpleSlice) {
    // Optimization #2, slice is memory contiguous (only occurs in dim 0)
    const size = slice_util.computeOutShape(begin, end, strides);
    result =
        reshape({inputs: [x],
                 backend, attrs: {begin: begin, size}});
  } else {
    result = backend.makeOutput(finalShapeSparse, 'float32');
  }
}
```javascript
xStridesBytes = new Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);
const beginBytes = new Uint8Array(new Int32Array(begin).buffer);
const endBytes = new Uint8Array(new Int32Array(end).buffer);
const stridesBytes = new Uint8Array(new Int32Array(strides).buffer);

const outputShapeBytes = new Uint8Array(new Int32Array(finalShapeSparse).buffer);
const outStridesBytes = new Uint8Array(new Int32Array(util.computeStrides(finalShapeSparse)).buffer);

const outId = backend.dataIdMap.get(out.dataId);

const result = reshape({inputs: [x, backend, attrs: {shape: finalShape}]}, backend.disposeData(out.dataId));

backend.disposeData(out.dataId);

return result;
}

export const stridedSliceConfig: KernelConfig = {
  kernelName: StridedSlice,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: stridedSlice as {} as KernelFunc
};

const supportsFullBroadcast = true;
export const subConfig: KernelConfig = createBinaryKernelConfig(Sub, supportsFullBroadcast);

import {backend_util, KernelConfig, KernelFunc, Sum, SumAttrs, SumInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {permuteAxesAndTranspose} from './kernel_utils';
import {CppDType} from './types';

let wasmSum: (xId: number, reduceSize: number, dtype: number, outId: number) => void =
    null;

function setup(backend: BackendWasm): void {
  wasmSum = backend.wasm.cwrap(Sum, null /*void*/, [
    'number',  // input_id
    'number',  // reduce_size
    'number',  // dtype
    'number',  // out_id
  ]);}

function sum(args: {backend: BackendWasm, inputs: SumInputs, attrs: SumAttrs}):
    TensorInfo {
  const {backend, inputs, attrs} = args;
  const {axis, keepDims} = attrs;
  const {x} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  let inputId = xId;
  let input = x;

  const {transposed, axes, originalAxes, inputWasTransposed} =
    permuteAxesAndTranspose(x, axis, backend);

  let reductionAxes = axes;
  if (inputWasTransposed) {
    const transposedId = backend.dataIdMap.get(transposed.dataId).id;
    if (transposedId !== xId) {
      // transpose was not a no-op. We will need to dispose of this tensor.
      backend.disposeData(transposed.dataId);
    }

    reductionAxes = backend_util.getInnerMostAxes(
        reductionAxes.length, input.shape.length);
  }

  backend_util.assertAxesAreInnerMostDims(
      'sum', reductionAxes, input.shape.length);
  const [outShape, reduceShape] =
    backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);
  const outId = backend.makeOutput(outShape, input.dtype);

  const wasmSum(inputId, reduceShape.length, CppDType[input.dtype], outId);

  // dispose of the transposed tensor.
  backend.disposeData(transposed.dataId);

  if (keepDims) {
    // reshape
    const newShape = backend_util.expandShapeToKeepDim(outShape, originalAxes);
  }

  return {
    backend: backend,
    ...input.attributes,
    ...output.attributes
  };
```
return out;
}
}

export const sumConfig: KernelConfig = {
  kernelName: Sum,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: sum as {} as KernelFunc
};

export const tanConfig: KernelConfig = createUnaryKernelConfig(Tan);

export const tanhConfig: KernelConfig = createUnaryKernelConfig(Tanh);

import {KernelConfig, Tile, TileAttr, TileInputs} from '@tensorflow/tfjs-core';

import {makeOutput, BackendWasm} from '../backend_wasm';

import {CppDType} from './types';

let wasmTile: (xId: number, xShape: Uint8Array, xShapeSize: number, newShape: Uint8Array, newShapeSize: number, dtype: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmTile = backend.wasm.cwrap(Tile, null, [
    'number', // x_id
    'array',   // x_shape
    'number',  // x_shape.length
    'array',   // new_shape
    'number',  // new_shape.length
    'number'   // out_id
  ]);}

function tile(args: {inputs: TileInputs, backend: BackendWasm, attrs: TileAttr}) {
  const {inputs, backend, attrs} = args;
  const {x} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  const {reps} = attrs;
  const newShape: number[] = new Array(x.shape.length);
  for (let i = 0; i < newShape.length; i++) {
    newShape[i] = x.shape[i] * reps[i];
  }
  const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);
  const newShapeBytes = new Uint8Array(new Int32Array(newShape).buffer);
  const out = makeOutput(newShape, x.dtype);
  const outId = backend.dataIdMap.get(out.dataId).id;
  wasmTile(xId, xShapeBytes, x.shape.length, newShapeBytes, newShape.length, CppDType[x.dtype], outId);
  return out;
}

export const tileConfig: KernelConfig = {
  kernelName: Tile,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: tile as {} as KernelFunc
};

import {KernelConfig, KernelFunc, TensorInfo, TopK, TopKAttrs, TopKInputs} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';
import {CppDType} from './types';

let wasmTopK:
    (xId: number, xShapeBytes: Uint8Array, xShapeLength: number,
    xDtype: CppDType, k: number, sorted: boolean, outValuesId: number,
    outIndicesId: number) => void;

function setup(backend: BackendWasm) {
  wasmTopK = backend.wasm.cwrap(TopK, null /* void */, 
      ['number', // xId
      'array',   // x.shape
      'number',  // x.shape.length
      'number',  // x.dtype
      'number',  // k
      'bool',    // sorted
      'number',  // outValuesId
      'number',  // outIndicesId
    ]); export const topk:
    (args: {inputs: TopKInputs, backend: BackendWasm, 
    attrs: TopKAttrs}) =>
        TensorInfo[] | TensorInfo = ({inputs, backend, attrs}) => {
          const {x} = inputs;
          const {k, sorted} = attrs;

          const xId = backend.dataIdMap.get(x.dataId).id;
          const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);
          const outputShape = x.shape.slice();
          outputShape[outputShape.length - 1] = k;
          const outValues = backend.makeOutput(outputShape, x.dtype);
          const outValuesId = backend.dataIdMap.get(outValues.dataId).id;
          const outIndices = backend.makeOutput(outputShape, 'int32');
          const outIndicesId = backend.dataIdMap.get(outIndices.dataId).id;

          wasmTopK(xId, xShapeBytes, x.shape.length, 
            CppDType[x.dtype], k, sorted, 
            outValuesId, outIndicesId);

          return [outValues, outIndices];
    };
break; }

wasmTransform(imageId, transformsId, (transforms.shape[0] > 1), batch, outHeight, 
outWidth, numChannels, imageWidth, imageHeight, strides, 
image.shape.length - 1, interpolationModelId, 
fillModelId, fillValue, outId);

return out;
}

export const transformConfig: KernelConfig = {
  kernelName: Transform, 
  backendName: 'wasm',
  setupFunc: setup, 
  kernelFunc: transform as {} as KernelFunc
};

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 */

import {KernelConfig, KernelFunc, TensorInfo, Unpack, UnpackAttrs, UnpackInputs} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {slice} from './Slice';

function unpack(args: {inputs: UnpackInputs, backend: BackendWasm, attrs: UnpackAttrs}) {
  const {inputs, backend, attrs} = args;
  const {value} = inputs;
  let {axis} = attrs;

  if (axis < 0) {
    axis += value.shape.length;
  }

  const numOutputs = value.shape[axis];
  const rank = value.shape.length;
  const outShape: number[] = new Array(rank - 1);
  let outIndex = 0;
  for (let i = 0; i < rank; i++) {
    if (i !== axis) {
      outShape[outIndex++] = value.shape[i];
    }
  }
  const outs: TensorInfo[][] = new Array(numOutputs);
  const begin = new Array(rank).fill(0);
  const size = value.shape.slice();
  size[axis] = 1;
  for (let i = 0; i < outs.length; i++) {
    begin[axis] = i;
    outs[i] = slice({inputs: {x: value}, attrs: {begin, size}, backend});
  }
  return outs.map(({dataId, dtype}) => ({dataId, dtype, shape: outShape}));
}

export const unpackConfig: KernelConfig = {
  kernelName: Unpack,
  backendName: 'wasm',
  kernelFunc: unpack as {} as KernelFunc,
};

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 */

import {KernelConfig, KernelFunc, ZerosLike, ZerosLikeInputs} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

function zerosLike(args: {inputs: ZerosLikeInputs, backend: BackendWasm}) {
  const {inputs: {x}, backend} = args;
  const out = backend.makeOutput(x.shape, x.dtype);
  const outVals = backend.typedArrayFromHeap(out);
  outVals.fill(0);
  return out;
}

export const zerosLikeConfig: KernelConfig = {
  kernelName: ZerosLike,
  backendName: 'wasm',
  kernelFunc: zerosLike as {} as KernelFunc
};

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 */

import {KernelConfig, KernelFunc, ZerosLike, ZerosLikeInputs} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

function zerosLike(args: {inputs: ZerosLikeInputs, backend: BackendWasm}) {
  const {inputs: {x}, backend} = args;
  const out = backend.makeOutput(x.shape, x.dtype);
  const outVals = backend.typedArrayFromHeap(out);
  outVals.fill(0);
  return out;
}

export const zerosLikeConfig: KernelConfig = {
  kernelName: ZerosLike,
  backendName: 'wasm',
  kernelFunc: zerosLike as {} as KernelFunc
};

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 */

import {KernelConfig, registerKernel} from '@tensorflow/tfjs-core';

// We explicitly import the modular kernels so they get registered in the global registry when we compile the library. A modular build would replace the contents of this file and import only the kernels that are needed.
import {KernelConfig, registerKernel} from '@tensorflow/tfjs-core';

// We explicitly import the modular kernels so they get registered in the global registry when we compile the library. A modular build would replace the contents of this file and import only the kernels that are needed.
kernelConfigs: KernelConfig[] = [
  absConfig,
  addConfig,
  addNConfig,
  allConfig,
  anyConfig,
  argMaxConfig,
  avgPoolConfig,
  batchMatMulConfig,
  batchToSpaceNDCfg,
  castConfig,
  ceilConfig,
  clipByValueConfig,
  concatConfig,
  conv2DConfig,
  conv2DBackpropInputConfig,
  cosConfig,
  coshConfig,
  cropAndResizeConfig,
  cumsumConfig,
  depthToSpaceConfig,
  depthwiseConv2dNativeConfig,
 eluConfig,
  equalConfig,
  expConfig,
  expandDimsConfig,
  fillConfig,
  flipLeftRightConfig,
  floorConfig,
  floorDivConfig,
  fusedMatMulConfig,
  fusedBatchNormConfig,
  fusedConv2DConfig,
  fusedDepthwiseConv2DConfig,
  gatherNdConfig,
  gatherV2Config,
  greaterConfig,
  greaterEqualConfig,
  identityConfig,
  leakyReluConfig,
  lessConfig,
  lessEqualConfig,
  logConfig,
  logicalAndConfig,
  maxConfig,
  maximumConfig,
  maxPoolConfig,
  meanConfig,
  minConfig,
  minimumConfig,
  mirrorPadConfig,
  multiplyConfig,
  negConfig,
  nonMaxSuppressionV3Config,
  nonMaxSuppressionV4Config,
  nonMaxSuppressionV5Config,
  notEqualConfig,
  oneHotConfig,
  onesLikeConfig,
  packConfig,
  padV2Config,
  powConfig,
  preluConfig,
  prodConfig,
  rangeConfig,
  realDivConfig,
  reluConfig,
  relu6Config,
  reshapeConfig,
  resizeBilinearConfig,
  roundConfig,
  scatterNdConfig,
  selectConfig,
  sigmoidConfig,
  sinConfig,
  sliceConfig,
  softmaxConfig,
  spaceToBatchNDConfig,
  splitVConfig,
  sqrtConfig,
  squareConfig,
  squaredDifferenceConfig,
  stepConfig,
  stridedSliceConfig,
  subConfig,
  sumConfig,
  tanConfig,
  tanhConfig,
  tileConfig,
  topKConfig,
  transformConfig,
  transposeConfig,
  unpackConfig,
  zerosLikeConfig
];

for (const kernelConfig of kernelConfigs) {
  registerKernel(kernelConfig);
}
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}function

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 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(f){var ret=read_(f,"binary");assert(typeof ret==="object");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",function(ex){if(!ex instanceof TypeError){throw ex}});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){var _scriptDir !== "undefined" && _scriptDir !== "default" && document.currentScript}{scriptDirectory=document.currentScript.src}if(typeof document!="undefined"&document.currentScript){scriptDirectory=document.currentScript.src}if(typeof _scriptDir !="undefined"&&

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```
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=shell_read(filename,true);
    if(ret.buffer){
        ret=Uint8Array(ret.buffer);
    }else{
        throw new Error("Invalid binary file")
    }
    return ret
}

readAsync=function(url,onLoad,onError){
    var xhr=new XMLHttpRequest;
    xhr.open("GET",url,true);
    xhr.responseType="arraybuffer";
    xhr.onload=
```
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<2048){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+2]=224|u>>12;heap[outIdx+1]=128|u>>6&63;heap[outIdx ++]=128|u&63}else if(outIdx+3>=endIdx)break;heap[outIdx+3]=240|u>>18;heap[outIdx+2]=128|u>>12&63;heap[outIdx ++]=128|u>>6&63;heap[outIdx+1]=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)}

INITIAL_MEMORY=Module["INITIAL_MEMORY"]||16777216;if(ENVIRONMENT_IS_PTHREAD){wasmMemory=Module["wasmMemory"]
}else{wasmMemory=new
WebAssembly.Memory({"initial":INITIAL_MEMORY/65536,"maximum":2147483648/65536,"shared":false});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)throw new Error("called preRun but ENVIRONMENT_IS_PTHREAD is false.");if(typeof Module.preRun=="function")Module.preRun();}

function initRuntime(){runtimeInitialized=true;if(ENVIRONMENT_IS_PTHREAD)throw new Error("called initRuntime but ENVIRONMENT_IS_PTHREAD is false.");callRuntimeCallbacks(__ATPRERUN__)}

function preMain(){if(ENVIRONMENT_IS_PTHREAD)callRuntimeCallbacks(__ATMAIN__)}

function exitRuntime(){if(ENVIRONMENT_IS_PTHREAD)return;runtimeExited=true;}

function postRun(){if(ENVIRONMENT_IS_PTHREAD)return;Module["postRun"]()}

function callRuntimeCallbacks(__ATPRERUN__){if(typeof Module["postRun"]=="function")Module["postRun"]=[];while(Module["postRun"].(length){addOnPostRun(Module["postRun"].(shift()));}

function addOnPostRun(cb){return function(){cb()}}

function callRuntimeCallbacks(__ATPOSTRUN__){return function(){callRuntimeCallbacks(__ATPOSTRUN__)}

function callRuntimeCallbacks(__ATEXIT__){return function(){callRuntimeCallbacks(__ATEXIT__)}}

function callRuntimeCallbacks(__ATINIT__){return function(){callRuntimeCallbacks(__ATINIT__)}}
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){Atoms.store(GROWABLE_HEAP_U32(),tb+100>>2,tlsMemory);Atoms.store(GROWABLE_HEAP_U32(),tb+40>>2,tb);};_emscripten_thread_init(tb,!ENVIRONMENT_IS_WORKER);_emscripten_register_main_browser_thread_id(tb);initWorker:function(){},PTreadExitHandlers:[],setThreadStatus:function(){},runExitHandlers:function(){while(PThread.threadExitHandlers.length>0){PThread.threadExitHandlers.pop()}}},initWorker:function(){},pthreads:{},threadExitHandlers:[],setThreadStatus:function(){},runExitHandlersAndDeinitThread:function(){var headPtr=tb+152;GROWABLE_HEAP_I32()[headPtr+2]=headPtr;var tlsMemory=_malloc(512);for(var i=0;i<128;++i){Atoms.store(GROWABLE_HEAP_U32(),tb+100>>2,tlsMemory);Atoms.store(GROWABLE_HEAP_U32(),tb+40>>2,tb);};_emscripten_thread_func_wake(tb+0,2147483647);_emscripten_thread_init(tb,0,0);threadExit:function(){var tb=tb+0;PThread.runExitHandlersAndDeinitThread(tb);},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[i]=null};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[i]=null};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;pthread.allocatedOwnStack&&pthread.stackBase)_free(pthread.stackBase);pthread.stackBase=0;if(pthread.worker)pthread.worker.pthread=null};returnWorkerToPool:function(worker){PThread.runWithoutMainThreadQueuedCalls(function(){var pthread=worker.pthreadInfoStruct;PThread.threadInfoStruct=pthread;PThread.freeThreadData(pthread);worker.terminate();PThread.runningWorkers[i]=null};freeThreadData:function(pthread){if(!(pthread)return;pthread.threadInfoStruct=0;pthread.allocatedOwnStack&&pthread.stackBase)_free(pthread.stackBase);pthread.stackBase=0;PThread.runWithoutMainThreadQueuedCalls(function(){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==="loadWasmModuleToWorker"){PThread.unloaded=true;if(onFinishedLoading)onFinishedLoading(worker);if(runner.runPthread){worker.runPthread();delete worker.runPthread}}}};
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){
    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=addr+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,numCallArgs,stack);stackRestore(stack);return ret
}function _emscripten_get_heap_size(){return GROWABLE_HEAP_U8().length}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)}}}
```javascript
REFERREDCALLS.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){JSEvents.runDeferredCalls();eventHandler.func.apply(null,eventHandler.args);JSEvents.runDeferredCalls();JSEvents.inEventHandler&&JSEvents.currentEventHandler.allowsDeferredCalls();runDeferredCalls();eventHandler.func.apply(null,eventHandler.args);JSEvents.runDeferredCalls();},addEventHandler(targetEventListener){eventHandler.target.addEventListener(eventHandler.eventTypeString,targetEventListener,h.useCapture);JSEvents.eventHandlers.push(eventHandler)}}},registerOrRemoveHandler:function(eventHandler){var jsEventHandler=function(jsEventHandler){++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)}}},queueEventHandlerOnThread_iiii:function(targetThread,eventHandlerFunc,eventTypeId,eventData,userData){var stackTop=stackSave();var args=stackAlloc(12);GROWABLE_HEAP_I32()[args>>2]=eventTypeId;GROWABLE_HEAP_I32()[args+4>>2]=eventData;GROWABLE_HEAP_I32()[args+8>>2]=userData;__emscripten_call_on_thread(0,targetThread,637534208,eventHandlerFunc,eventData,vars);stackRestore(stackTop)},getTargetThreadForEventCallback:function(targetThread){switch(targetThread){case 1:return 0;case 2:return PThread.currentProxiedOperationCallerThread;default:return targetThread}},getNodeNameForTarget:function(target){target=maybeCStringToJsString(target);var domElement=specialHTMLTargets[target]||(typeof document!=="undefined"?document.querySelector(target):undefined);return domElement},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 args=stackAlloc(12);var targetCanvasPtr=0;if(targetCanvas){targetCanvasPtr=stringToNewUTF8(targetCanvas)}GROWABLE_HEAP_I32()[args>>2]=targetCanvasPtr;GROWABLE_HEAP_I32()[args+4>>2]=width;GROWABLE_HEAP_I32()[args+8>>2]=height;__emscripten_call_on_thread(0,targetThread,657457152,0,targetCanvasPtr,vars);stackRestore(stackTop)},getEventTarget: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 args=stackAlloc(12);var targetCanvasPtr=0;if(targetCanvas){targetCanvasPtr=stringToNewUTF8(targetCanvas)}GROWABLE_HEAP_I32()[args>>2]=targetCanvasPtr;GROWABLE_HEAP_I32()[args+4>>2]=width;GROWABLE_HEAP_I32()[args+8>>2]=height;__emscripten_call_on_thread(0,targetThread,657457152,0,targetCanvasPtr,vars);stackRestore(stackTop)}},maybeCStringToJsString:function(cString){return cString>2?UTF8ToString(cString):cString},specialHTMLTargets:[0,typeof document!=="undefined"?document:0,typeof window!=="undefined"?window:0];function findCanvasEventTarget(target){target=document.getElementById(target);function maybeCStringToJsString(cString){return cString>2?UTF8ToString(cString):cString}var specialHTMLTargets=[0,typeof document!=="undefined"?document:0,typeof window!=="undefined"?window:0];function findCanvasEventTarget(target){return findEventTarget(target)}},maybeCStringToJsString:function(cString){return cString>2?UTF8ToString(cString):cString}function findCanvasEventTarget(target){return findCanvasEventTarget(target)}}},
Uint8Array(xhr.response)}]readAsync=function(url, onload, onerror){var xhr=new XMLHttpRequest;xhr.open("GET",url,true);xhr.onreadystatechange=function(){if(xhr.readyState==200||xhr.status==0&&xhr.readyState==4)xhr.onload=xhr.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")throw("no native wasm support detected")wasmMemory:var ABORT=false;var EXITSTATUS;function assert(condition, text){if(!condition){throw("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}function cwrap(ident, returnType, argTypes, opts){argTypes=argTypes||[];numericArgs=argTypes.every(function(type){return type==="number"});numericRet=returnType!=="string";if(numericRet&&numericArgs&&!opts){return getCFunc(ident)}return function(){return ccall(ident, returnType, argTypes, arguments, opts)}}var UTF8Decoder;if(typeof TextDecoder!==null)?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 u=heap[idx++];if(u>=55296&&u<=57343){var u1=heap[idx++];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+1]=192|u>>6&63}else{if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx+1]=192|u>>12&63;heap[outIdx+2]=128|u>>6&63}if(outIdx>=endIdx)break;heap[outIdx]=0}return outIdx-startIdx}function UTF8ToString(ptr, maxBytesToWrite){return UTF8ArrayToString(HEAPU8, ptr, maxBytesToWrite)}
writeArrayToMemory(array, buffer)
function
alignUp(x, multiple) { if (x % multiple > 0) { x += multiple - x % multiple } return x }
var buffer, HEAP8, HEAP16, HEAPU16, HEAP32, HEAPU32, HEAPF32, HEAPF64;
function updateGlobalBufferAndViews(buf) {
  buffer = buf;
  Module["HEAP8"] = HEAP8 = new Uint8Array(buf);
  Module["HEAP16"] = HEAP16 = new Uint16Array(buf);
  Module["HEAP32"] = HEAP32 = new Uint32Array(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);
}

INITIAL_MEMORY = Module["INITIAL_MEMORY"] || 16777216;

var runtimeInitialized = false;

function preRun() {
  if (Module["preRun"], Module["preRun"]) {
    while (Module["preRun"].length) {
      addOnPreRun(Module["preRun"].shift());
    }
  }
}

function initRuntime() {
  runtimeInitialized = true;
  callRuntimeCallbacks(__ATPRERUN__);
}

function preMain() {
  callRuntimeCallbacks(__ATMAIN__);
}

function postRun() {
  if (Module["postRun"], Module["postRun"]) {
    while (Module["postRun"].length) {
      addOnPostRun(Module["postRun"].shift());
    }
  }
}

function addOnPreRun(cb) {
  __ATPRERUN__.unshift(cb);
}

function addOnPostRun(cb) {
  __ATPOSTRUN__.unshift(cb);
}

function addRunDependency(id) {
  runDependencies++;
  if (Module["monitorRunDependencies"], Module["monitorRunDependencies"]) {
    Module["monitorRunDependencies"].push(id);
  }
}

function createWasm() {
  var info = {
    a: asmLibraryArg
  };
  function receiveInstance(instance, module) {
    var
  }
}
exports=instance.exports;Module["asm"] = exports; wasmMemory = Module["asm"]["v"]; updateGlobalBufferAndViews(wasmMemory.buffer); wasmTable = Module["asm"]["r"]; removeRunDependency("wasm-instantiate");

function receiveInstantiatedSource(output) {
  receiveInstance(output["instance"]);
}

function instantiateArrayBuffer(receiver) {
  return getBinaryPromise().then(function(binary) {
    return WebAssembly.instantiateSync(binary, info);
  }).then(receiver, function(reason) {
    err("failed to asynchronously prepare wasm: "+reason);
    abort(reason);
  });
}

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) {
    return 0;
  }
}

function _emscripten_resize_heap(requestedSize) {
  var oldSize = _emscripten_get_heap_size();
  var maxHeapSize = 2147483648;
  if (requestedSize > maxHeapSize) {
    return false;
  }

  var cutDown = 1;
  while (cutDown <= 4) {
    var overGrownHeapSize = oldSize * (1 + 0.2 / 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;
    } else {
      return false;
    }
  }

  var SYSCALLS = {
    mappings: {},
    buffers: [null, [], []],
    printChar: function(stream, curr) {
      buffer = SYSCALLS.buffers[stream];
      if (curr === 0 || curr === 10) {
        (stream === 1 ? out : err)(UTF8ArrayToString(buffer, 0));
      } else {
        buffer.push(curr);
        var vars = undefined;
      }
    },
    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;
    },
    _fd_close: function(fd) {
      return 0;
    },
    _fd_seek: function(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];
          var len = HEAP32[iov + i * 8 + 2];
          if (var j = 0; j < len; j++) {
            SYSCALLS.printChar(fd, HEAPU8[ptr + j]);
          }
        }
        return ret;
      }
    },
    _pthread_create: function() {
      return 6;
    },
    _pthread_join: function() {
      return 28;
    },
    setErrNo: function(error) {
      HEAP32[___errno_location() >> 2] = error;
      return error;
    },
    _sysconf: function(name) {
      switch (name) {
        case 30: return 16384;
        case 85: var maxHeapSize = 2147483648;
        case 16384: return 16384;
        case 132: return 133;
        case 12: return 137;
        case 13: return 15;
        case 235: return 16;
        case 17: return 18;
        case 19: return 20;
        case 149: return 13;
        case 10: return 236;
        case 153: return 159;
        case 154: return 14;
        case 77: return 78;
        case 139: return 82;
        case 68: return 67;
        case 66: return 14;
        case 46: return 200809;
        case 27: return 246;
        case 248: return 127;
        case 24: return 128;
        case 23: return 160;
        case 161: return 181;
        case 182: return 183;
        case 242: return 243;
        case 244: return 245;
        case 165: return 178;
        case 179: return 176;
        case 177: return 175;
        case 176: return 177;
        case 175: return 176;
        case 97: return 76;
        case 32: return 32;
        case 32: return 35;
        case 80: return 81;
        case 79: return 78;
        case 177: return 177;
        case 7: return 5;
        case 8: return 157;
        case 157: return 125;
        case 126: return 92;
        case 93: return 129;
        case 130:
      }
    }
  }

  return {}/
memoryOffset);

    if (values != null) {
      this.wasm.HEAPU8.set(
          new Uint8Array(values.buffer, values.byteOffset, numBytes),
          memoryOffset);
    }

  }

  async read(dataId: DataId): Promise<backend_util.BackendValues> {
    return this.readSync(dataId);
  }

  readSync(dataId: DataId): backend_util.BackendValues {
    const {memoryOffset, dtype, shape, stringBytes} =
        this.dataIdMap.get(dataId);
    if (dtype === 'string') {
      return stringBytes;
    }
    const bytes = this.wasm.HEAPU8.slice(
        memoryOffset,
        memoryOffset + util.sizeFromShape(shape) * util.bytesPerElement(dtype));
    return typedArrayFromBuffer(bytes.buffer, dtype);
  }

  disposeData(dataId: DataId, force = false): boolean {
    if (this.dataIdMap.has(dataId)) {
      const data =
          this.dataIdMap.get(dataId);
      data.refCount--;
      if (!force && data.refCount > 0) {
        return false;
      }
      this.wasm._free(data.memoryOffset);
      this.wasm.tfjs.disposeData(data.id);
      this.dataIdMap.delete(dataId);
    }
    return true;
  }

  refCount(dataId: DataId): number {
    if (this.dataIdMap.has(dataId)) {
      const tensorData =
          this.dataIdMap.get(dataId);
      return tensorData.refCount;
    }
    return 0;
  }

  incRef(dataId: DataId) {
    const data = this.dataIdMap.get(dataId);
    if (data != null) {
      data.refCount++;
    }
  }

  floatPrecision(): number {
    return 32;
  }

  getMemoryOffset(dataId: DataId): number {
    return this.dataIdMap.get(dataId).memoryOffset;
  }

  dispose() {
    this.wasm.tfjs.dispose();
    if ('PThread' in this.wasm) {
      this.wasm.PThread.terminateAllThreads();
    }
    this.wasm = null;
  }

  /**
   * Returns the path of the WASM binary.
   * @param simdSupported whether SIMD is supported
   * @param threadsSupported whether multithreading is supported
   * @param wasmModuleFolder the directory containing the WASM binaries.
   */
  getPathToWasmBinary(
      simdSupported: boolean, threadsSupported: boolean,
      wasmModuleFolder: string) {
    if (wasmPath != null) {
      // If wasmPath is defined, the user has supplied a full path to
      // the Wasm binary file at $(path) or
      // minprogram's output path.
      return wasmPath;
    }
    let path: WasmBinaryName = 'tfjs-backend-wasm.wasm';
    if (simdSupported && threadsSupported) {
      path = 'tfjs-backend-wasm-threaded-simd.wasm';
    } else if (simdSupported) {
      path = 'tfjs-backend-wasm-simd.wasm';
    }
    if (wasmFileMap != null) {
      return wasmFileMap[path];
    }
    path = wasmModuleFolder + path;
    this.wasmFileMap[path] = this.wasmFileMap[path] || {*
      * Initialize the wasm module and creates the js <-> wasm bridge.
      * NOTE: We wrap the wasm module in a object with property
'wasm' instead of

* returning Promise<BackendWasmModule> to avoid freezing Chrome (last tested
* in Chrome 76);}
* nx export async function init(): Promise<{wasm: BackendWasmModule}> {,

* const [simdSupported, threadsSupported] = await Promise.all([env().getAsPromised('WASM_HAS_SIMD_SUPPORT'),

* env().getAsPromised('WASM_HAS_MULTITHREAD_SUPPORT')]));

* return new Promise(resolve, reject) => {

* const factoryConfig: WasmFactoryConfig = {};

* /** * This function overrides the Emscripten module locateFile utility. @param path The relative path to the file that needs to be loaded. @param prefix The path to the main JavaScript file's directory.

* };

* factoryConfig.locateFile = (path, prefix) => {

* if (path.endsWith('.worker.js')) {

* const response = wasmWorkerContents;

* const blob = new Blob([response], {type: 'application/javascript'});

* return URL.createObjectURL(blob);

* }

* if (path.endsWith('.wasm')) {

* return getPathToWasmBinary(simdSupported as boolean, threadsSupported as boolean, wasmPathPrefix != null ? wasmPathPrefix : prefix);

* }

* return prefix + path;

* };

* // Use the instantiateWasm override when system fetch is not available.

* // Reference:

* // https://github.com/emscripten-core/emscripten/blob/2bca683cb65a4133db61b7d74d041f7eefcfa907/tests/manual_wasm_instantiate.html#L170

* if (customFetch) {

* createInstantiateWasmFunc(getPathToWasmBinary(simdSupported as boolean, threadsSupported as boolean, wasmPathPrefix != null ? wasmPathPrefix : prefix), wasmPath == null) {

* factoryConfig.mainScriptUrlOrBlob = new Blob(['var WasmBackendModuleThreadedSimd = ` + wasmFactoryThreadedSimd.toString(),

* wasm = wasmFactoryThreadedSimd(factoryConfig);

* } else {

* The wasmFactory works for both vanilla and SIMD binaries.

* wasm = wasmFactory(factoryConfig);

* } // The WASM module has been successfully created by the factory.

* // Any error will be caught by the onAbort callback defined above.

* if (wasm.then(mod) => {

* let initialized = false;

* const voidReturnType: string = null;

* module.cwrap('register_tensor', null, [

* 'number',  // id

* 'number',  // size

* 'number',  // memoryOffset

* ]); module.cwrap('dispose_data', 'void', [

* 'number',  // memoryOffset

* ]); disposeData: module.cwrap('dispose_data', voidReturnType, ['number'], dispose: module.cwrap('dispose', voidReturnType, [], resolve({wasm: module}));

* });

* };

* function typedArrayFromBuffer(buffer: ArrayBuffer, dtype: DataType): backend_util.TypedArray {

* switch (dtype) {

* case 'float32':

* return new Float32Array(buffer);

* case 'int32':

* return new Int32Array(buffer);

* case 'bool':

* return new Uint8Array(buffer);

* default:

* throw new Error(`Unknown dtype ${dtype}`);

* }

* };

* const wasmPath = null;

* const wasmPathPrefix = null;

* const wasmFileMap: {key in WasmBinaryName} = {};

* let initAborted = false;

* let customFetch = false;

* /**

* @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
*
* @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'}

*
*/\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
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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","sliceI
mplCPU","Slice","BatchToSpaceND","Cast","Ceil","ClipByValue","concatImplCPU","Concat","Conv2D","Conv2
DBackpropInput","Cos","Cosh","CropAndResize","Cumsum","DepthToSpace","DepthwiseConv2dNative","Elu","s

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=============================================================================

import {_FusedMatMul, _FusedMatMulAttrs, _FusedMatMulInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {FusableActivation} from './types';

let wasmFusedMatMul:
    (aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,
     bShape: Uint8Array, bShapeSize: number, transposeA: boolean, transposeB: boolean, activation: number,
     biasId: number, preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>
      void;

function setup(backend: BackendWasm) {
  wasmFusedMatMul = backend.wasm.cwrap(_FusedMatMul,
      null /* void */,[
      'number',  // a_id
      'array',   // a_shape
      'number',  // a_shape.length
      'number',  // b_id
      'array',   // b_shape
      'number',  // b_shape.length
      'number',  // transpose_a
      'number',  // transpose_b
      'number',  // activation
      'number', // biasId
      'number', // preluActivationWeightsId
      'number', // leakyreluAlpha
      'number', // out_id
    ]);}

function fusedBatchMatMul(args: {
  inputs: _FusedMatMulInputs,
  backend: BackendWasm,
  attrs: _FusedMatMulAttrs
}) {
  const {inputs, backend, attrs} = args;
  const {a, b, bias, preluActivationWeights} = inputs;

  if (a.dtype !== 'float32' || b.dtype !== 'float32') {
    throw new Error(`_FusedMatMul for non-float32 tensors not yet supported.`);
  }

  const {transposeA, transposeB, activation, leakyreluAlpha} = attrs;
  const aId = backend.dataIdMap.get(a.dataId).id;
  const bId = backend.dataIdMap.get(b.dataId).id;

  const biasId = 0;
  if (bias != null) {
    const biasData = backend.dataIdMap.get(bias.dataId);
    if (biasData.shape.length !== 1) {
      throw new Error(`_FusedMatMul only supports rank-1 bias but got ` +
          `rank ${biasData.shape.length}.`);
    }
    biasId = biasData.id;
  }
  const preluActivationWeightsId = preluActivationWeights == null ?
      0 :
      backend.dataIdMap.get(preluActivationWeights.dataId).id;
  const fusedActivation =
      FusableActivation[activation as {} as keyof typeof FusableActivation];
  if (fusedActivation == null) {
    throw new Error(`_FusedMatMul for non-float32 tensors not yet supported.`);
  }

  const batchDim = a.shape[0];

  const out = backend.makeOutput([batchDim, leftDim, rightDim], a.dtype);
  const outId = backend.dataIdMap.get(out.dataId).id;

  const aShapeBytes = new Uint8Array(new Int32Array(a.shape).buffer);
  const bShapeBytes = new Uint8Array(new Int32Array(b.shape).buffer);

  wasmFusedMatMul(aId, aShapeBytes, a.shape.length, bId, bShapeBytes, b.shape.length,
      transposeA, transposeB, fusedActivation, biasId, preluActivationWeightsId,
      leakyreluAlpha || 0, outId);

  return out;
}

export const fusedMatMulConfig: KernelConfig = {
  kernelName: _FusedMatMul,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: fusedBatchMatMul as {} as KernelFunc
};

=============================================================================

import {DataType, KernelConfig, TensorInfo, UnaryInputs, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {CppDType} from './types';

export function createUnaryKernelConfig(
    kernelName: string, outType?: DataType): KernelConfig {
  let wasmFunc: (xId: number, dtype: number, outId: number) => void;

  function setupFunc(backend: BackendWasm): void {
    wasmFunc = backend.wasm.cwrap(kernelName, null /* void */,[
      'number', // x_id
      'number', // dtype
    ]);}

  function unaryFunction(inputs: UnaryInputs, backend: BackendWasm): TensorInfo {
    const {inputs, backend} = inputs;
    const {a} = inputs;

    if (a.dtype !== 'float32') {
      throw new Error(`Unknown dtype for unary function ${kernelName}`);
    }

    const xId = backend.dataIdMap.get(a.dataId).id;

    wasmFunc(xId, CppDType.float32, backend.dataIdMap.get(out.dataId).id);

    return {type: 'float32'};
  }

  function unaryOutputInfo(backend: BackendWasm): TensorInfo {
    const outId = backend.dataIdMap.get(out.dataId).id;

    return {dtype: 'float32', shape: [1]};
  }

  return {setupFunc, kernelFunc: unaryFunction as {} as KernelFunc,
    outputInfo: unaryOutputInfo};

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=============================================================================

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function kernelFunc(args: {backend: BackendWasm, inputs: UnaryInputs}): TensorInfo {
  const {backend, inputs: {x}} = args;
  const xId = backend.dataIdMap.get(x.dataId).id;
  const out = backend.makeOutput(x.shape, outType || x.dtype);
  const outId = backend.dataIdMap.get(out.dataId).id;
  // Short-circuit zero-sized tensors.
  if (util.sizeFromShape(out.shape) === 0) {
    return out;
  }
  const wasmFunc = backend.wasm.cwrap(kernelName, ['number', 'array', 'array', 'number', 'number', 'number', 'number'], ['number', 'number', 'number', 'number'], [xId, CppDType[x.dtype], outId]);
  const returnOut = backend.makeOutput([outId], outType);
  if (util.sizeFromShape(out.shape) === 0) {
    return returnOut;
  }
  return {kernelName, backendName: 'wasm', setupFunc, kernelFunc}.
}

function kernelFunc(args: {backend: BackendWasm, inputs: BinaryInputs}): TensorInfo {
  const {backend, inputs} = args;
  const {a, b} = inputs;
  const aId = backend.dataIdMap.get(a.dataId).id;
  const bId = backend.dataIdMap.get(b.dataId).id;

  const outputType = dtype != null ? dtype : a.dtype;
  const newShape = backend_util.assertAndGetBroadcastShape(a.shape, b.shape);
  const out = backend.makeOutput(newShape, outputType);

  // Short-circuit zero-sized tensors.
  if (util.sizeFromShape(newShape) === 0) {
    return out;
  }
  const aBytes = new Uint8Array(a.shape.buffer);
  const bBytes = new Uint8Array(b.shape.buffer);
  const outId = backend.dataIdMap.get(out.dataId).id;
  const kernelFunc = () => wasmFunc(aId, aBytes, bBytes, a.shape, b.shape, aId, bId, outputType, outputType);
  const returnOut = backend.makeOutput([outId], outputType);
  return returnOut;
}

function kernelFunc(args: {backend: BackendWasm, inputs: BinaryInputs}): TensorInfo {
  const {backend, inputs: {a, b}} = args;
  const aId = backend.dataIdMap.get(a.dataId).id;
  const bId = backend.dataIdMap.get(b.dataId).id;
  const outputType = dtype != null ? dtype : a.dtype;
  const newShape = backend_util.assertAndGetBroadcastShape(a.shape, b.shape);
  const out = backend.makeOutput(newShape, outputType);
  const aBytes = new Uint8Array(a.shape.buffer);
  const bBytes = new Uint8Array(b.shape.buffer);
  const outId = backend.dataIdMap.get(out.dataId).id;
  const kernelFunc = () => wasmFunc(aId, aBytes, a.shape, bId, bBytes, b.shape, bId, outputType, outputType);
  const returnOut = backend.makeOutput([outId], outputType);
  return returnOut;
}

function kernelFunc(args: {backend: BackendWasm, inputs: BinaryInputs}): TensorInfo {
  const {backend, inputs: {a, b}} = args;
  const aId = backend.dataIdMap.get(a.dataId).id;
  const bId = backend.dataIdMap.get(b.dataId).id;
  const outputType = dtype != null ? dtype : a.dtype;
  const newShape = backend_util.assertAndGetBroadcastShape(a.shape, b.shape);
  const out = backend.makeOutput(newShape, outputType);
  const aBytes = new Uint8Array(a.shape.buffer);
  const bBytes = new Uint8Array(b.shape.buffer);
  const outId = backend.dataIdMap.get(out.dataId).id;
  const kernelFunc = () => wasmFunc(aId, aBytes, a.shape, bId, bBytes, b.shape, bId, outputType, outputType);
  const returnOut = backend.makeOutput([outId], outputType);
  return returnOut;
}
import {KernelConfig, KernelFunc, TensorInfo, Transpose, TransposeAttrs, TransposeInputs} from '@tensorflow/tfjs-core';

import {BackendWasm} from '.backend_wasm';

import {Identity} from './Identity';
import {CppDType} from './types';

let wasmTranspose: (xId: number, xShape: Uint8Array, xShapeLength: number, dtype: CppDType, outId: number, perm: Uint8Array, permLength: number) => void;


export function setup(backend: BackendWasm) {
  wasmTranspose = backend.wasm.cwrap(Transpose, null /* void */, ['number', // xId in 'array', // x.shape in 'array', // outId in 'array', // perm in 'array', // perm.length in 'number']);
}

export const transposeConfig: KernelConfig = {
  kernelName: Transpose,
  backendName: 'wasm',
  kernelFunc: transpose as {} as KernelFunc,
  setupFunc: setup,
};

/**
   * Compute permutation axes and do a transpose
   * Used by reduction ops.
   * @param x input TensorInfo
   * @param axis reduction axes
   * @param backend wasm backend instance
   * @return null if const newShape: number[] = new Array(inShape.length);
   * for (let i = 0; i < inShape.length; ++i) {
   *   inShape[i] = inShape[perm[i]]; // inSlice
   *   inShape = computeOutShape(inShape, attrs.perm);
   *   const newShape: number[] = new Array(inShape.length);
   *   for (let i = 0; i < inShape.length; ++i) {
   *     newShape[i] = inShape[perm[i]]; // inSlice
   *   }
   *   newShape = backend.makeOutput(newShape, x.dtype);
   *   const xId = backend.dataIdMap.get(x.dataId).id;
   *   const outId = backend.dataIdMap.get(out.dataId).id;
   *   const permBytes = new Uint8Array(new Int32Array(perm).buffer);
   *   const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);
   *   wasmTranspose(xId, xShapeBytes, x.shape.length, CppDType[x.dtype], outId, permBytes, out.perm.length);
   *   return out;
   * }
   */

   function computeOutShape(inShape: number[], perm: number[]): number[] {
     const newShape = new Array(inShape.length);
     for (let i = 0; i < inShape.length; ++i) {
       newShape[i] = inShape[perm[i]]; // inSlice
     }
     return newShape;
   }

   export function removeOneSizeDims(inShape: number[], perm: number[]): [number[], number[]] {
     const newShape: number[] = [];
     const newPerm: number[] = [];
     for (let i = 0; i < inShape.length; ++i) {
       if (inShape[i] !== 1) {
         newShape.push(inShape[i]);
         if (perm[i] >= i) {
           newPerm.push(perm[i]);
         }
       }
     }
     for (let i = 0; i < newPerm.length; ++i) {
       let minValIdx = -1;
       for (let j = 0; j < newPerm.length; ++j) {
         if (newPerm[j] >= i && (minValIdx === -1 || newPerm[minValIdx] > newPerm[j])) {
           minValIdx = j;
         }
       }
     }
     return [newShape, newPerm];
   }

   export function permuteAxesAndTranspose(x: TensorInfo, axis: number|number[], backend: BackendWasm): {
     const xShape = x.shape;
     const xRank = x.shape.length;
     const originalAxes = util.parseAxisParam(axis, x.shape);
     let axes = originalAxes;
     const permutedAxes = backend_util.getAxesPermutation(axes.length, xRank);
     const xId = backend.dataIdMap.get(x.dataId).id;
     const transposedId = backend.dataIdMap.get(xTransposed.dataId).id;
     if (transposedId !== xId) {
       inputWasTransposed = true;
     }
   }
wasmAny(inputId, reduceSize, outId);

  if (inputWasTransposed) {
    // dispose of the transposed tensor.
    backend.disposeData(transposed.dataId);
  } 

  if (keepDims) {
    // reshape
    const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);
    out.shape = newShape;
  }

  return out;
}

export const anyConfig: KernelConfig = {
  kernelName: Any,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: any as {} as KernelFunc
};

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 */

import {ArgMax, ArgMaxAttrs, ArgMaxInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {permuteAxesAndTranspose} from './kernel_utils';
import {CppDType} from './types';

let wasmFunc: (xId: number, dtype: number, outerSize: number, innerSize: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmFunc = backend.wasm.cwrap(ArgMax, null /* void */, [
      'number',  // x_id
      'number',  // dtype
      'number',  // outer_size
      'number',  // inner_size
      'number'   // out_id
    ]);}

function argmax(
    args: {inputs: ArgMaxInputs, backend: BackendWasm, attrs: ArgMaxAttrs}) {
  const {backend, inputs, attrs} = args;
  const {axis} = attrs as {} as ArgMaxAttrs;
  const {x} = inputs as {} as ArgMaxInputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  let inputId = xId;
  let input = x;

  const {transposed, axes, inputWasTransposed} =
      permuteAxesAndTranspose(x, axis, backend);

  if (inputWasTransposed) {
    const transposedId = backend.dataIdMap.get(transposed.dataId).id;
    if (transposedId !== xId) {
      // transpose was not a no-op. We will need to dispose of this
      // once we are done.
      input = transposed;
      inputId = transposedId;
    }
  }

  const outShape = input.shape.slice(0, -1);
  const out = backend.makeOutput(outShape, 'int32');
  const outId = backend.dataIdMap.get(out.dataId).id;
  const outerSize = util.sizeFromShape(out.shape);
  const innerSize = input.shape[axes[0]];
  wasmFunc(inputId, CppDType[input.dtype], outerSize, innerSize, outId);

  if (inputWasTransposed) {
    // dispose of the transposed tensor.
    backend.disposeData(transposed.dataId);
  }

  return out;
}

export const argMaxConfig: KernelConfig = {
  kernelName: ArgMax,
  backendName: 'wasm',
  kernelFunc: argmax as {} as KernelFunc,
  setupFunc: setup
};

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 */

import {AvgPool, AvgPoolAttrs, AvgPoolInputs, backend_util, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmAvgPool: (xId: number, batchSize: number, inputHeight: number, inputWidth: number, filterHeight: number, filterWidth: number, padTop: number, padRight: number, padBottom: number, padLeft: number, strideHeight: number, strideWidth: number, channels: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmAvgPool = backend.wasm.cwrap(AvgPool, null /* void */, [
      'number',  // xId
      'number',  // number
      'number',  // number
      'number',  // number
      'number',  // number
      'number',  // number
      'number',  // number
      'number'   // number
    ]);}

function avgPool(
    args: {inputs: AvgPoolInputs, backend: BackendWasm, attrs: AvgPoolAttrs}) {
  const {inputs, attrs,
backend] = args;

const x = inputs.x as Tensor4D;
const xId = backend.dataIdMap.get(x.dataId).id;

const {filterSize, strides, pad, dimRoundingMode} = attrs;
const convInfo = backend_util.computePool2DInfo(x.shape, filterSize, strides, 1 /* dilations */, pad, dimRoundingMode);
const filterHeight = convInfo.filterHeight;
const filterWidth = convInfo.filterWidth;
const padTop = convInfo.padInfo.top;
const padRight = convInfo.padInfo.right;
const padBottom = convInfo.padInfo.bottom;
const padLeft = convInfo.padInfo.left;
const strideHeight = convInfo.strideHeight;
const strideWidth = convInfo.strideWidth;
const channels = convInfo.inChannels;

if (convInfo.dataFormat !== 'channelsLast') { throw new Error('wasm backend does not support dataFormat: ' + convInfo.dataFormat). message; } else { use 'channelsLast'. }

const outId = backend.dataIdMap.get(out.dataId).id;

wasmAvgPool(xId, x.shape[0], x.shape[1], x.shape[2], filterHeight, filterWidth, outId);
return out;
}

export const avgPoolConfig: KernelConfig = {
  kernelName: AvgPool,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: avgPool as {} as KernelFunc
};

export function reshape(
    args: {
      inputs: ReshapeInputs,
      attrs: ReshapeAttrs,
      backend: BackendWasm
    }) {
  const {inputs, attrs} = args;
  const {x} = inputs;
  const {shape} = attrs;

  const xSize = util.sizeFromShape(x.shape);
  const $shape = util.inferFromImplicitShape(shape, xSize);

  util.assert(xSize === util.sizeFromShape($shape), () => `new shape: ${$shape}, old shape: ${x.shape}. New shape and old shape must have the same number of elements. `);

  // Backend needs to track refCount for the dataId for reshape op
  args.backend.incRef(x.dataId);
  return {dataId: x.dataId, shape: $shape, dtype: x.dtype};
}

export const reshapeConfig: KernelConfig = {
  kernelName: Reshape,
  backendName: 'wasm',
  kernelFunc: reshape as {} as KernelFunc
};

export function batchMatMul(
    a: number[], b: number[], transposeA: boolean, transposeB: boolean, out: number[], backend: BackendWasm) {
  wasmBatchMatMul(a.length, b.length, transposeA, transposeB, out.length, backend.wasm);
```javascript
'BatchMatMul for non-non-float32 tensors not yet supported.'

```
assertNotComplex(x, 'slice');
const [$begin, $size] = slice_util.parseSliceParams(x, begin, size);
slice_util.assertParamsValid(x, $begin, $size);
const vals = backend.data.get(x.dataId).values;
const outVals = sliceImpl(vals, $begin, $size, x.shape, x.dtype);
return backend.makeTensorInfo($size, x.dtype, outVals);

export const sliceConfig = {
  kernelName: Slice,
  backendName: 'cpu',
  kernelFunc: slice
};

sourceMappingURL=data:application/json;base64,eyJ2ZXJzaW9uIjozLCJmaWxlIjoiU2xpY2UsbWVzc2FnZSIsIm5ldyI6e3�y

*\n
import {backend_util, KernelConfig, KernelFunc, Slice, slice_util, SliceAttrs, SliceInputs, TypedArray, util} from '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';
import {sliceImplCPU} from '../kernel_utils/shared';

export function slice(
    args: {inputs: SliceInputs, attrs: SliceAttrs, backend: BackendWasm}) {
  const {inputs: {x}, attrs: {begin, size}, backend} = args;
  const xVals = backend.readAsync(x.dataId);
  const xStrides = util.computeStrides(x.shape);
  const outData = backend.dataIdMap.get(out.dataId);
  if (x.dtype !== 'string') {
    const outData.stringBytes = (xVals as Uint8Array[])
        .slice(flatOffset, flatOffset + util.sizeFromShape(size_));
  } else if (x.dtype === 'string') {
    const res = sliceImplCPU(xVals, begin, size, x.dtype);
    outData.stringBytes = res as Uint8Array[];
  }

  return out;
}

function slice2d(
    xVals: backend_util.TypedArray, xStride: number,
    outVals: backend_util.TypedArray, begin: [number, number],
    size: [number, number]): void {
  let outOffset = 0;
  for (let i = begin[0]; i < endI; i++) {
    const xOffset = i * xStride + begin[1];
    outVals.set(xVals.subarray(xOffset, xOffset + size[1]), outOffset);
    outOffset += size[1];
  }
}

function slice3d(
    xVals: backend_util.TypedArray, xStride0: number, xStride1: number,
    outVals: backend_util.TypedArray, begin: [number, number, number],
    size: [number, number, number]): void {
  let outOffset = 0;
  for (let i = begin[0]; i < endI; i++) {
    for (let j = begin[1]; j < endJ; j++) {
      const xOffset = i * xStride0 + j * xStride1 + begin[2];
      outVals.set(xVals.subarray(xOffset, xOffset + size[2]), outOffset);
      outOffset += size[2];
    }
  }
}

function slice4d(
    xVals: backend_util.TypedArray, xStride0: number, xStride1: number,
    xStride2: number, xStride3: number,
    outVals: backend_util.TypedArray, begin: [number, number, number, number],
    size: [number, number, number, number]): void {
  let outOffset = 0;
  for (let i = begin[0]; i < endI; i++) {
    for (let j = begin[1]; j < endJ; j++) {
      for (let k = begin[2]; k < endK; k++) {
        const xOffset = i * xStride0 + j * xStride1 + k * xStride2 + begin[3];
        outVals.set(xVals.subarray(xOffset, xOffset + size[3]), outOffset);
        outOffset += size[3];
      }
    }
  }
}

export const sliceConfig: KernelConfig = {
  kernelName: Slice,
  backendName: 'wasm',
  kernelFunc: slice as {} as KernelFunc,
};

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import {backend_util, BatchToSpaceND, BatchToSpaceNDAttrs, BatchToSpaceNDInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';
import {reshape} from './Reshape';
import {slice} from './Slice';
import {transpose} from './Transpose';

function batchToSpaceND(args: {
  inputs: BatchToSpaceNDInputs,
  backend: BackendWasm,
  attrs: BatchToSpaceNDAttrs
}) {
  const {inputs, backend, attrs} = args;
  const {x} = inputs;
  const {blockShape, crops} = attrs;
  const prod = blockShape.reduce((a, b) => a * b);
  const reshaped = backend_util.getReshaped(x.shape, blockShape, prod);
  const permuted = backend_util.getPermutted(reshaped.length, blockShape.length);
  const reshapedPermuted = backend_util.getReshapedPermutted(x.shape, blockShape, prod);
  const sliceBeginCoords = backend_util.getSliceBeginCoords(crops, blockShape.length);
  const sliceSize = backend_util.getSliceSize(reshapedPermuted, crops, blockShape.length);
  const xReshaped = reshape({inputs: {x}, backend, attrs: {shape: reshaped}});
  const xTransposed = transpose({inputs: {x: xReshaped}, backend, attrs: {perm: permuted}});
  const xTransposedReshaped = reshape({inputs: {x: xTransposed}, backend, attrs: {shape: reshapedPermuted}});
  const result = slice({inputs: {x: xTransposedReshaped}, backend, attrs: {begin: sliceBeginCoords, size: sliceSize}});
  backend.disposeData(xReshaped.dataId);
  backend.disposeData(xTransposed.dataId);
  backend.disposeData(xReshaped.dataId);
  return result;
}

export const batchToSpaceNDConfig: KernelConfig = {
  kernelName: BatchToSpaceND,
  backendName: 'wasm',
  kernelFunc: batchToSpaceND as {} as KernelFunc,
};

import {Cast, CastAttrs, CastInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';
import {TensorInfo} from '@tensorflow/tfjs-core';

export function cast(args: {inputs: CastInputs, attrs: CastAttrs, backend: BackendWasm}): TensorInfo {
  const {inputs: {x}, attrs: {dtype}, backend} = args;
  const out = backend.makeOutput(x.shape, dtype);
  const inVals = backend.typedArrayFromHeap(x);
  const outVals = backend.typedArrayFromHeap(out);
  outVals.set(inVals);
  return out;
}

export const castConfig: KernelConfig = {
  kernelName: Cast,
  backendName: 'wasm',
  kernelFunc: cast as {} as KernelFunc,
};

import {KernelConfig, Ceil} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';

export const ceilConfig: KernelConfig = createUnaryKernelConfig(Ceil);
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* * *

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============================================================================

*/

import {ClipByValue, ClipByValueAttrs, ClipByValueInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';

let wasmClip: (xId: number, min: number, max: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmClip = backend.wasm.cwrap(ClipByValue, null /* void */, [ /* inputs */ ClipByValueInputs, /* backend */ BackendWasm, /* attr */ ClipByValueAttrs]);
  const xId = backend.dataIdMap.get(x.dataId).id;
  const outId = backend.dataIdMap.get(out.dataId).id;
  const out = backend.makeOutput(x.shape, x.dtype);
  return out;
}

function clip(args: {inputs: ClipByValueInputs, backend: BackendWasm, attrs: ClipByValueAttrs}) {
  const {inputs, backend, attrs} = args;
  const {x} = inputs;
  const {clipValueMin, clipValueMax} = attrs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  const out = backend.makeOutput(x.shape, x.dtype);
  const outId = backend.dataIdMap.get(out.dataId).id;
  wasmClip(xId, clipValueMin, clipValueMax, outId);
  return out;
}

export const clipByValueConfig: KernelConfig = {
  kernelName: ClipByValue,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: clip as {} as KernelFunc
};

export function concat(args: {inputs: ConcatInputs, backend: BackendWasm, attrs: ConcatAttrs}) {
  const {inputs, backend} = args;
  // Keep only non-empty tensors (ignore tensors with 0 in their shape).
  const outputs = inputs.filter(t => util.sizeFromShape(t.shape) > 0);
  const outShape = backend_util.computeOutShape(outputs.map(t => t.shape), axis);
  if (outputs.length === 0) {
    return outputs[0];
  }
  const shapes = outputs.map(t => t.shape);
  backend_util.assertParamsConsistent(shapes, axis);
  const output = backend.makeOutput(outShape, outputs[0].dtype);
  for (let b = 0; b <
BatchDim; b++) {
    let outOffset = b * sumInnerDims; // for (let i = 0; i < inVals.length; i++) {
    const innerDim = inInnerDims[i];
    const inOffset = b * innerDim;
    const vals = inVals[i].subarray(inOffset, inOffset + innerDim);
    outVals.set(vals, outOffset);
    outOffset += innerDim;
  }
  return out;
}

export const concatConfig: KernelConfig = {
  kernelName: Concat,
  backendName: 'wasm',
  kernelFunc: concat as {} as KernelFunc,
};

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 */
import { backend_util, util } from '@tensorflow/tfjs-core';
export function concatImpl(inputs, outShape, dtype, simplyConcat) {
    const outVals = util.getArrayFromDType(dtype, util.sizeFromShape(outShape));
    if (simplyConcat && dtype !== 'string') {
        // Use built-in TypedArray.set() method for speed.
        let offset = 0;
        inputs.forEach(input => {
            const size = util.sizeFromShape(input.shape);
            outVals.set(input.vals, offset);
            offset += size;
        });
    } else {
        let colOffset = 0;
        inputs.forEach(input => {
            const decodedData = dtype === 'string' ?
                backend_util.fromUint8ToStringArray(input.vals) :
                input.vals;
            let tIdx = 0;
            for (let row = 0; row < input.shape[0]; ++row) {
                const resIdx = row * outShape[1] + colOffset;
                for (let col = 0; col < input.shape[1]; ++col) {
                    outVals[resIdx + col] = decodedData[tIdx++];
                }
            }
            colOffset += input.shape[1];
        });
    }
    return outVals;
}
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
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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

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inputShape, filter.shape as [number, number, number, number], strides,\n dilations, pad, dimRoundingMode, false /* depthwise */, \n 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 } =\n convInfo;\n const topPad = filterHeight - 1 - convInfo.padInfo.top;\n const leftPad = filterWidth - 1 - convInfo.padInfo.left;\n const isChannelsLast = convInfo.dataFormat === 'channelsLast';\n const dxStrides =\n 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 =\n 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 =\n isChannelsLast ? dyStrides[1] : dyStrides[2];\n const yColStride = isChannelsLast ? dyStrides[2] : 1;\n const yChannelStride = isChannelsLast ? 1 : dyStrides[1];\n const outId = backend.makeOutput(outShape, \n \n 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const dyId =\n backend.dataIdMap.get(dy.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n
wasmConv2DBackpropInput(dyId, filterId, batchSize, filterHeight, filterWidth, inHeight, inWidth,\n inChannels, outHeight, outWidth, outChannels, strideHeight, strideWidth, topPad, leftPad, fltS0, fltS1, fltS2,\n xBatchStride, xRowStride, 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:\n   conv2DBackpropInput as {} as KernelFunc;\n };
function setup(backend: BackendWasm): void {
  wasmCropAndResize = backend.wasm.cwrap(CropAndResize, null /*void*/,
    [\\u2018number\\u2019, \n    imagesShape: Uint8Array, cropHeight: number, cropWidth: number, \n    method: number, \n    extrapolationValue: number, \n    outId: number]) => void;

  function cropAndResize(args: {\n    backend: BackendWasm, \n    inputs: CropAndResizeInputs, \n    attrs: CropAndResizeAttrs}): TensorInfo {\n    const [backend, inputs, attrs] = args; \n    const {method, \n      extrapolationValue, cropSize} = attrs; \n    const {image, boxes, boxInd} = inputs; \n    const numBoxes = boxes.shape[0]; \n    const [cropHeight, cropWidth] = cropSize as [number, number]; \n    const outShape = [numBoxes, cropHeight, cropWidth, image.shape[3]]; \n    const imagesData = backend.dataIdMap.get(image.dataId); \n    const boxesId = backend.dataIdMap.get(boxes.dataId).id; \n    const boxIndId = backend.dataIdMap.get(boxInd.dataId).id; \n    const out = backend.makeOutput(outShape, 'float32'); \n    const outId = backend.dataIdMap.get(out.dataId).id; \n    const imagesShapeBytes = new Uint8Array(new Int32Array(image.shape).buffer); \n    wasmCropAndResize(imagesId, boxesId, boxIndId, numBoxes, imagesShapeBytes, cropHeight, \n      cropWidth, \n      InterpolationMethod[\method as {} as keyof typeof InterpolationMethod], \n      extrapolationValue, outId); \n  }

  const castedData = cast([\backend, inputs: {x: image}, attrs: {dtype: 'float32'}]); \n  const imagesData = backend.dataIdMap.get(castedData.dataId); \n  const imagesId = backend.dataIdMap.get(image.dataId).id; \n  const boxesId = backend.dataIdMap.get(boxes.dataId).id; \n  const boxIndId = backend.dataIdMap.get(boxInd.dataId).id; \n  const out = backend.makeOutput(outShape, 'float32'); \n  const outId = backend.dataIdMap.get(out.dataId).id; \n  const imagesShapeBytes = new Uint8Array(new Int32Array(image.shape).buffer); \n  wasmCropAndResize(imagesId, boxesId, boxIndId, numBoxes, imagesShapeBytes, cropHeight, \n    cropWidth, \n    InterpolationMethod[\method as {} as keyof typeof InterpolationMethod], \n    extrapolationValue, outId); \n
  if (castedData != null) \n    backend.disposeData(castedData.dataId); \n  return out;
}

export function cumsum(
  args: {inputs: CumsumInputs, backend: BackendWasm, attrs: CumsumAttrs}): TensorInfo {
  const {inputs, backend, attrs} = args;
  const {x} = inputs;
  const {axis, \n    exclusive, reverse} = attrs;
  const xRank = x.shape.length;

  util.assert(x.dtype === 'float32' || x.dtype === 'int32', () => `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;
  if (permutation !== null) {
    permutedX = transpose({inputs: {x}, attrs: {perm: permutation}, backend}); \n  }

  const permutedAxis = backend_util.getInnerMostAxes(1, xRank)[0]; \n  \n  const permutatedAxis = backend_util.getInnerMostAxes(1, xRank)[0]; \n  let permutatedX = transpose({inputs: {x}, attrs: {perm: permutation}, backend}); \n  const permutatedAxis = backend_util.getInnerMostAxes(1, xRank)[0]; \n  let permutatedX = transpose({inputs: {x}, attrs: {perm: permutation}, backend}); \n
  const permutatedAxis = backend_util.getInnerMostAxes(1, xRank)[0]; \n  let permutatedX = transpose({inputs: {x}, attrs: {perm: permutation}, backend}); \n  const permutatedAxis = backend_util.getInnerMostAxes(1, xRank)[0]; \n  let permutatedX = transpose({inputs: {x}, attrs: {perm: permutation}, backend});
import { DepthToSpace, DepthToSpaceAttrs, DepthToSpaceInputs, KernelConfig, KernelFunc, TensorInfo, util } from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmDepthToSpace: (xId: number, blockSize: number, channelsLast: number, xStrides: Uint8Array, xStridesLength: number, outputShape: Uint8Array, outputStrides: Uint8Array, outSize: number, outId: number) => void = null;

function setup(backend: BackendWasm): void {
  wasmDepthToSpace = backend.wasm.cwrap(DepthToSpace, null /*void*/, 
      ['number',  // xId
       'number',  // blockSize
       'number',  // channelsLast
       'array',   // xStrides
       'number',  // xStridesLength
       'array',   // outputShape
       'array',   // outputStrides
       'number',  // outSize
       'number', // outId
     ]);}

export function depthToSpace(args: {
  backend: BackendWasm,
  inputs: DepthToSpaceInputs,
  attrs: DepthToSpaceAttrs
}): TensorInfo {
  const {backend, inputs, attrs} = args;

  const {x} = inputs;
  const {blockSize, dataFormat} = attrs;

  const batchSize = x.shape[0];
  const inputHeight = (dataFormat === 'NHWC') ? x.shape[1] : x.shape[2];
  const inputWidth = (dataFormat === 'NHWC') ? x.shape[2] : x.shape[3];
  const inputDepth = (dataFormat === 'NHWC') ? x.shape[3] : x.shape[1];

  const outputHeight = inputHeight * blockSize;
  const outputWidth = inputWidth * blockSize;
  const outputDepth = inputDepth / (blockSize * blockSize);

  const outputShape = (dataFormat === 'NHWC') ? [batchSize, outputHeight, outputWidth, outputDepth] : [batchSize, outputDepth, outputHeight, outputWidth];

  const out = backend.makeOutput(outputShape, 'float32');

  const xData = backend.dataIdMap.get(x.dataId);
  const xId = xData.id;
  const xStridesBytes = new Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);

  const outputShapeBytes = new Uint8Array(new Int32Array(outputShape).buffer);
  const outStridesBytes = new Uint8Array(new Int32Array(outputShape).buffer);

  const outId = backend.dataIdMap.get(out.dataId);
  const channelsLast = dataFormat === 'NHWC' ? 1 : 0;
  const wasmDepthToSpace = backend.wasm.cwrap(DepthToSpace, null /*void*/, 
      ['number', // 'number'
       'number', // 'number'
       'number', // 'number'
       'number', // 'number'
       'number', // 'number'
       'number', // 'number'
       'number', // 'number'
     ]);}

const out = backend.makeOutput(outputShape, 'float32');

const xData = backend.dataIdMap.get(x.dataId);
const xId = xData.id;
const xStridesBytes = new Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);
const outputShapeBytes = new Uint8Array(new Int32Array(outputShape).buffer);
const outStridesBytes = new Uint8Array(new Int32Array(outputShape).buffer);
const outId = backend.dataIdMap.get(out.dataId);
const channelsLast = dataFormat === 'NHWC' ? 1 : 0;
const wasmDepthToSpace = backend.wasm.cwrap(DepthToSpace, null /*void*/, 
      ['number', // 'number'
       'number', // 'number'
       'number', // 'number'
       'number', // 'number'
       'number', // 'number'
       'number', // 'number'
     ]);
```javascript
outputChannels: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmDepthwiseConv2d =
    backend.wasm.cwrap(DepthwiseConv2dNative, null /* void */, [
      'number', // xId
      'number', // batchSize
      'number', // inputHeight
      'number', // inputWidth
      'number', // filterId
      'number', // filterHeight
      'number', // filterWidth
      'number', // padTop
      'number', // padLeft
      'number', // isSamePad
      'number', // dilationHeight
      'number', // dilationWidth
      'number', // strideHeight
      'number', // strideWidth
      'number', // inputChannels
      'number', // outputChannels
      'number', // outId
    ]); //

  function depthwiseConv2d(args: {
    inputs: DepthwiseConv2dNativeInputs,
    backend: BackendWasm,
    attrs: DepthwiseConv2dNativeAttrs
  }) {
    const {inputs, attrs, backend} = args;
    const xId = backend.dataIdMap.get(x.dataId).id;
    const filterId = backend.dataIdMap.get(filter.dataId).id;
    const strides, dilations, pad, dimRoundingMode = attrs;
    const convInfo = backend_util.computeConv2DInfo(
      (x as Tensor4D).shape, (filter as Tensor4D).shape,
      strides, dilations as number | [number, number], pad, dimRoundingMode,
      true /* depthwise */)
    const filterHeight = convInfo.filterHeight;
    const filterWidth = convInfo.filterWidth;
    const padTop = convInfo.padding.top;
    const padRight = convInfo.padding.right;
    const padBottom = convInfo.padding.bottom;
    const dilations = convInfo.dilationWidth;
    const strideHeight = convInfo.strideHeight;
    const strideWidth = convInfo.strideWidth;
    const inputChannels = convInfo.inChannels;
    const outputChannels = convInfo.outChannels;
    const isSamePad = convInfo.padding.type === 'SAME' ? 1 : 0;
    if (!convInfo.dataFormat || convInfo.dataFormat !== 'channelsLast') {
      throw Error('wasm backend DepthwiseConv2dNative does not support dataFormat: ');
    }
    const out = backend.makeOutput(convInfo.outShape, 'float32');
    const outId = backend.dataIdMap.get(out.dataId).id;
    wasmDepthwiseConv2d(xId, x.shape[0], x.shape[1], x.shape[2], filterId, filterHeight, filterWidth,
      padTop, padRight, padBottom, padLeft, isSamePad, dilationHeight, dilationWidth, strideHeight, strideWidth,
      inputChannels, outId);
  }

  export const depthwiseConv2dNativeConfig:
    KernelConfig = {
      kernelName: DepthwiseConv2dNative,
      backendName: 'wasm',
      setupFunc: setup, //
      kernelFunc: depthwiseConv2d as {} as KernelFunc
    }; //

  import {Elu, KernelConfig} from '@tensorflow/tfjs-core';
  import {createUnaryKernelConfig} from './unary_kernel';
  export const eluConfig: KernelConfig = createUnaryKernelConfig(Elu);

  import {Equal, KernelConfig} from '@tensorflow/tfjs-core';
  import {createBinaryKernelConfig} from './binary_kernel';

  const supportsFullBroadcast = false;
  export const equalConfig: KernelConfig =
    createBinaryKernelConfig(Equal, supportsFullBroadcast, 'bool');
}
```

---

```
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 *
*=============================================================================

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```

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```
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 * limitations under the License.
 *
*=============================================================================

import {Elu, KernelConfig} from '@tensorflow/tfjs-core';
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export const eluConfig: KernelConfig = createUnaryKernelConfig(Elu);

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import {createBinaryKernelConfig} from './binary_kernel';

const supportsFullBroadcast = false;
export const equalConfig: KernelConfig = createBinaryKernelConfig(Equals, supportsFullBroadcast, 'bool');

import {Elu, KernelConfig} from '@tensorflow/tfjs-core';
import {createUnaryKernelConfig} from './unary_kernel';
export const eluConfig: KernelConfig = createUnaryKernelConfig(Elu);

import {Equal, KernelConfig} from '@tensorflow/tfjs-core';
import {createBinaryKernelConfig} from './binary_kernel';

const supportsFullBroadcast = false;
export const equalConfig: KernelConfig = createBinaryKernelConfig(Equals, supportsFullBroadcast, 'bool');
```

---

```
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 * limitations under the License.
 *
*=============================================================================

import {Elu, KernelConfig} from '@tensorflow/tfjs-core';
import {createUnaryKernelConfig} from './unary_kernel';
export const eluConfig: KernelConfig = createUnaryKernelConfig(Elu);

import {Equal, KernelConfig} from '@tensorflow/tfjs-core';
import {createBinaryKernelConfig} from './binary_kernel';

const supportsFullBroadcast = false;
export const equalConfig: KernelConfig = createBinaryKernelConfig(Equals, supportsFullBroadcast, 'bool');

import {Elu, KernelConfig} from '@tensorflow/tfjs-core';
import {createUnaryKernelConfig} from './unary_kernel';
export const eluConfig: KernelConfig = createUnaryKernelConfig(Elu);

import {Equal, KernelConfig} from '@tensorflow/tfjs-core';
import {createBinaryKernelConfig} from './binary_kernel';

const supportsFullBroadcast = false;
export const equalConfig: KernelConfig = createBinaryKernelConfig(Equals, supportsFullBroadcast, 'bool');
```
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import {Floor, KernelConfig} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';
export const floorConfig: KernelConfig = createUnaryKernelConfig(Floor);

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 */

import {FloorDiv, KernelConfig} from '@tensorflow/tfjs-core';

import {createBinaryKernelConfig} from './binary_kernel';

const supportsFullBroadcast = false;
export const floorDivConfig: KernelConfig =
createBinaryKernelConfig(FloorDiv, supportsFullBroadcast);

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 */

import {FusedBatchNorm, FusedBatchNormAttrs, FusedBatchNormInputs, KernelConfig, KernelFunc,
TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmBatchNorm: (
    xId: number, meanId: number, varianceId: number, offsetId: number,
    scaleId: number, varianceEpsilon: number, outId: number) => void;

function setup(backend: BackendWasm): void {
    wasmBatchNorm = backend.wasm.cwrap(
        FusedBatchNorm, null /* void */,
        ['number', 'number', 'number', 'number', 'number', 'number', 'number']
    );
}

function fusedBatchNorm(args: {
    backend: BackendWasm,
    inputs: FusedBatchNormInputs,
    attrs: FusedBatchNormAttrs
}): TensorInfo {
    const {backend, inputs, attrs} = args;
    const {varianceEpsilon} = attrs;
    const {x, mean, variance, offset, scale} = inputs;
    const xId = backend.dataIdMap.get(x.dataId).id;
    const meanId = backend.dataIdMap.get(mean.dataId).id;
    const varianceId = backend.dataIdMap.get(variance.dataId).id;
    const offsetId = offset != null ? backend.dataIdMap.get(offset.dataId).id : 0;
    const scaleId = scale != null ? backend.dataIdMap.get(scale.dataId).id : 0;
    const outId = backend.dataIdMap.get(out.dataId).id;
    const out = backend.makeOutput(x.shape, x.dtype);

    // Short-circuit zero-sized tensors.
    if (util.sizeFromShape(x.shape) === 0) {
        return out;
    }

    // Short-circuit zero-sized tensors.
    if (util.sizeFromShape(x.shape) === 0) {
        return out;
    }
```
```javascript
backend.dataIdMap.get(out.dataId).id;

wasmBatchNorm(xId, meanId, varianceId, offsetId, scaleId, varianceEpsilon, outId);

return out;

export const fusedBatchNormConfig: KernelConfig = {
  kernelName: 'wasm',
  setupFunc: setup,
  kernelFunc: fusedBatchNorm as {} as KernelFunc
};

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 */

import {backend_util, FusedConv2D, FusedConv2DAttrs, FusedConv2DInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {FusableActivation} from './types';

let wasmFusedConv2d:
  (xId: number, batchSize: number, inputHeight: number, inputWidth: number, filterId: number, filterHeight: number, filterWidth: number, biasId: number, padTop: number, padRight: number, padBottom: number, padLeft: number, isSamePad: number, dilationHeight: number, dilationWidth: number, strideHeight: number, strideWidth: number, inputChannels: number, outputChannels: number, activation: number, preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmFusedConv2d = backend.wasm.cwrap(FusedConv2D, null /* void */, [
    'number',  // xId
    'number',  // batchSize
    'number',  // inputHeight
    'number',  // inputWidth
    'number',  // filterId
    'number',  // filterHeight
    'number',  // filterWidth
    'number',  // biasId
    'number',  // padTop
    'number',  // padRight
    'number',  // padBottom
    'number',  // padLeft
    'number',  // isSamePad
    'number',  // dilationHeight
    'number',  // dilationWidth
    'number',  // strideHeight
    'number',  // strideWidth
    'number',  // inputChannels
    'number',  // outputChannels
    'number',  // activation
    'number',  // preluActivationWeightsId
    'number',  // leakyreluAlpha
    'number',  // outId
  ]);}

function fusedConv2d(args: {
  inputs: FusedConv2DInputs,
  backend: BackendWasm,
  attrs: FusedConv2DAttrs
}) {
  const {inputs, attrs, backend} = args;
  const {x, filter, bias, preluActivationWeights} = inputs;
  const {
    strides,
    pad,
    dilations,
    dataFormat,
    dimRoundingMode,
    activation,
    leakyreluAlpha
  } = attrs;

  const convInfo = backend_util.computeConv2DInfo((x as Tensor4D).shape, (filter as Tensor4D).shape, (bias != null) ? bias : 0, dataFormat !== 'NHWC' ? new Error(`wasm backend FusedConv2D does not support dataFormat: '${dataFormat}'. Please use 'NHWC.'`) : null);

  const xId = backend.dataIdMap.get(x.dataId).id;
  const filterId = backend.dataIdMap.get(filter.dataId).id;

  const outputChannels = convInfo.outChannels;
  let biasId = 0;

  if (bias != null) {
    let biasData = backend.dataIdMap.get(bias.dataId);
    if (biasData.shape.length !== 1) {
      throw new Error(`FusedConv2D bias shape (${biasData.shape}) does not match the number of output channels (${outputChannels})`);
    }
    biasId = biasData.id;
  }

  const filterHeight = convInfo.filterHeight;
  const filterWidth = convInfo.filterWidth;
  const padTop = convInfo.padInfo.top;
  const padRight = convInfo.padInfo.right;
  const padBottom = convInfo.padInfo.bottom;
  const padLeft = convInfo.padInfo.left;
  const dilationHeight = convInfo.dilationHeight;
  const dilationWidth = convInfo.dilationWidth;
  const strideHeight = convInfo.strideHeight;
  const strideWidth = convInfo.strideWidth;
  const inputChannels = convInfo.inChannels;
  const isSamePad = convInfo.padInfo.type === 'SAME';
  let batchSize = convInfo.batchSize;
  let inHeight = convInfo.inHeight;
  let inWidth = convInfo.inWidth;
  if (dataFormat !== 'NHWC') {
    throw new Error(`wasm backend FusedConv2D does not support dataFormat: '${dataFormat}'. Please use 'NHWC.'`);
  }
```

---

/open Source Used In Cisco Meeting Server (formerly Acano Server) 3.4  5164
function setup(backend: BackendWasm) {
  wasmFusedDepthwiseConv2d =
    backend.wasm.cwrap(FusedDepthwiseConv2D, null /* void */, 
    ['number',  // xId
     'number',  // batchSize
     'number',  // inputHeight
     'number',  // inputWidth
     'number',  // filterId
     'number',  // filterHeight
     'number',  // filterWidth
     'number',  // biasId
     'number',  // padTop
     'number',  // padRight
     'number',  // padBottom
     'number',  // padLeft
     'number',  // isSamePad
     'number',  // dilationHeight
     'number',  // dilationWidth
     'number',  // strideHeight
     'number',  // strideWidth
     'number',  // inputChannels
     'number',  // number, activation:
     'number',  // // // preluActivationWeightsId:
     'number',  // // // leakyreluAlpha:
     'number',  // // // outId:
     'number' ]);}

function fusedDepthwiseConv2d(args: {
  inputs: FusedDepthwiseConv2DInputs,
  backend: BackendWasm,
  attrs: FusedDepthwiseConv2DAttrs
}) {
  const {inputs, attrs, backend} = args;
  const {x, filter, bias,
     preluActivationWeights} = inputs;
  const {
    strides,
    pad,
    dilations,
    dataFormat,
    dimRoundingMode,
    activation,
    leakyreluAlpha
  } = attrs;

  const convInfo =
      backend_util.computeConv2DInfo(
          (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,
          pad, dimRoundingMode, true /* depthwise */);\n\n    const fusedActivation =
        FusableActivation[activation as {} as keyof typeof FusableActivation] as {} as FusableActivation;
    if (fusedActivation == null) {
        throw new Error(`FusableActivation not yet supported for FusedDepthwiseConv2D in the wasm backend.`);
    }\n\n    const xId = backend.dataIdMap.get(x.dataId).id;
    const filterId = backend.dataIdMap.get(filter.dataId).id;
    const biasId = backend.dataIdMap.get(bias.dataId).id;
    const filterHeight = backend.dataIdMap.get(filter.dataId).id;
    const filterWidth = backend.dataIdMap.get(filter.dataId).id;
    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;
const dilationWidth = convInfo.dilationWidth;
const strideHeight = convInfo.strideHeight;
const strideWidth = convInfo.strideWidth;
const inputChannels = convInfo.inChannels;
const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;
const batchSize = convInfo batchSize;
const inHeight = convInfo.inHeight;
const inWidth = convInfo.inWidth;

if (dataFormat !== 'NHWC') {
  throw new Error(`wasm backend FusedDepthwiseConv2D does not support dataFormat: '${dataFormat}'. Please use 'NHWC'.`);
}

const out = backend.makeOutput(convInfo.outShape, 'float32');
const outId = backend.dataIdMap.get(out.dataId).id;
const preluActivationWeightsId = preluActivationWeights == null ? 0 : backend.dataIdMap.get(preluActivationWeights.dataId).id;

wasmFusedDepthwiseConv2d(id, batchSize, inHeight, inWidth, filterId, filterHeight, filterWidth, biasId, padTop, padRight, padBottom, padLeft, isSamePad, dilationHeight, dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels, fusedActivation, preluActivationWeightsId, leakyreluAlpha || 0, outId);

return out;

export const fusedDepthwiseConv2DConfig: KernelConfig = {
  kernelName: FusedDepthwiseConv2D,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: fusedDepthwiseConv2d as {} as KernelFunc
};

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 */

import {GatherNd, GatherNdInputs, KernelConfig, TensorInfo} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {Reshape} from './Reshape';
import {CppDType} from './types';

let wasmGatherNd: (id: number, dtype: CppDType, indicesId: number, numSlices: number, sliceRank: number, sliceSize: number, strides: Uint8Array, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmGatherNd = backend.wasm.cwrap(GatherNd, null /*void*/, ['number', 'number', 'number', 'number', 'number', 'number', 'number', 'number']);
}

function gatherNd(args: {backend: BackendWasm, inputs: GatherNdInputs}):
    TensorInfo {
  const {backend, inputs} = args;
  const {params, indices} = inputs;

  const [resultShape, numSlices, sliceSize, strides] = GatherUtil.prepareAndValidate(params, indices);
  const out = backend.makeOutput(resultShape, params.dtype);
  if (numSlices === 0) {
    return out;
  }

  const indicesShape = indices.shape;
  const sliceRank = indicesShape[indicesShape.length - 1];

  const xData = backend.dataIdMap.get(params.dataId);
  const xId = xData.id;

  const out = backend.dataIdMap.get(indices.dataId);
  const outId = backend.dataIdMap.get(out.dataId);

  const stridesBytes = new Uint8Array(new Int32Array(strides).buffer);

  wasmGatherNd(xId, CppDType[params.dtype], indicesId, numSlices, sliceRank, sliceSize, strides, outId);
  return out;

}

export const gatherNdConfig: KernelConfig = {
  kernelName: GatherNd,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: gatherNd as {} as KernelFunc
};

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 */

import {GatherV2, GatherV2Inputs, KernelConfig, KernelFunc, TensorInfo, TypedArray, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {reshape} from './Reshape';
import {CppDType} from './types';

let wasmGatherV2: (id: number, dtype: CppDType, indicesId: number, numSlices: number, sliceRank: number, sliceSize: number, strides: Uint8Array, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmGatherV2 = backend.wasm.cwrap(GatherV2, null /*void*/, ['number', 'number', 'number', 'number', 'number', 'number', 'number', 'number']);
}

function gatherV2(args: {backend: BackendWasm, inputs: GatherV2Inputs}):
    Tensor {
  const {backend, inputs} = args;
  const {params, indices} = inputs;

  const [resultShape, numSlices, sliceSize] = GatherUtil.prepareAndValidate(params, indices);
  const out = backend.makeOutput(resultShape, params.dtype);
  if (numSlices === 0) {
    return out;
  }

  const indicesShape = indices.shape;
  const sliceRank = indicesShape[indicesShape.length - 1];

  const xData = backend.dataIdMap.get(params.dataId);
  const xId = xData.id;

  const out = backend.dataIdMap.get(indices.dataId);
  const outId = backend.dataIdMap.get(out.dataId);

  const stridesBytes = new Uint8Array(new Int32Array(strides).buffer);

  wasmGatherV2(xId, CppDType[params.dtype], indicesId, numSlices, sliceRank, sliceSize, strides, outId);
  return out;

}

export const gatherV2Config: KernelConfig = {
  kernelName: GatherV2,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: gatherV2 as {} as KernelFunc
};

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 */
function setup(backend: BackendWasm): void {
  wasmGather = backend.wasm.cwrap('Gather', null /*void*/, [
    'number',  // xId
    'number',  // dtype
    'array',   // xStrides
    'number',  // stridesSize
    'number',  // indicesId
    'number',  // batchSize
    'array',   // outStrides
    'number',  // outId
  ]); return; // Throwing error when any index is out of bound.
}

function gatherV2(
    inputs: GatherV2Inputs, attrs: GatherV2Attrs):
  TensorInfo {
  const {inputs, attrs} = args;
  // ...}
}
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*\n*\n*\n*\n
import {KernelConfig, KernelFunc, LeakyRelu, LeakyReluAttrs, LeakyReluInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {CppDType} from './types';

let wasmFunc: (
    xId: number, dtype: number, leakyreluAlpha: number, outId: number) => void;

function setupFunc(backend: BackendWasm): void {
  wasmFunc = backend.wasm.cwrap(LeakyRelu,
null /* void */, [ 
    'number',  // x_id
    'number',  // dtype
    'number',  // leakyrelu_alpha
    'number',  // out_id
  ]);}

export function leakyRelu(
    args: {
        inputs: LeakyReluInputs, attrs: LeakyReluAttrs, 
        backend: BackendWasm
    }): TensorInfo {
  const {inputs: {x}, attrs: {alpha}, backend} = args;

  const xId = backend.dataIdMap.get(x.dataId).id;
  // According to TF API, LeakyRelu returns float32 when input is either 
  // float32 or int32.
  const out = backend.makeOutput(x.shape, 'float32');
  if (util.sizeFromShape(x.shape) !== 0) {
    const outId = backend.dataIdMap.get(out.dataId).id;
    wasmFunc(xId, CppDType[x.dtype], alpha,
    outId);
  }

  return out;
}

export const leakyReluConfig: KernelConfig = {
  kernelName: LeakyRelu,
  backendName: 'wasm',
  setupFunc,
  kernelFunc: leakyRelu as {} as KernelFunc,
};

/*=============================================================================
*/

import {KernelConfig, Less} from '@tensorflow/tfjs-core';

import {createBinaryKernelConfig} from './binary_kernel';

const supportsFullBroadcast = false;
export const lessConfig: KernelConfig = createBinaryKernelConfig(Less,
    supportsFullBroadcast, 'bool');

/*=============================================================================
*/

import {KernelConfig, LessEqual} from '@tensorflow/tfjs-core';

import {createBinaryKernelConfig} from './binary_kernel';

const supportsFullBroadcast = false;
export const lessEqualConfig: KernelConfig = createBinaryKernelConfig(LessEqual,
    supportsFullBroadcast, 'bool');

/*=============================================================================
*/

import {KernelConfig, Log} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';

export const logConfig: KernelConfig = createUnaryKernelConfig(Log);

/*=============================================================================
*/

import {KernelConfig, Less} from '@tensorflow/tfjs-core';

import {createBinaryKernelConfig} from './binary_kernel';

const supportsFullBroadcast = false;
export const lessConfig: KernelConfig = createBinaryKernelConfig(Less,
    supportsFullBroadcast, 'bool');

/*=============================================================================
*/

import {KernelConfig, LessEqual} from '@tensorflow/tfjs-core';

import {createBinaryKernelConfig} from './binary_kernel';

const supportsFullBroadcast = false;
export const lessEqualConfig: KernelConfig = createBinaryKernelConfig(LessEqual,
    supportsFullBroadcast, 'bool');

/*=============================================================================
*/

import {KernelConfig, Log} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';

export const logConfig: KernelConfig = createUnaryKernelConfig(Log);

/*=============================================================================
*/
import {backend_util, KernelConfig, KernelFunc, MaxPool, MaxPoolAttrs, MaxPoolInputs, Tensor4D, util} from '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';

let wasmMaxPool: (
  xId: number, batchSize: number, inputHeight: number, inputWidth: number, outputChannels: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmMaxPool = backend.wasm.cwrap(MaxPool, null /* void */, [
    'number', // xId
    'number', // batchSize
    'number', // inputHeight
    'number', // inputWidth
    'number', // outputChannels
    'number', // outId
  ]);}

function maxPool(
  args: {inputs: MaxPoolInputs, backend: BackendWasm, attrs: MaxPoolAttrs}) {
  const {inputs, backend, attrs} = args;

  const x = inputs.x as Tensor4D;
  const xId = backend.dataIdMap.get(x.dataId).id;

  // TF API supports int32 input. CPU and WebGL backend also support int32
  // input. WASM backend doesn't support it
  // because it uses xnnpack which only supports float32.
  // Add the following assert only for the WASM
  // backend instead of at core op level.
  //
  // TODO: add support for int32 input.
  util.assert(
    x.dtype === 'float32',
    () =>
        `Error in MaxPool: only float32 input is supported. Got ${x.dtype}.`);

  const {filterSize, strides, pad, dimRoundingMode} = attrs;
  const convInfo = backend_util.computePool2DInfo(
    x.shape, filterSize, strides, 1 /* dilations */, pad, dimRoundingMode);

  const filterHeight = convInfo.filterHeight;
  const filterWidth = convInfo.filterWidth;
  const padTop = convInfo.padInfo.top;
  const padRight = convInfo.padInfo.right;
  const padBottom = convInfo.padInfo.bottom;
  const padLeft = convInfo.padInfo.left;
  const dilationHeight = convInfo.dilationHeight;
  const dilationWidth = convInfo.dilationWidth;
  const strideHeight = convInfo.strideHeight;
  const strideWidth = convInfo.strideWidth;
  const inputChannels = convInfo.inChannels;
  const outputChannels = convInfo.outChannels;

  const out = backend.makeOutput(convInfo.outShape, 'float32');
  const outId = backend.dataIdMap.get(out.dataId).id;

  wasmMaxPool(
    xId, x.shape[0], x.shape[1], x.shape[2],
    filterHeight, filterWidth,
    padTop, padRight, padBottom, padLeft, dilationHeight, dilationWidth,
    inputChannels, number, outputChannels: number, outId: number) => void;

  return out;
}

export const maxPoolConfig: KernelConfig = {
  kernelName: MaxPool,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: maxPool as {} as KernelFunc
};
```javascript
from './kernel_utils';

let wasmMean: (xId: number, reduceSize: number, outId: number) => void;  
unfunction setup(backend: BackendWasm): void { 
  wasmMean = 
  backend.wasm.cwrap('Mean', null /*void*/);  
}

TensorInfo { const [backend, inputs, 
  attrs] = args;  
  const [axis, keepDims] = attrs;  
  const [x] = inputs;  
  const xId = 
  backend.dataIdMap.get(x.dataId).id; 
  let inputId = xId; 
  let input = x; 
  const [transposed, axes, originalAxes, 
  inputWasTransposed] = 
  permuteAxesAndTranspose(x, axes, backend); 
  let reductionAxes = axes; 
  if 
  (inputWasTransposed) { 
    const transposedId = backend.dataIdMap.get(transposed.dataId).id;  
    if (transposedId !== xId) { 
      // transposed was not a no-op. We will need to dispose of this in 
      // once we are done. 
      input = transposedId; 
      reductionAxes = backend_util.getInnerMostAxes(in 
      reductionAxes.length, input.shape.length); 
    }  
  }
  const mean = backend_util.assertAxesAreInnerMostDims( 
    backend_util.mean, 
    reductionAxes); 
  const outShape, reduceShape = 
  backend_util.computeOutAndReduceShapes(input.shape, reduceAxes); 
  const castSize = 
  util.sizeFromShape(reduceShape);  
  const castedInput = input; 
  if (input.dtype !== 'float32') { 
    castedInput = 
    cast({backend, inputs: {x: input}, attrs: {dtype: 'float32'}}); 
    inputId = 
    backend.dataIdMap.get(castedInput.dataId).id; 
  }
  const out = backend.makeOutput(outShape, 'float32'); 
  if (util.sizeFromShape(input.shape) !== 0) { 
    const outId = backend.dataIdMap.get(out.dataId).id; 
    wasmMean(inputId, reduceSize, outId);  
  }
  if (inputWasTransposed) { 
    // dispose of the transposed tensor. 
    backend.disposeData(transposed.dataId); 
  }
  if (keepDims) { 
    // reshape
    const newShape = 
    backend_util.expandShapeToKeepDim(out.shape, originalAxes); 
    out.shape = newShape; 
  }
  if (input.dtype 
  !== 'float32') { 
    backend.disposeData(castedInput.dataId); 
  }
  return out;
}

const meanConfig: 
  KernelConfig = { 
    kernelName: 'Mean', 
    backendName: 'wasm', 
    setupFunc: setup, 
    kernelFunc: mean as 
  as KernelFunc
};
```
import {KernelConfig, Multiply} from '@tensorflow/tfjs-core';

import {createBinaryKernelConfig} from './binary_kernel';

const supportsFullBroadcast = true;

export const multiplyConfig: KernelConfig = createBinaryKernelConfig(Multiply, supportsFullBroadcast);

import {KernelConfig, Neg} from '@tensorflow/tfjs-core';

export const negConfig: KernelConfig = createUnaryKernelConfig(Neg);

// Analogous to `struct Result` in `non_max_suppression_impl.h`.  
interface Result {
  pSelectedIndices: number;
  selectedSize: number;
  pSelectedScores: number;
  pValidOutputs: number;
}

export function parseResultStruct(backend: BackendWasm, resOffset: number): Result {
  const result = new Int32Array(backend.wasm.HEAPU8.buffer, resOffset, 4);
  const pSelectedIndices = result[0];
  const selectedSize = result[1];
  const pSelectedScores = result[2];
  const pValidOutputs = result[3];
  // Since the result was allocated on the heap, we have to delete it.
  backend.wasm._free(resOffset);
  return {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs};
}

// Analogous to `NonMaxSuppressionV3Impl` in `non_max_suppression_impl.h`. 

function setup(backend: BackendWasm): void {
  wasmFunc = backend.wasm.cwrap(NonMaxSuppressionV3, 'number', [
    'number',  // boxesId
    'number',  // scoresId
    'number',  // maxOutputSize
    'number',  // iouThreshold
    'number',  // scoreThreshold
  ]);}

function kernelFunc(args: {
  backend: BackendWasm,
  inputs: NonMaxSuppressionV3Inputs,
  attrs: NonMaxSuppressionV3Attrs
}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {iouThreshold, maxOutputSize, scoreThreshold} = attrs;
  const {boxes, scores} = inputs;

  const boxesId = backend.dataIdMap.get(boxes.dataId).id;
  const scoresId = backend.dataIdMap.get(scores.dataId).id;

  const resOffset = wasmFunc(boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold);

  const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} = parseResultStruct(backend, resOffset);

  // Result
  // boxesId
  // scoresId
  // maxOutputSize
  // iouThreshold
  // scoreThreshold
  // pSelectedIndices
  // selectedSize
  // pSelectedScores
  // pValidOutputs

  // Return
  // boxesId
  // scoresId
  // maxOutputSize
  // iouThreshold
  // scoreThreshold
  // pSelectedIndices
  // selectedSize
  // pSelectedScores
  // pValidOutputs

  // Return
// Since we are not using scores for V3, we have to delete it from the heap.
backend.wasm._free(pSelectedScores);
backend.wasm._free(pValidOutputs);
const selectedIndicesTensor =
  backend.makeOutput([selectedSize], 'int32', pSelectedIndices);
return selectedIndicesTensor;

export const nonMaxSuppressionV3Config: KernelConfig = {
  kernelName: 'NonMaxSuppressionV3',
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: kernelFunc as {},
};

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 */

import {KernelConfig, KernelFunc, NonMaxSuppressionV4, NonMaxSuppressionV4Attrs,
  NonMaxSuppressionV4Inputs, TensorInfo} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {parseResultStruct} from './NonMaxSuppression_util';

let wasmFunc: (boxesId: number, scoresId: number, maxOutputSize: number,
  iouThreshold: number, scoreThreshold: number,
  padToMaxOutputSize: boolean) => number;

function setup(backend: BackendWasm): void {
  wasmFunc = backend.wasm.cwrap(
      NonMaxSuppressionV4,
      'number',  // Result*
      
      'number',  // boxesId
      'number',  // scoresId
      'number',  // maxOutputSize
      'number',  // iouThreshold
      'number',  // scoreThreshold
      'bool',  // padToMaxOutputSize
    );
}

function nonMaxSuppressionV4(args: {
  backend: BackendWasm,
  inputs: NonMaxSuppressionV4Inputs,
  attrs: NonMaxSuppressionV4Attrs
}): TensorInfo[] {
  const {backend, inputs, attrs} = args;
  const {iouThreshold, maxOutputSize, scoreThreshold,
    padToMaxOutputSize} = attrs;
  const {boxes, scores} = inputs;

  const boxesId = backend.dataIdMap.get(boxes.dataId).id;
  const scoresId = backend.dataIdMap.get(scores.dataId).id;

  const resOffset = wasmFunc(
    boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold,
    padToMaxOutputSize);

  const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} =
    parseResultStruct(backend, resOffset);

  // Since we are not using scores for V4, we have to delete it from the heap.
  backend.wasm._free(pSelectedScores);

  const selectedIndicesTensor =
    backend.makeOutput([selectedSize], 'int32', pSelectedIndices);

  const validOutputsTensor =
    backend.makeOutput([], 'int32', pValidOutputs);

  return [selectedIndicesTensor, validOutputsTensor];
}

export const nonMaxSuppressionV4Config: KernelConfig = {
  kernelName: 'NonMaxSuppressionV4',
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: nonMaxSuppressionV4 as {},
};

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 */

import {KernelConfig, KernelFunc, NonMaxSuppressionV5, NonMaxSuppressionV5Attrs,
  NonMaxSuppressionV5Inputs, TensorInfo} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {parseResultStruct} from './NonMaxSuppression_util';

let wasmFunc: (boxesId: number, scoresId: number, maxOutputSize: number,
  iouThreshold: number, scoreThreshold: number,
  softNmsSigma: number) => number;

function setup(backend: BackendWasm): void {
  wasmFunc = backend.wasm.cwrap(
      NonMaxSuppressionV5,
      'number',  // Result*
      
      'number',  // boxesId
      'number',  // scoresId
      'number',  // maxOutputSize
      'number',  // iouThreshold
      'number',  // scoreThreshold
      'number',  // softNmsSigma
    );
}
scoreThreshold
        'number', // softNmsSigma
      });
    }

    function kernelFunc(args: {
      backend:
        BackendWasm,
      inputs: NonMaxSuppressionV5Inputs,
      attrs: NonMaxSuppressionV5Attrs
    }): TensorInfo[] {
      const {backend, inputs, attrs} = args;
      const {iouThreshold, maxOutputSize, scoreThreshold, softNmsSigma} = attrs;
      const {boxes, scores} = inputs;
      const boxesId = backend.dataIdMap.get(boxes.dataId).id;
      const scoresId = backend.dataIdMap.get(scores.dataId).id;
      const resOffset = wasmFunc(boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold, softNmsSigma);
      const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} = parseResultStruct(backend, resOffset);
      // Since we are not using validOutputs for V5, we have to delete it from the heap.
      heap.delete(pValidOutputs);
      const selectedIndicesTensor = backend.makeOutput([selectedSize], 'int32', pSelectedIndices);
      const selectedScoresTensor = backend.makeOutput([selectedSize], 'float32', pSelectedScores);
      return [
        selectedIndicesTensor, selectedScoresTensor
      ];
    }

    export const nonMaxSuppressionV5Config: KernelConfig = {
      kernelName: NonMaxSuppressionV5,
      backendName: 'wasm',
      setupFunc: setup,
      kernelFunc: kernelFunc as {} as KernelFunc,
    };

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    // limitations under the License.
    */

    import {KernelConfig, NotEqual} from '@tensorflow/tfjs-core';
    import {createBinaryKernelConfig} from './binary_kernel';
    import {BackendWasm} from '../backend_wasm';

    let wasmOneHot: (indicesId: number, depth: number, onValue: number, offValue: number, outId: number) => void;
    function setup(backend: BackendWasm) {
      wasmOneHot = backend.wasm.cwrap(OneHot, null /* void */, [
        'number',  // indices_id
        'number',  // depth,
        'number',  // onValue
        'number',  // offValue
        'number'   // out_id
      ]);}

    function oneHot(args: {inputs: OneHotInputs, attrs: OneHotAttrs, backend: BackendWasm}) {
      const {inputs, backend, attrs} = args;
      const {indices} = inputs;
      const {depth, onValue, offValue} = attrs;

      const out = backend.makeOutput([...indices.shape, depth], 'int32');
      const {pSelectedIndices, selectedSize, pSelectedScores} = parseResultStruct(backend, out);
      wasmOneHot(indices.dataId, depth, onValue, offValue, out.dataId);
      return [pSelectedIndices, selectedSize, pSelectedScores, out];
    }

    export const oneHotConfig: KernelConfig = {
      kernelName: OneHot,
      backendName: 'wasm',
      setupFunc: setup,
      kernelFunc: oneHot as {} as KernelFunc,
    };

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    /=============================================================================

    import {KernelConfig, NotEqual} from '@tensorflow/tfjs-core';
    import {createBinaryKernelConfig} from './binary_kernel';
    import {BackendWasm} from '../backend_wasm';

    let wasmOneHot: (indicesId: number, depth: number, onValue: number, offValue: number, outId: number) => void;
    function setup(backend: BackendWasm) {
      wasmOneHot = backend.wasm.cwrap(OneHot, null /* void */, [
        'number',  // indices_id
        'number',  // depth,
        'number',  // onValue
        'number',  // offValue
        'number'   // out_id
      ]);}

    function oneHot(args: {inputs: OneHotInputs, attrs: OneHotAttrs, backend: BackendWasm}) {
      const {inputs, backend, attrs} = args;
      const {indices} = inputs;
      const {depth, onValue, offValue} = attrs;

      const out = backend.makeOutput([...indices.shape, depth], 'int32');
      const {pSelectedIndices, selectedSize, pSelectedScores} = parseResultStruct(backend, out);
      wasmOneHot(indices.dataId, depth, onValue, offValue, out.dataId);
      return [pSelectedIndices, selectedSize, pSelectedScores, out];
    }

    export const oneHotConfig: KernelConfig = {
      kernelName: OneHot,
      backendName: 'wasm',
      setupFunc: setup,
      kernelFunc: oneHot as {} as KernelFunc,
    };

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```javascript
import {KernelConfig, KernelFunc, OnesLike, OnesLikeInputs} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

function onesLike(args: {inputs: OnesLikeInputs, backend: BackendWasm}) {
  const {inputs: {x}, backend} = args;
  const out = backend.makeOutput(x.shape, x.dtype);
  const outVals = backend.registerArrayFromHeap(out);
  outVals.fill(1);
  return out;
}

export const onesLikeConfig: KernelConfig = {
  kernelName: OnesLike,
  backendName: 'wasm',
  kernelFunc: onesLike as {} as KernelFunc,
};

import {KernelConfig, KernelFunc, Pack, PackAttrs, PackInputs, TensorInfo, util} from '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';

import {concat} from './Concat';
import {expandDims} from './ExpandDims';

export function pack(
    args: {inputs: PackInputs, backend: BackendWasm, attrs: PackAttrs}):
    TensorInfo {
  const {inputs, backend, attrs} = args;
  const {axis} = attrs;

  if (inputs.length === 1) {
    return expandDims(
        {inputs: {input: inputs[0]}, backend, attrs: {dim: axis}});
  }

  const shape = inputs[0].shape;
  const dtype = inputs[0].dtype;
  inputs.forEach(t => {
    util.assertShapesMatch(
        shape, t.shape,
        'All tensors passed to stack must have matching shapes');
    util.assert(
        dtype === t.dtype,
        () => 'All tensors passed to stack must have matching dtypes');
  });

  const intermediateTensorInfos: TensorInfo[] = [];
  const expandedTensors = inputs.map(t => {
    const expandedT = expandDims({inputs: {input: t}, backend, attrs: {dim: axis}});
    intermediateTensorInfos.push(expandedT);
    return expandedT;
  });

  const result = concat({inputs: expandedTensors, backend, attrs: {axis}});

  intermediateTensorInfos.forEach(t => backend.disposeData(t.dataId));

  return result;
}

export const packConfig: KernelConfig = {
  kernelName: Pack,
  backendName: 'wasm',
  kernelFunc: pack as {} as KernelFunc
};
```

---

```
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 */
```

---

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outTensorData = backend.dataIdMap.get(out.dataId);
const outId = outTensorData.id;
const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);
const prePaddingsFlat = paddings.map(padTuple =>
  padTuple[0]);
const postPaddingsFlat = paddings.map(padTuple => padTuple[1]);
const prePaddingsBytes = new Uint8Array(new Int32Array(prePaddingsFlat).buffer);
const postPaddingsBytes = new Uint8Array(new Int32Array(postPaddingsFlat).buffer);

const outTensorData = backend.dataIdMap.get(out.dataId);
const outId = outTensorData.id;

const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);

const prePaddingsFlat = paddings.map(padTuple => padTuple[0]);
const postPaddingsFlat = paddings.map(padTuple => padTuple[1]);

const prePaddingsBytes = new Uint8Array(new Int32Array(prePaddingsFlat).buffer);
const postPaddingsBytes = new Uint8Array(new Int32Array(postPaddingsFlat).buffer);

wasmPadV2(xId, xShapeBytes, x.shape.length, CppDType[x.dtype], prePaddingsBytes, postPaddingsBytes, constantValue, outId);
return out;
}

export const padV2Config: KernelConfig = {
  kernelName: PadV2,
  backendName: 'wasm',
  kernelFunc: pad as {} as KernelFunc,
  setupFunc: setup
};

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 */

import {KernelConfig, Pow} from '@tensorflow/tfjs-core';

const supportsFullBroadcast = false;
export const powConfig: KernelConfig = createBinaryKernelConfig(Pow, supportsFullBroadcast);

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 */

import {backend_util, KernelConfig, KernelFunc, Prod, ProdAttrs, ProdInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

const wasmProd = backend.wasm.cwrap(Prod, null /* void */, [  // x_id, weightsId, out_id   ]);

const prodConfig = (inputs: ProdInputs, backend: BackendWasm, weightsId: number, outId: number) => {
  const xId = backend.dataIdMap.get(x.dataId).id;
  const weightsId = backend.dataIdMap.get(weights.dataId).id;

  const prod = wasmProd(xId, weightsId, outId);

  return prod;
};

export const prodConfig: KernelConfig = {
  kernelName: Prod,
  backendName: 'wasm',
  setupFunc: setup
};
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```javascript
function setup(backend:
    BackendWasm): void {
  wasmProd = backend.wasm.cwrap(Prod, null /*void*/, ['number','number','number','number']);
}

function prod(args: {
  backend: BackendWasm,
  inputs: ProdInputs,
  attrs: ProdAttrs
}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {axis, keepDims} = attrs;
  const {x} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  let inputId = xId;
  let input = x;

  const transposed, axes, originalAxes, inputWasTransposed = permuteAxesAndTranspose(x, axis, backend);
  const reductionAxes = axes;
  if (inputWasTransposed) {
    const transposedId = backend.dataIdMap.get(transposed.dataId).id;
    if (transposedId !== xId) {
      // transpose was not a no-op. We will need to dispose of this
      // once we are done.
      input = transposed;
      inputId = transposedId;
    }
  }

  backend_util.assertAxesAreInnerMostDims(‘prod’, reductionAxes.length, input.shape.length);
  const [outShape, reduceShape] = backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);
  const reduceSize = util.sizeFromShape(reduceShape);

  const out = backend.makeOutput(outShape, input.dtype);
  if (util.sizeFromShape(input.shape) !== 0) {
    const outId = backend.dataIdMap.get(out.dataId).id;
    wasmProd(inputId, reduceSize, CppDType[out.dtype], outId);
  }

  if (inputWasTransposed) {
    // dispose of the transposed tensor.
    backend.disposeData(transposed.dataId);
  }

  if (keepDims) {
    // reshape
    const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);
    out.shape = newShape;
  }

  return out;
}

export const prodConfig: KernelConfig = {
  kernelName: Prod,
  backendName: ‘wasm’,
  setupFunc: setup,
  kernelFunc: prod as {} as KernelFunc
};

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 */

import { KernelConfig, KernelFunc, Range, RangeAttrs, TensorInfo } from ‘@tensorflow/tfjs-core’;
import { BackendWasm } from ‘../backend_wasm’;
import { rangeImplCPU } from ‘../kernel_utils/shared’;

export const range =
    (args: {backend: BackendWasm, attrs: RangeAttrs}): TensorInfo => {
      const {backend, attrs} = args;
      const {start, stop, step, dtype} = attrs;
      const values = rangeImplCPU(start, stop, step, dtype);

      const out = backend.makeOutput([values.length], dtype);
      const outVals = backend.typedArrayFromHeap(out);
      outVals.set(values);
      return out;
    };

export const rangeConfig:
    KernelConfig = {
      kernelName: Range,
      backendName: ‘wasm’,
      setupFunc: setup, // KernelFunc as *
      kernelFunc: range as {} as KernelFunc
    };

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 */

import { util } from '@tensorflow/tfjs-core';

export function rangeImpl(start, stop, step, dtype) {
  const sameStartStop = start === stop;
  const increasingRangeNegativeStep = start < stop && step < 0;
  const decreasingRangePositiveStep = stop < start && &step > 1;
  if (sameStartStop || increasingRangeNegativeStep ||
    decreasingRangePositiveStep) {
    return util.makeZerosTypedArray(0, dtype);
  }
  const range = Math.abs(Math.ceil((stop - start) / step));
  const values = util.makeZerosTypedArray(range, dtype);
  values[0] = start;
  for (let i = 1; i < values.length; i++) {
    values[i] = values[i - 1] +
  }
```
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```javascript
import {KernelConfig, RealDiv} from '@tensorflow/tfjs-core';
import {createBinaryKernelConfig} from './binary_kernel';

const supportsFullBroadcast = true;
export const realDivConfig: KernelConfig = createBinaryKernelConfig(RealDiv, supportsFullBroadcast);
```

```javascript
import {KernelConfig, Relu} from '@tensorflow/tfjs-core';
import {createUnaryKernelConfig} from './unary_kernel';
export const reluConfig: KernelConfig = createUnaryKernelConfig(Relu);
```

```javascript
import {KernelConfig, Relu6} from '@tensorflow/tfjs-core';
import {createUnaryKernelConfig} from './unary_kernel';
export const relu6Config: KernelConfig = createUnaryKernelConfig(Relu6);
```

```javascript
import {KernelConfig, KernelFunc, ResizeBilinear, ResizeBilinearAttrs, ResizeBilinearInputs, TensorInfo, util} from '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';
import {cast} from './Cast';

let wasmResizeBilinear: (
    xId: number, batch: number, oldHeight: number, oldWidth: number,
    numChannels: number, newHeight: number, newWidth: number,
    alignCorners: number, halfPixelCenters: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmResizeBilinear = backend.wasm.cwrap(ResizeBilinear, null /*void*/, [
      'number',  // xId
      'number',  // batch
      'number',  // oldHeight
      'number',  // oldWidth
      'number',  // numChannels
      'number',  // newHeight
      'number',  // newWidth
      'number',  // alignCorners
      'number',  // halfPixelCenters
      'number'   // outId
  ]);
}

function resizeBilinear(args: {
  backend: BackendWasm,
  inputs: ResizeBilinearInputs,
  attrs: ResizeBilinearAttrs
}): TensorInfo {
  const {backend, inputs, attrs} = args;

  const {images} = inputs;
  const {alignCorners, halfPixelCenters, size} = attrs;
  const [newHeight, newWidth] = size;
  const [batch, oldHeight, oldWidth, numChannels] = images.shape;
  const outShape = [batch, newHeight, newWidth, numChannels];

  let xData = backend.dataIdMap.get(images.dataId);
  if (xData.dtype !== 'float32') {
    xData = cast({backend: BackendWasm, inputs: inputs, attrs: attrs})(xData);
  }

  let xId = backend.dataIdMap.add(xData);
  let oldHeightId = backend.dataIdMap.add(images.dataId);

  const sizeId = backend.dataIdMap.add(size);  
```

```javascript
import {KernelConfig, KernelFunc, ResizeBilinear, ResizeBilinearAttrs, ResizeBilinearInputs, TensorInfo, util} from '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';
import {cast} from './Cast';

let wasmResizeBilinear: (
    xId: number, batch: number, oldHeight: number, oldWidth: number,
    numChannels: number, newHeight: number, newWidth: number,
    alignCorners: number, halfPixelCenters: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmResizeBilinear = backend.wasm.cwrap(ResizeBilinear, null /*void*/, [
      'number',  // xId
      'number',  // batch
      'number',  // oldHeight
      'number',  // oldWidth
      'number',  // numChannels
      'number',  // newHeight
      'number',  // newWidth
      'number',  // alignCorners
      'number',  // halfPixelCenters
      'number'   // outId
  ]);
}

function resizeBilinear(args: {
  backend: BackendWasm,
  inputs: ResizeBilinearInputs,
  attrs: ResizeBilinearAttrs
}): TensorInfo {
  const {backend, inputs, attrs} = args;

  const {images} = inputs;
  const {alignCorners, halfPixelCenters, size} = attrs;
  const [newHeight, newWidth] = size;
  const [batch, oldHeight, oldWidth, numChannels] = images.shape;
  const outShape = [batch, newHeight, newWidth, numChannels];

  let xData = backend.dataIdMap.get(images.dataId);
  if (xData.dtype !== 'float32') {
    xData = cast({backend: BackendWasm, inputs: inputs, attrs: attrs})(xData);
  }

  let xId = backend.dataIdMap.add(xData);
  let oldHeightId = backend.dataIdMap.add(images.dataId);

  const sizeId = backend.dataIdMap.add(size);  

```
backend.dataIdMap.get(castedData.dataId);

  const outId = backend.dataIdMap.get(out.dataId).id;
  const out = backend.makeOutput(outShape, 'float32');
  if (util.sizeFromShape(images.shape) === 0) {
    return out;
  }

  const outId = backend.dataIdMap.get(out.dataId).id;

  wasmResizeBilinear(xId, batch, oldHeight, oldWidth, numChannels, newHeight, newWidth, align_corners ? 1 : 0, half_pixel_centers ? 1 : 0, outId);

  if (castedData != null) {
    backend.disposeData(castedData.dataId);
  }

  return out;
}

export const resizeBilinearConfig: KernelConfig = {
  kernelName: ResizeBilinear,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: resizeBilinear as {} as KernelFunc
};

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 */

import {KernelConfig, KernelFunc, Reverse, ReverseAttrs, ReverseInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {identity} from './Identity';
import {reshape} from './Reshape';

let wasmReverse: (xId: number, axes: Uint8Array, axesLength: number, outShape: Uint8Array, outShapeLength: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmReverse = backend.wasm.cwrap(Reverse, null, 
    [ 'number', // x_id
      'array',   // axes
      'number',  // axes_length
      'array',   // out_shape
      'number',  // out_shape_length
      'number'   // out_id
    ]); 

  backend.disposeData(x.dataId);
}

export function reverse(args: {
  inputs: ReverseInputs,
  backend: BackendWasm,
  attrs: ReverseAttrs
}): TensorInfo {
  const {inputs, backend, attrs} = args;
  const {x} = inputs;
  const {dims} = attrs;

  const axes = util.parseAxisParam(dims, x.shape);

  if (x.shape.length === 0) {
    return identity({inputs: {x}, backend});
  }

  const out = backend.makeOutput(x.shape, x.dtype);
  const xId = backend.dataIdMap.get(x.dataId).id;
  const outId = backend.dataIdMap.get(out.dataId).id;

  const axesBytes = new Uint8Array(new Int32Array(axes).buffer);
  const outShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);

  wasmReverse(xId, axesBytes, axes.length, outShapeBytes, x.shape.length, outId);

  const reshaped = reshape({inputs: {x: out}, attrs: {shape: x.shape}, backend});

  backend.disposeData(out.dataId);

  return reshaped;
}

export const reverseConfig: KernelConfig = {
  kernelName: Reverse,
  backendName: 'wasm',
  kernelFunc: reverse as {} as KernelFunc,
  setupFunc: setup
};

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 */

import {KernelConfig, KernelFunc, RotateWithOffset, RotateWithOffsetAttrs, RotateWithOffsetInputs, TensorInfo} from '@tensorflow/tfjs-core';
import {backend_util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmRotate: (xId: number, batch: number, imageHeight: number, imageWidth: number, numChannels: number, radians: number, centerX: number, centerY: number, numBytes: Uint8Array, fillLength: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmRotate = backend.wasm.cwrap(RotateWithOffset, null, 
    [ 'number', // x_id
      'array',   // batch
      'number',  // imageHeight
      'number',  // imageWidth
      'number',  // numChannels
      'number',  // radians
      'number',  // centerX
      'number',  // centerY
      'array',   // fillBytes
      'number',  // fillLength
    ]); 

  backend.disposeData(x.dataId);
}

export function rotateWithOffset(args: {
  inputs: RotateWithOffsetInputs,
  backend: BackendWasm,
  attrs: RotateWithOffsetAttrs
}): TensorInfo {
  const {inputs, backend, attrs} = args;
  const {x} = inputs;
  const {batch, numChannels, numBytes, fillBytes, centerX, centerY, radian, fillLength, outId} = attrs;

  const outId = backend.dataIdMap.get(out.dataId).id;

  const out = backend.makeOutput(out.shape, out.dtype);

  wasmRotate(xId, batch, imageHeight, imageWidth, numChannels, radians, centerX, centerY, numBytes, fillLength, outId);

  return out;
}

export const rotateWithOffsetConfig: KernelConfig = {
  kernelName: RotateWithOffset,
  backendName: 'wasm',
  kernelFunc: rotateWithOffset as {} as KernelFunc,
  setupFunc: setup
};
args;

const {image} = inputs;
const {rad, fillValue, center} = attrs;
const out = backend.makeOutput(image.shape, image.dtype);
const imageId = backend.dataIdMap.get(image.dataId).id;
const outId = backend.dataIdMap.get(out.dataId).id;
const {batch, imageHeight, imageWidth, numChannels} = image.shape;
const [centerX, centerY] = center;
const fillIsBlack = fillValue === 0;
const fullOpacityValue = 255;
const fillValues = typeof fillValue === 'number' ? [fillValue, fillValue, fillValue, fillIsBlack ? 0 : fullOpacityValue] :
[...fillValue, fullOpacityValue];
const outId = backend.dataIdMap.get(out.dataId).id;
const [batch, imageHeight, imageWidth, numChannels] = image.shape;
const [centerX, centerY] = center;
const fillBytes = new Uint8Array(new Int32Array(fillValues).buffer);

wasmRotate(imageId, batch, imageHeight, imageWidth, numChannels, rad, centerX, centerY, fillBytes, fillValues.length, outId);
return out;

export const rotateWithOffsetConfig: KernelConfig = {
  kernelName: RotateWithOffset,
  backendName: 'wasm',
  kernelFunc: rotateWithOffset as {} as KernelFunc,
  setupFunc: setup
};

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 */
import {KernelConfig, Round} from '@tensorflow/tfjs-core';
import {createUnaryKernelConfig} from './unary_kernel';
export const roundConfig: KernelConfig = createUnaryKernelConfig(Round);

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 */
import {KernelConfig, Rsqrt} from '@tensorflow/tfjs-core';
import {createUnaryKernelConfig} from './unary_kernel';
export const rsqrtConfig: KernelConfig = createUnaryKernelConfig(Rsqrt);

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 */

import {KernelConfig, KernelFunc, scatter_util, ScatterNd, ScatterNdAttrs, ScatterNdInputs, TensorInfo, util} from '@tensorflow/tfjs-core';
import {CppDType} from './types';
import {BackendWasm} from '../backend_wasm';

let wasmScatterNd: (indicesId: number, updatesId: number, dtype: CppDType, sliceRank: number, numUpdates: number, sliceSize: number, strides: Uint8Array, outputSize: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmScatterNd = backend.wasm.cwrap(ScatterNd, null /*void*/,
    ['number',  // indicesId
    'number',  // updatesId
    'number',  // dtype
    'number',  // sliceRank
    'number',  // numUpdates
    'number',  // sliceSize
    'array',   // strides
    'number'   // outputSize
  ]);
}

function scatterNd(args: {backend: BackendWasm, inputs: ScatterNdInputs, attrs: ScatterNdAttrs}): TensorInfo {
  const backend = args.backend;
  const inputs = args.inputs;
  const {shape} = attrs;
  const out = backend.makeOutput(shape, updates.dtype);
  if (util.sizeFromShape(shape) === 0) {
    return out;
  }
  const {shape, numUpdates, sliceSize, strides, outputSize} = scatter_util.calculateShapes(updates, indices, shape);
  const indicesData =
```javascript
backend.dataIdMap.get(indices.dataId);
const indicesId = indicesData.id;

const updatesData = backend.dataIdMap.get(updates.dataId);
const updatesId = updatesData.id;

const stridesBytes = new Uint8Array(new Int32Array(strides).buffer);

const updatesData = backend.dataIdMap.get(updates.dataId);
const updatesId = updatesData.id;

const stridesBytes = new Uint8Array(new Int32Array(strides).buffer);

const outId = backend.dataIdMap.get(out.dataId).id;

wasmScatterNd(indicesId, updatesId, CppDType[updates.dtype], sliceRank, numUpdates, sliceSize, stridesBytes, outputSize, outId);

return out;
}

export const scatterNdConfig: KernelConfig = {
  kernelName: ScatterNd,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: scatterNd as {} as KernelFunc
};
```

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 */

import {KernelConfig, KernelFunc, Select, SelectInputs, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmSelect: (conditionId: number, tId: number, eId: number, offset: number, outId: number) => void; /* @license */

function setup(backend: BackendWasm) {
  wasmSelect = backend.wasm.cwrap('SelectV2', null, ['number', // conditionId
    'number', // tId
    'number', // eId
    'number', // offset
    'number', // outId
  ]); /* @license */
}

function select(args: {inputs: SelectInputs, backend: BackendWasm}) {
  const {inputs, backend} = args;
  const {condition, t, e} = inputs;

  const conditionId = backend.dataIdMap.get(condition.dataId).id;
  const tId = backend.dataIdMap.get(t.dataId).id;
  const eId = backend.dataIdMap.get(e.dataId).id;
  const out = backend.makeOutput(t.shape, t.dtype);
  const outId = backend.dataIdMap.get(out.dataId).id;

  const cRank = condition.shape.length;
  const tRank = t.shape.length;

  const offset = cRank === 0 || cRank > 1 || tRank === 1 ?
      util.sizeFromShape(t.shape.slice(1)) :
      1;

  const cRank = condition.shape.length;
  const tRank = t.shape.length;

  wasmSelect(conditionId, tId, eId, offset, outId);
  return out;
}

export const selectConfig: KernelConfig = {
  kernelName: Select,
  backendName: 'wasm',
  kernelFunc: select as {} as KernelFunc,
  setupFunc: setup
};
```

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 */

import {KernelConfig, KernelFunc, Sigmoid, SigmoidInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmFunc: (xId: number, outId: number) => void; /* @license */

function setup(backend: BackendWasm): void {
  wasmFunc = backend.wasm.cwrap(Sigmoid, null, ['number', 'number']); /* @license */
}

function sigmoid(args: {backend: BackendWasm, inputs: SigmoidInputs}) {
  const {backend, inputs: {x}} = args;
  const xId = backend.dataIdMap.get(x.dataId).id;
  const outId = backend.dataIdMap.get(out.dataId).id;
  const out = backend.makeOutput(x.shape, x.dtype);
  const outId = backend.dataIdMap.get(out.dataId).id;
  util.sizeFromShape(out.shape); /* @license */

  wasmFunc(xId, outId);
  return out;
}

export const sigmoidConfig: KernelConfig = {
  kernelName: 'Sigmoid',
  backendName: 'wasm',
  kernelFunc: sigmoid as {} as KernelFunc,
  setupFunc: setup
};
```

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 */

import {KernelConfig, KernelFunc, Sigmoid, SigmoidInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmFunc: (xId: number, outId: number) => void; /* @license */

function setup(backend: BackendWasm): void {
  wasmFunc = backend.wasm.cwrap(Sigmoid, null, ['number', 'number']); /* @license */
}

function sigmoid(args: {backend: BackendWasm, inputs: SigmoidInputs}) {
  const {backend, inputs: {x}} = args;
  const xId = backend.dataIdMap.get(x.dataId).id;
  const outId = backend.dataIdMap.get(out.dataId).id;
  util.sizeFromShape(out.shape); /* @license */

  wasmFunc(xId, outId);
  return out;
}

export const sigmoidConfig: KernelConfig = {
  kernelName: 'Sigmoid',
  backendName: 'wasm',
  kernelFunc: sigmoid as {} as KernelFunc,
  setupFunc: setup
};
```

---

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---

```javascript
backend.dataIdMap.get(indices.dataId);
const indicesId = indicesData.id;

const updatesData = backend.dataIdMap.get(updates.dataId);
const updatesId = updatesData.id;

const stridesBytes = new Uint8Array(new Int32Array(strides).buffer);

const updatesData = backend.dataIdMap.get(updates.dataId);
const updatesId = updatesData.id;

const stridesBytes = new Uint8Array(new Int32Array(strides).buffer);

const outId = backend.dataIdMap.get(out.dataId).id;

wasmScatterNd(indicesId, updatesId, CppDType[updates.dtype], sliceRank, numUpdates, sliceSize, stridesBytes, outputSize, outId);

return out;
}

export const scatterNdConfig: KernelConfig = {
  kernelName: ScatterNd,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: scatterNd as {} as KernelFunc
};
```
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=============================================================================

*/

import {KernelConfig, Sin} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';

export const sinConfig: KernelConfig = createUnaryKernelConfig(Sin);

/*=============================================================================

*/

import {KernelConfig, KernelFunc, Softmax, SoftmaxAttrs, SoftmaxInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmFunc: (xId: number, outId: number, channels: number, batch: number) => void;

function setup(backend: BackendWasm): void {
  wasmFunc = backend.wasm.cwrap(Softmax, null /* void */, [
    'number',  // xId
    'number',  // outId
    'number',  // channels
    'number'   // batch
  ]);}

function softmax(args: {
  backend: BackendWasm,
  inputs: SoftmaxInputs,
  attrs: SoftmaxAttrs
}): TensorInfo {
  const {backend, inputs: {logits}, attrs: {dim}} = args;
  const xId = backend.dataIdMap.get(logits.dataId).id;
  const out = backend.makeOutput(logits.shape, logits.dtype);
  const outId = backend.dataIdMap.get(out.dataId).id;
  const channels = logits.shape[dim];
  const batch = util.sizeFromShape(logits.shape) / channels;

  if (util.sizeFromShape(out.shape) === 0) {
    return out;
  }

  wasmFunc(xId, outId, channels, batch);
  return out;
}

export const softmaxConfig: KernelConfig = {
  kernelName: Softmax,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: softmax as {} as KernelFunc
};

/*=============================================================================

*/

import {backend_util, KernelConfig, KernelFunc, ReshapeAttrs, ReshapeInputs, SpaceToBatchND, SpaceToBatchNDAttrs, SpaceToBatchNDInputs, TensorInfo, TransposeAttrs, TransposeInputs, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {padV2Config} from './PadV2';
import {reshape} from './Reshape';
import {transpose} from './Transpose';

function spaceToBatchND(args: {
  inputs: SpaceToBatchNDInputs,
  backend: BackendWasm,
  attrs: SpaceToBatchNDAttrs
}) {
  const {inputs, backend, attrs} = args;
  const {x} = inputs;
  const {blockShape, paddings} = attrs;
  const completePaddings: Array<[number, number]> = 
      padV2Config.kernelFunc({inputs: {x}, backend, attrs: {paddings: [0, 0], constantValue: 0}}) as TensorInfo;
  const reshapedPaddedShape = backend_util.getReshaped(paddedX.shape, blockShape, prod, false);
  const permutedReshapedPaddedPermutation = backend_util.getPermuted(reshapedPaddedShape.length, blockShape.length, false);
  const flattenShape = backend_util.getReshapedPermuted(paddedX.shape, blockShape, prod, false);
  const reshapeInputs: ReshapeInputs = {x: paddedX};
  const reshapeAttrs = {shape: reshapedPaddedShape};
  const reshaaped = reshape({inputs: reshapeInputs, backend, attrs: reshapeAttrs});
  const transposeInputs: TransposeInputs = {x: reshaped};
  const transposeAttrs = {perm: permutedReshapedPaddedPermutation};
  const reshapex = transpose({inputs: transposeInputs, backend,
attrs: transposeAttrs});

  const resultReshapeInputs: ReshapeInputs = {x: paddedXT};
  const resultReshapeAttrs: ReshapeAttrs = {shape: flattenShape};
  const result = reshape({inputs: resultReshapeInputs, backend, attrs: resultReshapeAttrs});

  backend.disposeData(paddedX.dataId);
  backend.disposeData(paddedXReshaped.dataId);
  backend.disposeData(paddedXT.dataId);

  return result;
}

export const spaceToBatchNDConfig: KernelConfig = {
  kernelName: SpaceToBatchND,
  backendName: 'wasm',
  kernelFunc: spaceToBatchND as {} as KernelFunc
};

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 */

import {KernelConfig, KernelFunc, SplitV, SplitVAttrs, SplitVInputs, util} from '@tensorflow/tfjs-core';
import {backend_util} from '@tensorflow/tfjs-core';

import {Slice} from '../backend_wasm';

import {slice} from './Slice';

export function splitV(
    args: {inputs: SplitVInputs, attrs: SplitVAttrs, backend: BackendWasm}) {
  const {inputs, attrs, backend} = args;
  const {x} = inputs;
  const {numOrSizeSplits, axis} = attrs;

  const $axis = util.parseAxisParam(axis, x.shape)[0];

  const splitSizes = backend_util.prepareSplitSize(x, numOrSizeSplits, $axis);
  const begin = new Array(x.shape.length).fill(0);

  const size = x.shape.slice();
  return splitSizes.map(s => {
    const xSliceSize = [...size];
    xSliceSize[$axis] = s;
    const xSlice =
        slice({inputs: {x}, attrs: {begin, size: xSliceSize}, backend});
    begin[$axis] += s;
    return xSlice;
  });
}

export const splitVConfig: KernelConfig = {
  kernelName: SplitV,
  backendName: 'wasm',
  kernelFunc: splitV as {} as KernelFunc
};

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 */

import {KernelConfig, Sqrt} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';
export const sqrtConfig: KernelConfig = createUnaryKernelConfig(Sqrt);

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 */

import {KernelConfig, Square} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';
export const squareConfig: KernelConfig = createUnaryKernelConfig(Square);
import {KernelConfig, SquaredDifference} from '@tensorflow/tfjs-core';
import {createBinaryKernelConfig} from './binary_kernel';
const supportsFullBroadcast = true;
export const squaredDifferenceConfig: KernelConfig =
    createBinaryKernelConfig(SquaredDifference, supportsFullBroadcast);

import {KernelConfig, KernelFunc, slice_util, StridedSlice, StridedSliceAttrs, StridedSliceInputs, TensorInfo, util} from '@tensorflow/tfjs-core';
import {backend_wasm} from './backend_wasm';
import {reshape} from './Reshape';
import {slice} from './Slice';

let wasmStridedSlice: (
    xId: number, xStridesBytes: Uint8Array, xRank: number,
    beginBytes: Uint8Array, endBytes: Uint8Array, stridesBytes: Uint8Array,
    outShapeBytes: Uint8Array, outStridesBytes: Uint8Array,
    outShapeLength: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmStridedSlice = backend.wasm.cwrap(StridedSlice, null /*void*/, 
      ['number',  // xId
       'array',   // xStrides
       'number',  // xRank
       'array',   // begin
       'array',   // end
       'array',   // strides
       'array',   // outShape
       'array',   // outStrides
       'number',  // outShapeLength
       'number',  // outId
     ]);}

export function stridedSlice(args: {
  backend: BackendWasm,
  inputs: StridedSliceInputs,
  attrs: StridedSliceAttrs
}): TensorInfo {
  const {backend, inputs, attrs} = args;

  const {x} = inputs;

  const {
    begin,
    end,
    strides,
    beginMask,
    endMask,
    ellipsisMask,
    newAxisMask,
    shrinkAxisMask
  } =
      slice_util.sliceInfo(
          x.shape, begin, end, strides, beginMask, endMask, ellipsisMask,
          newAxisMask, shrinkAxisMask);

  let result;

  if (isIdentity) {
    // Optimization #1, slice is a no-op plus reshape
    result = reshape({inputs: {x}, backend, attrs: {shape: finalShape}});
  } else if (sliceDim0 || isSimpleSlice) {
    // Memory contiguous (only occurs in dim 0)
    const size = slice_util.computeOutShape(begin, end, strides);
    result =
        reshape({inputs: {x: slice({begin, size})}, backend, attrs: {shape: finalShape}});
  } else {

  }
backend.makeOutput(finalShapeSparse, 'float32');

    const xId = backend.dataIdMap.get(x.dataId).id;
    const xStridesBytes = new Uint8Array(new Int32Array(x.shape).buffer);
    const beginBytes = new Uint8Array(new Int32Array($begin).buffer);
    const endBytes = new Uint8Array(new Int32Array($end).buffer);
    const stridesBytes = new Uint8Array(new Int32Array($strides).buffer);
    const outputShapeBytes = new Uint8Array(new Int32Array(finalShapeSparse).buffer);
    const outStridesBytes = new Uint8Array(finalShapeSparse.shape.length, outId);
    const outId = backend.dataIdMap.get(out.dataId).id;

    wasmStridedSlice(xId, xStridesBytes, x.shape.length, beginBytes, endBytes, stridesBytes,
        outputShapeBytes, outStridesBytes, finalShapeSparse.length, outId);

    result = reshape({inputs: {x: out}, backend, attrs: {shape: finalShape}});

    backend.disposeData(out.dataId);

  return result;
}

export const stridedSliceConfig: KernelConfig = {
  kernelName: StridedSlice,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: stridedSlice as {} as KernelFunc
};

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 *=============================================================================
 */
import {KernelConfig, Sub} from '@tensorflow/tfjs-core';
import {createBinaryKernelConfig} from './binary_kernel';
const supportsFullBroadcast = true;
export const subConfig: KernelConfig = createBinaryKernelConfig(Sub, supportsFullBroadcast);

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 *=============================================================================
 */

import {backend_util, KernelConfig, KernelFunc, Sum, SumAttrs, SumInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {permuteAxesAndTranspose} from './kernel_utils';
import {CppDType} from './types';

let wasmSum: (xId: number, reduceSize: number, dtype: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmSum = backend.wasm.cwrap(Sum, null /*void*/, [
    'number',  // input_id
    'number',  // reduce_size
    'number',  // dtype
    'number',  // out_id
  ]);
}

function sum(args: {backend: BackendWasm, inputs: SumInputs, attrs: SumAttrs}):
    TensorInfo {
  const {backend, inputs, attrs} = args;
  const {axis, keepDims} = attrs;
  const {x} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  let inputId = xId;
  let input = x;

  const {transposed, axes, originalAxes, inputWasTransposed} =
    permuteAxesAndTranspose(x, axis, backend);
  let reductionAxes = axes;
  if (inputWasTransposed) {
    const transposedId = backend.dataIdMap.get(transposed.dataId).id;
    if (transposedId !== xId) {
      // transpose was not a no-op. We will need to dispose of this
      // once we are done.
      input = transposed;
      inputId = transposedId;
      reductionAxes = backend_util.getInnerMostAxes(reductionAxes.length,
          input.shape.length);
    }
  }

  backend_util.assertAxesAreInnerMostDims('sum', reductionAxes, input.shape.length);
  const [outShape, reduceShape] =
    backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);
  const reduceSize =
    util.sizeFromShape(reduceShape);
  const out = backend.makeOutput(outShape, input.dtype);
  if (reduceSize !== 0) {
    const outId = backend.dataIdMap.get(out.dataId).id;
    wasmSum(inputId, reduceSize, CppDType[input.dtype], outId);
  } else if (inputWasTransposed) {
    // dispose of the transposed tensor.
    backend.disposeData(transposed.dataId);
  } else if (keepDims) {
    // reshape
    const
newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes); out.shape = newShape;
}

export const sumConfig: KernelConfig = {
  kernelName: Sum,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: sum as {} as KernelFunc
};

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 */
import {KernelConfig, Tan} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';
export const tanConfig: KernelConfig = createUnaryKernelConfig(Tan);

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 */
import {KernelConfig, KernelFunc, Tile, TileAttrs, TileInputs} from '@tensorflow/tfjs-core';

import {CppDType} from './types';

let wasmTile: (
    xId: number, xShape: Uint8Array, xShapeSize: number, newShape: Uint8Array,
    newShapeSize: number, dtype: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmTile = backend.wasm.cwrap(Tile, null /* void */, 
    'number',  // x_id
    'array',   // x_shape
    'number',  // x_shape.length
    'array',   // new_shape
    'number',  // new_shape.length
    'number'   // out_id
  );
}

function tile(
    args: {inputs: TileInputs, backend: BackendWasm, attrs: TileAttrs}) {
  const {inputs, backend, attrs} = args;
  const {x} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  const {reps} = attrs;

  const newShape: number[] = new Array(x.shape.length);
  for (let i = 0; i < newShape.length; i++) {
    newShape[i] = x.shape[i] * reps[i];
  }
  const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);
  const newShapeBytes = new Uint8Array(new Int32Array(newShape).buffer);

  const out = backend.makeOutput(newShape, x.dtype);
  const outId = backend.dataIdMap.get(out.dataId).id;
  wasmTile(xId, xShapeBytes, x.shape.length, newShapeBytes, newShape.length,
    CppDType[out.dtype], outId);
}

export const tileConfig: KernelConfig = {
  kernelName: Tile,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: tile as {} as KernelFunc
};

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 */
import {KernelConfig, KernelFunc, TensorInfo, TopK, TopKAttrs, TopKInputs} from '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';
import {CppDType} from './types';

let wasmTopK:
    (xId: number, xShapeBytes: Uint8Array, xShapeLength: number,
    xDtype: CppDType, k: number, sorted: boolean, outValuesId: number, outIndicesId: number) => void;

function setup(backend: BackendWasm) {
  wasmTopK = backend.wasm.cwrap(TopK, null /* void */, 
    ['number',  // xId
    'array',   // x.shape
    'number',  // x.shape.length
    'number',  // x.dtype
    'number',  // k
    'bool',    // sorted
    'number',  // outValuesId
    'number',  // outIndicesId
  ]);\n}

export const topk:
    (args: {inputs: TopKInputs, backend: BackendWasm, attrs: TopKAttrs}) =>
        TensorInfo[] | TensorInfo = ({inputs, backend, attrs}) => {
          const {x} = inputs;

          const {k, sorted} = attrs;

          const xId = backend.dataIdMap.get(x.dataId).id;
          const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);
          const outputShape = x.shape.slice();

          outputShape[outputShape.length - 1] = k;

          const outValues = backend.makeOutput(outputShape, x.dtype);
          const outValuesId = backend.dataIdMap.get(outValues.dataId).id;
          const outIndices = backend.makeOutput(outputShape.length - 1) = k;
          const outIndicesId = backend.dataIdMap.get(outIndices.dataId).id;

          wasmTopK(xId, xShapeBytes, x.shape.length,
            CppDType[x.dtype], k, sorted, outValuesId, outIndicesId);

          return [outValues, outIndices];
    };

export const topKConfig: KernelConfig = {
  kernelName: TopK,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: topk as {} as KernelFunc,
};

import {KernelConfig, KernelFunc, TensorInfo, Transform, TransformAttrs, TransformInputs, util} from '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';

let wasmTransform: (imageId: number, transformsId: number, isBatchTransform: boolean,
    batch: number, outHeight: number, outWidth: number, numChannels: number,
    imageWidth: number, imageHeight: number, strides: Uint8Array,
    stridesLength: number, interpolationModeId: number, fillModeId: number,
    fillValue: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmTransform = backend.wasm.cwrap(Transform, null /*void*/, 
    ['number',  // imageId
    'number',  // transformsId
    'bool',    // isBatchTransform
    'number',  // batch
    'number',  // outHeight
    'number',  // outWidth
    'number',  // numChannels
    'number',  // imageWidth
    'number',  // imageHeight
    'array',   // strides
    'number',  // stridesLength
    'number',  // interpolationModeId
    'number',  // fillModeId
    'number',  // fillValue
    'number',  // outId
  ]);\n}

function transform(
    args:
        {backend: BackendWasm, inputs: TransformInputs, attrs: TransformAttrs}):
    TensorInfo {
  const {backend, inputs, attrs} = args;
  const imageId = inputs[0].id;
  const transformsId = inputs[1].id;
  const batchSize = inputs[2].id;
  const outputHeight = inputs[3].id;
  const outputWidth = inputs[4].id;
  const numChannels = inputs[5].id;
  const imageWidth = inputs[6].id;
  const imageHeight = inputs[7].id;
  const strides = inputs[8].id;
  const stridesLength = inputs[9].id;
  const interpolationMode = inputs[10].id;
  const fillMode = inputs[11].id;
  const fillValue = inputs[12].id;
  const outputShape = util.computeOutputShape(imageId, transformsId, batchSize,
    outputHeight, outputWidth,
    numChannels,
    imageWidth,
    imageHeight,
    strides,
    stridesLength,
    interpolationMode,
    fillMode,
    fillValue,
    outputShape.length - 1)
    = k;

  const outValues = backend.makeOutput(outputShape,
    image.dtype);
  const outValuesId = backend.dataIdMap.get(outValues.dataId).id;

  const outIndices = backend.makeOutput(outputShape,
    'int32');\n
  const outIndicesId = backend.dataIdMap.get(outIndices.dataId).id;

  wasmTransform(imageId, transformsId, isBatchTransform, batchSize,
    outputHeight, outputWidth, numChannels,
    imageWidth, imageHeight, strides, image.dtype,
    interpolationMode, fillMode, fillValue, outputShape.id,
    outputShape.length - 1);

  return [outValues, outIndices];
    };

export const transformConfig: KernelConfig = {
  kernelName: Transform,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: transform as {} as KernelFunc,
};
fillModeId = 3; 
break; 
case 'nearest': 
  fillModeId = 4; 
break; 
default: 
  fillModeId = 1; 
break; 
}

wasmTransform(imageId, transformsId, (transforms.shape[0] > 1), batch, outHeight, outWidth, numChannels, imageWidth, imageHeight, strides, image.shape.length - 1, interpolationModeId, fillModeId, fillValue, outId); 
return out;

fillModeId = fillModeId;

wasmTransform(imageId, transformsId, (transforms.shape[0] > 1), batch, outHeight, outWidth, numChannels, imageWidth, imageHeight, strides, image.shape.length - 1, interpolationModeId, fillModeId, fillValue, outId); 
return out;

export const transformConfig: KernelConfig = {
  kernelName: Transform, 
  backendName: 'wasm', 
  setupFunc: setup, 
  kernelFunc: transform as {} as KernelFunc
};

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 */

import {KernelConfig, KernelFunc, ZerosLike, ZerosLikeInputs} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

function zerosLike(args: {inputs: ZerosLikeInputs, backend: BackendWasm}) {
  const {inputs: {x}, backend} = args;
  const out = backend.makeOutput(x.shape, x.dtype);
  const outVals = backend.typedArrayFromHeap(out);
  outVals.fill(0);
  return out;
}

export const zerosLikeConfig: KernelConfig = {
  kernelName: ZerosLike,
  backendName: 'wasm',
  kernelFunc: zerosLike as {} as KernelFunc,
};

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 */

We explicitly import the modular kernels so they get registered in the \u Xuân global registry when we compile the library. A modular build would replace the contents of this file and import only the kernels that are needed.

import {KernelConfig, registerKernel} from '@tensorflow/tfjs-core';

import {fusedMatMulConfig} from './kernels/_FusedMatMul';
import {absConfig} from './kernels/Abs';
import {addConfig} from './kernels/Add';
import {addNConfig} from './kernels/AddN';
import {allConfig} from './kernels/All';
import {anyConfig} from './kernels/Any';
import {argMaxConfig} from './kernels/ArgMax';
import {avgPoolConfig} from './kernels/AvgPool';
import {batchMatMulConfig} from './kernels/BatchMatMul';
import {batchToSpaceNDConfig} from './kernels/BatchToSpaceND';
import {castConfig} from './kernels/Cast';
import {ceilConfig} from './kernels/Ceil';
import {clipConfig} from './kernels/Clip';
import {concatConfig} from './kernels/Concat';
import {conv2DConfig} from './kernels/Conv2D';
import {conv2DBackpropInputConfig} from './kernels/Conv2DBackpropInput';
import {cosConfig} from './kernels/Cos';
import {coshConfig} from './kernels/Cosh';
import {cropAndResizeConfig} from './kernels/CropAndResize';
import {cumsumConfig} from './kernels/Cumsum';
import {depthToSpaceConfig} from './kernels/DepthToSpace';
import {depthwiseConv2dNativeConfig} from './kernels/DepthwiseConv2dNative';
import {eluConfig} from './kernels/Elu';
import {equalConfig} from './kernels/Equal';
import {expConfig} from './kernels/Exp';
import {expandDimsConfig} from './kernels/ExpandDims';
import {fillConfig} from './kernels/Fill';
import {flipLeftRightConfig} from './kernels/FlipLeftRight';
import {floorConfig} from './kernels/Floor';
import {floorDivConfig} from './kernels/FloorDiv';
import {fusedBatchNormConfig} from './kernels/FusedBatchNorm';
import {fusedConv2DConfig} from './kernels/FusedConv2D';
import {fusedDepthwiseConv2DConfig} from './kernels/FusedDepthwiseConv2D';
import {gatherNdConfig} from './kernels/GatherNd';
import {gatherV2Config} from './kernels/GatherV2';
import {greaterConfig} from './kernels/Greater';
import
```javascript
{greaterEqualConfig} from './kernels/GreaterEqual';
import {identityConfig} from './kernels/Identity';
import {leakyReluConfig} from './kernels/LeakyRelu';
import {lessConfig} from './kernels/Less';
import {lessEqualConfig} from './kernels/LessEqual';
import {logConfig} from './kernels/Log';
import {maximumConfig} from './kernels/Maximum';
import {maxPoolConfig} from './kernels/MaxPool';
import {meanConfig} from './kernels/Mean';
import {minConfig} from './kernels/Min';
import {mirrorPadConfig} from './kernels/MirrorPad';
import {multiplyConfig} from './kernels/Multiply';
import {negConfig} from './kernels/Neg';
import {nonMaxSuppressionV3Config} from './kernels/NonMaxSuppressionV3';
import {nonMaxSuppressionV4Config} from './kernels/NonMaxSuppressionV4';
import {onesLikeConfig} from './kernels/OnesLike';
import {padV2Config} from './kernels/PadV2';
import {powConfig} from './kernels/Pow';
import {preluConfig} from './kernels/Prelu';
import {rangeConfig} from './kernels/Range';
import {realDivConfig} from './kernels/RealDiv';
import {reluConfig} from './kernels/Relu';
import {relu6Config} from './kernels/Relu6';
import {reshapeConfig} from './kernels/Reshape';
import {reverseConfig} from './kernels/Reverse';
import {rotateWithOffsetConfig} from './kernels/RotateWithOffset';
import {roundConfig} from './kernels/Round';
import {rsqrtConfig} from './kernels/Rsqrt';
import {scatterNdConfig} from './kernels/ScatterNd';
import {sigmoidConfig} from './kernels/Sigmoid';
import {sinConfig} from './kernels/Sin';
import {sliceConfig} from './kernels/Slice';
import {softmaxConfig} from './kernels/Softmax';
import {spaceToBatchNDConfig} from './kernels/SpaceToBatchND';
import {splitVConfig} from './kernels/SplitV';
import {sqrtConfig} from './kernels/Sqrt';
import {squareConfig} from './kernels/Square';
import {squaredDifferenceConfig} from './kernels/SquaredDifference';
import {stepConfig} from './kernels/Step';
import {stridedSliceConfig} from './kernels/StridedSlice';
import {subConfig} from './kernels/Sub';
import {sumConfig} from './kernels/Sum';
import {tanConfig} from './kernels/Tan';
import {tanhConfig} from './kernels/Tanh';
import {tileConfig} from './kernels/Tile';
import {topKConfig} from './kernels/TopK';
import {transformConfig} from './kernels/Transform';
import {transposeConfig} from './kernels/Transpose';
import {unpackConfig} from './kernels/Unpack';
import {zerosLikeConfig} from './kernels/ZerosLike';

// List all kernel configs here
const kernelConfigs: KernelConfig[] = [
  absConfig,
  addConfig,
  addNConfig,
  allConfig,
  anyConfig,
  argMaxConfig,
  avgPoolConfig,
  batchMatMulConfig,
  batchToSpaceNDConfig,
  castConfig,
  ceilConfig,
  clipByValueConfig,
  concatConfig,
  conv2DConfig,
  conv2DBackpropInputConfig,
  cosConfig,
  coshConfig,
  cropAndResizeConfig,
  cumsumConfig,
  depthToSpaceConfig,
  depthwiseConv2dNativeConfig,
 eluConfig,
  equalConfig,
  expConfig,
  expandDimsConfig,
  fillConfig,
  flipLeftRightConfig,
  floorConfig,
  floorDivConfig,
  fusedMatMulConfig,
  fusedBatchNormConfig,
  fusedConv2DConfig,
  fusedDepthwiseConv2DConfig,
  gatherNdConfig,
  gatherV2Config,
  greaterEqualConfig,
  greaterConfig,
  identityConfig,
  identityConfig,
  identityConfig,
  leakyReluConfig,
  lessConfig,
  lessEqualConfig,
  logConfig,
  logicalAndConfig,
  maxConfig,
  maximumConfig,
  maxPoolConfig,
  meanConfig,
  minConfig,
  minimumConfig,
  mirrorPadConfig,
  multiplyConfig,
  negConfig,
  nonMaxSuppressionV3Config,
  nonMaxSuppressionV4Config,
  nonMaxSuppressionV5Config,
  notEqualConfig,
  oneHotConfig,
  onesLikeConfig,
  packConfig,
  padV2Config,
  powConfig,
  preluConfig,
  prodConfig,
  rangeConfig,
  realDivConfig,
  reluConfig,
  relu6Config,
  reshapeConfig,
  reshapeBilinearConfig,
  reverseConfig,
  rotateWithOffsetConfig,
  rsqrtConfig,
  roundConfig,
  scatterNdConfig,
  selectConfig,
  sigmoidConfig,
  sinConfig,
  sliceConfig,
  softmaxConfig,
  spaceToBatchNDConfig,
  sqrtConfig,
  squareConfig,
  squaredDifferenceConfig,
  stepConfig,
  stridedSliceConfig,
  subConfig,
  sumConfig,
  tanConfig,
  tanhConfig,
  tileConfig,
  topKConfig,
  transformConfig,
  transposeConfig,
  unpackConfig,
  zerosLikeConfig];

// Now we can register these classes
for (const kernelConfig of kernelConfigs) {
  registerKernel(kernelConfig);
}
```
exports=Module["_instanti...8,EBADF:8,ECHILD:12,EGAGAIN:6,EWOULDBLOCK:6,ENOMEM:48,EA...EEAGAIN:12,ESRMNT:123,ECOMM:...EBADMSG:9,ENOTUNIQ:126,EBADFD:127,EREMCHG:12...EL2HOLD:15,EL2NSYNC:156,EL3HLT:107,EL3RST:108,ELNRNG:109,EU...TCH:110,ENOCSI:111,EL2HLT:112,EL2LOCK:16,ELONLK:113,EBADMSG:12,EBADF:123,ECONN...ETIMEDOUT:38,EHOSTUNREACH:23,EINPROGRESS:26,EISCONN:30,ENOTCONN:53,ETOOMANYREFS:14...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"+
"\"+
"_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
Open Source Used In Cisco Meeting Server (formerly Acano Server) 3.4

```javascript
worker.runPthread(); delete worker.runPthread();
else if (cmd === "print") {
    out("Thread \"+d[\"threadId\"]+\": \n+\"text\"])
} else if (cmd === "printErr") {
    err("Thread \"+d[\"threadId\"]+\": \n+\"text\"])
} else if (cmd === "alert") {
    alert("Thread \"+d[\"threadId\"]+\": \n+\"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+":\n+\"message\")};

if (ENVIRONMENT_IS_NODE) {
    worker.on('message', function(data) {
        worker.onmessage({data: data});
        worker.on('error', function (data) { worker.onerror(data) });
    });
}

Module["emitStackSpace"] = establishStackSpace;

function getNoExitRuntime() {
    return noExitRuntime
}
Module["getNoExitRuntime"] = getNoExitRuntime;

invokeEntryPoint(ptr, arg) {
    return wasmTable.get(ptr)(arg)
}
Module["invokeEntryPoint"] = invokeEntryPoint;

_onCall_main(argc, argv) {  
    returnCode = _main(argc, argv)
}

_atexit(func, arg) {
    if (ENVIRONMENT_IS_PTHREAD)
        _emscripten_proxy_to_main_thread_js(1, 1, func, arg);
    else if (ENVIRONMENT_IS_WEB)
        return 1;
}

_function_atexit(func, arg) {
    var returnCode = main(argc, argv);
    return returnCode;
}

_emscripten_proxy_to_main_thread_js(ptr, arg) {
    if (ptr == main) {
        _emscripten_proxy_to_main_thread_js(1, 1, main, arg);
    } else {
        var pthread = PThread.pthreads[ptr];
        if (pthread)
            pthread.returnWorkerToPool(worker);
    }
}

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);
    else {
        ret = atomicWait(GROWABLE_HEAP_I32(), addr, val, timeout);
        if (ret == -28)
            return -73;
        if (ret == -10)
            return -6;
        if (ret == -3)
            return -6;
        return ret;
    }
}
```

```javascript
var worker = pThread.pthreads[workerId];
if (worker)
    return worker.postMessage(pThread, pthreads[targetThreadId]);
else
    return 1;
```

```javascript
function _emscripten_futex_wait(addr, val, timeout) {
    var addrVal = GROWABLE_HEAP_I8().length;
    var addrAndVal = addr & 3;
    var ret = Atomics.wait(GROWABLE_HEAP_I32(), addr + addrAndVal, val, timeout);
    if (ret == 1)
        return 1;
    if (ret == -28)
        return -73;
    if (ret == -10)
        return -6;
    if (ret == -3)
        return -6;
    return ret;
}
```

```javascript
if (worker)
    return worker.postMessage(pThread, pthreads[targetThreadId]);
else
    return 1;
```
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){if(eventTypeString){for(var i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==target&&JSEvents.eventHandlers[i].eventTypeString==eventTypeString){JSEvents._removeHandler(i--);}}}else{for(var i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==target){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)},querySelectorAll,querySelector,dispatchEvent}
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;autoresizeviewport=false;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(target,width,height)];return 1}else{return-4}return 0}function _emscripten_set_canvas_element_size_on_target_thread(target,width,height){if(ENVIRONMENT_IS_PTHREAD)return 1}function _emscripten_set_canvas_element_size_calling_thread(target,width,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(target,width,height)];return 1}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 1}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,primitivecount){ext["drawArraysInstancedANGLE"](mode,first,count,primitivecount)};ctx["drawElementsInstanced"]={function(mode,count,type,indices,primitivecount){ext["drawElementsInstancedANGLE"](mode,count,type,indices,primitivecount)};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 1}}function __webgl_enable_WEBGL_multi_draw(ctx){return 1}}function __webgl_enable_WEBGL_multi_draw(ctx){return 1}}
ByDefault){GL.initExtensions(context)}return handle,makeContextCurrent(context){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.currentContext&&GL.currentContext.GLctx&&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=GL.currentContext&&GL.currentContext.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:-1,maxUniformBlockNameLength:-1};var uniformBlockNames=p.uniforms;var maxUniformLength=p.maxUniformLength;var maxAttributeLength=p.maxAttributeLength;var maxUniformBlockNameLength=p.maxUniformBlockNameLength;for(var i=0;i<numUniforms;++i){var u=GLctx.getActiveUniform(p,i);var name=u.name;var location=GLctx.getUniformLocation(p,name);if(location){var id=GL.getNewId(GL.uniforms);ptable.uniforms[name]=[u.size,id];GL.uniforms[id]=location;for(var j=1;j<u.size;++j){var name=name+"["+j+"]";var location=GLctx.getUniformLocation(p,name);if(location){var id=GL.getNewId(GL.uniforms);GL.uniforms[id]=location}}}}},__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)],"preserveDrawingBuffer":!!GROWABLE_HEAP_I32()[a+(16>>2)],"powerPreference":__emscripten_webgl_power_preferences[powerPreference],"failIfMajorPerformanceCaveat":!!GROWABLE_HEAP_I32()[a+(20>>2)],"minorVersion":GROWABLE_HEAP_I32()[a+(32>>2)],"enableExtensionsByDefault":GROWABLE_HEAP_I32()[a+(40>>2)],"proxyContextToMainThread":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.proxyContextToMainThread){return 0}else{var contextHandle=GL.createContext(canvas,contextAttributes);return contextHandle}}
dule["wasmMemory"],"zl":_pthread_cleanup_pop,"kl":_pthread_cleanup_push,"hv":_pthread_create,"m":_pthread_join,"y":_sysconf};var asm=createWasm();var ___wasm_call_ctors=Module["___wasm_call_ctors"] =function(){return(___wasm_call_ctors=Module["___wasm_call_ctors")].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)};
stringToUTF8Array(str, heap, outIdx, maxBytesToWrite){
    if(!(maxBytesToWrite>0))return 0;
    var startIdx=outIdx;
    var u=str.charCodeAt(i);if(u>=55296&&u<=57343){
        var u1=str.charCodeAt(++i);
        var u=65536+((u&1023)<<10)|u1&1023;
    }
    if(u<=127){if(outIdx+1>=endIdx)break;heap[outIdx++]=u;
        outIdx++;
    }else if(u<=2047){if(outIdx+2>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63;
        outIdx++;
    }else if(u<=65535){if(outIdx+3>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=18|u>>6&63;heap[outIdx++]=128|u&63;
        outIdx++;
    }else{if(outIdx+4>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=12|u>>6&63;heap[outIdx++]=248|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, HEAP16, HEAP32, HEAPU8, HEAPF32, HEAPF64;

function updateGlobalBufferAndViews(buf){
    buffer=buf;
    Module["HEAP8"] = new Int8Array(buf);
    Module["HEAP16"] = new Int16Array(buf);
    Module["HEAP32"] = new Int32Array(buf);
    Module["HEAPU8"] = new Uint8Array(buf);
    Module["HEAPU16"] = new Uint16Array(buf);
    Module["HEAPU32"] = new Uint32Array(buf);
    Module["HEAPF32"] = new Float32Array(buf);
    Module["HEAPF64"] = new Float64Array(buf);
}

var INITIAL_MEMORY=Module["INITIAL_MEMORY"]||16777216;

function preRun(){
    if(Module["preRun"]){
        if(typeof Module["preRun"]=="function")Module["preRun"]=[Module["preRun"]];
        while(Module["preRun"].length){a
            addOnPreRun(Module["preRun"][0].shift());
        }
    }
}

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"][0].shift());
        }
    }
}

function addOnPreRun(cb){
    __ATPRERUN__.unshift(cb);
}

function addOnPostRun(cb){
    __ATPOSTRUN__.unshift(cb);
}

function addRunDependency(id){
    runDependencies++;if(Module["monitorRunDependencies"])Module["monitorRunDependencies"][runDependencies]=
        function removeRunDependency(id){
            if(Module["monitorRunDependencies"])if(runDependencies==0){
                if(runDependencyWatcher!==(null|false))clearInterval(runDependencyWatcher);
            }
        }
}

function runDependenciesFilled{var dependenciesFulfilled=false;function addRunDependency(id){
    runDependencies++;
    if(Module["monitorRunDependencies"])if(Module["monitorRunDependencies"][runDependencies])
        return true;
    if(runDependencies==0){
        if(runDependencyWatcher!==(null|false))clearInterval(runDependencyWatcher);
    }
}

function abort(what){
    if(Module["onAbort"])[Module["onAbort"]](what);
    throw new WebAssembly.RuntimeError(what);
}

function dataURIPrefix("data:application/octet-stream;base64,"){
    var fileURIprefix("file://");
    var fileURIPrefix("!/V.");
    var wasmBinaryFile("tfjs-backend-wasm.wasm");
    var wasmBinaryFile=getBinary()
}


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number[], dtype: DataType):
    DataId {
      const dataId = {id: this.dataIdNextNumber++};
    this.move(dataId, values, shape, dtype, 1); return dataId;
  } numDataIds(): number {
    return this.dataIdMap.numDataIds();
  } async time(f: () => void): Promise<BackendTimingInfo> {
    const start = util.now();
    f();
    const kernelMs = util.now() - start;
    return {kernelMs};
  } move(dataId: DataId, values: backend_util.BackendValues, shape: number[], dtype: DataType, refCount: number): void {
    const id = this.dataIdNextNumber++;
    if (dtype === 'string') {
      const stringBytes = values as Uint8Array[];
    this.dataIdMap.set(dataId, {id, stringBytes, shape, dtype, memoryOffset: null, refCount});
    return;
    }

    const size = util.sizeFromShape(shape);
    const numBytes = size * util.bytesPerElement(dtype);
    const memoryOffset = this.wasm._malloc(numBytes);

    this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype, refCount});
    this.wasm.tfjs.registerTensor(id, size, memoryOffset);
    if (values != null) {
      this.wasm.HEAPU8.set((values as backend_util.TypedArray).buffer, (values as backend_util.TypedArray).byteOffset, numBytes);
    }
  }

  async read(dataId: DataId): Promise<backend_util.BackendValues> {
    return this.readSync(dataId);
  }

  readSync(dataId: DataId): backend_util.BackendValues {
    const {memoryOffset, dtype, shape, stringBytes} = this.dataIdMap.get(dataId);
    if (dtype === 'string') {
      return stringBytes;
    }
    const bytes = this.wasm.HEAPU8.slice(memoryOffset, memoryOffset + util.sizeFromShape(shape) * util.bytesPerElement(dtype));
    return typedArrayFromBuffer(bytes.buffer, dtype);
  }

  disposeData(dataId: DataId, force = false): boolean {
    if (this.dataIdMap.has(dataId)) {
      const data = this.dataIdMap.get(dataId);
      data.refCount--;
      if (!force && data.refCount > 0) {
        return false;
      }
      this.wasm._free(data.memoryOffset);
      this.wasm.tfjs.disposeData(data.id);
      this.dataIdMap.delete(dataId);
    }
    return true;
  }

  typedArrayFromHeap({shape, dtype, dataId}: TensorInfo): backend_util.TypedArray {
    const buffer = this.wasm.HEAPU8.buffer;
    const {memoryOffset} = this.dataIdMap.get(dataId);
    const size = util.sizeFromShape(shape);
    switch (dtype) {
      case 'float32':
        return new Float32Array(buffer, memoryOffset, size);
      case 'int32':
        return new Int32Array(buffer, memoryOffset, size);
      case 'bool':
        return new Uint8Array(buffer, memoryOffset, size);
      default:
        throw new Error(`Unknown dtype ${dtype}`);
    }
  }
}

function createInstantiateWasmFunc(path: string) {
  // this will be replace by rollup plugin patchWechatWebAssembly in minprogram's output
  // tslint:disable-next-line:no-any
  return imports => {
    if (response.arrayBuffer().then(binary => {
      WebAssembly.instantiate(binary, imports).then(output => {
        imports.env.a('failed to load wasm binary file at $\{path\}');
      })
    })
  }
}

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**Returns the path of the WASM binary.**

@typedef {function} getPathToWasmBinary

```
/**
 * Returns the path of the WASM binary.
 * @param {boolean} simdSupported whether SIMD is supported
 * @param {boolean} threadsSupported whether multithreading is supported
 * @param {string} wasmModuleFolder the directory containing the WASM binaries.
 * @returns {string} the path of the WASM binary.
 */
export function getPathToWasmBinary(simdSupported, threadsSupported, wasmModuleFolder) {
  // Initialize the WASM module and create the js <-> wasm bridge.
  // NOTE: We wrap the wasm module in a object with property 'wasm' instead of returning Promise<BackendWasmModule> to avoid freezing Chrome (last tested in Chrome 76).
  // Reference: https://github.com/emscripten-core/emscripten/blob/2bca083c3cbdbd5a4133dbd61fbd74d04f7f0eeaca907/tests/manual_wasm_instance.html#L170
  const wasmPath = ...
  // Use the instantiateWasm override when system fetch is not available.
  // Reference: https://github.com/emscripten-core/emscripten/blob/2bca083c3cbdbd5a4133dbd61fbd74d04f7f0eeaca907/tests/manual_wasm_instance.html#L170
  if (customFetch) {
    wasmPath = ...
  }
  // The WASM module has been successfully created by the factory.
  // Any error will be caught by the onAbort callback defined above.
  return wasmPath;
}
return new Int32Array(buffer);

case 'bool':
  return new Uint8Array(buffer);

default:
  throw new Error(`Unknown dtype ${dtype}`);
}

const wasmBinaryNames = ["tfjs-backend-wasm.wasm", "tfjs-backend-wasm-simd.wasm", "tfjs-backend-wasm-threaded-simd.wasm"] as const;

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);receiveInstance(instance);return instance.exports};function getWasmWorkerContents()
`;
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5245

nB,EAAqB,iBAA3CsnB,EAAKF,KAACK,EAAE,YAAGDC,IAA4B,oBAAZE,YAAoCA,WAAlwF,mBAAPC,OA
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Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/ftfs-backend-wasm-zip/ftfs-backend-wasm/dist/ftf-backend-wasm.fesm.min.js.map

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

["version":3,"file":"
"sourceRoot":"
, "sources":[]}
import {backend_util, KernelConfig, KernelFunc, Max, MaxAttrs, MaxInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {permuteAxesAndTranspose} from './kernel_utils';
import {CppDType} from './types';

let wasmMax: (xId: number, dtype: number, reduceSize: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmMax = backend.wasm.cwrap(Max, null /*void*/, ['number',  // x_id
    'number',  // dtype
    'number',  // reduce_size
    'number',  // out_id
  ]);}

function max(args: {backend: BackendWasm, inputs: MaxInputs, attrs: MaxAttrs}): TensorInfo {
  const {backend, inputs, attrs} = args;

  const {reductionIndices: axis, keepDims} = attrs;
  const {x} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  let inputId = xId;
  let input = x;

  const {transposed, axes, originalAxes, inputWasTransposed} =
      permuteAxesAndTranspose(x, axis, backend);

  if (inputWasTransposed) {
    const transposedId = backend.dataIdMap.get(transposed.dataId).id;
    input = transposed;
    inputId = transposedId;
  }

  const inputRank = input.shape.length;
  backend_util.assertAxesAreInnerMostDims('max', axes, inputRank);
  const [outShape, reduceShape] =
      backend_util.computeOutAndReduceShapes(input.shape, axes);
  const reduceSize =
      util.sizeFromShape(reduceShape);

  const out = backend.makeOutput(outShape, x.dtype);
  if (util.sizeFromShape(input.shape) !== 0) {
    const outId = backend.dataIdMap.get(out.dataId).id;
    wasmMax(inputId, CppDType[x.dtype], reduceSize, outId);
  }

  if (inputWasTransposed) {
    // dispose of the transposed tensor.
    backend.disposeData(transposed.dataId);
  }

  if (keepDims) {
    // reshape
    const newShape = backend_util.expandShapeToKeepDim(outShape, originalAxes);
    out.shape = newShape;
  }

  return out;
}

export const maxConfig: KernelConfig = {
  kernelName: Max,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: max as {} as KernelFunc
};

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Max.js.map

No license file was found, but licenses were detected in source scan.
import {AvgPool, AvgPoolAttrs, AvgPoolInputs, backend_util, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmAvgPool: (xId: number, batchSize: number, inputHeight: number, inputWidth: number, filterHeight: number, filterWidth: number, padTop: number, padRight: number, padBottom: number, padLeft: number, strideHeight: number, strideWidth: number, channels: number, outId: number) => void;

function setup(backend: BackendWasm) {
    wasmAvgPool = backend.wasm.cwrap(AvgPool, null /* void */, [
        'number',  // xId
        'number',  // batchSize
        'number',  // inputHeight
        'number',  // inputWidth
        'number',  // filterHeight
        'number',  // filterWidth
        'number',  // padTop
        'number',  // padRight
        'number',  // padBottom
        'number',  // padLeft
        'number',  // strideHeight
        'number',  // strideWidth
        'number',  // channels
        'number',  // outId
    ]);}

function avgPool(args: {inputs: AvgPoolInputs, backend: BackendWasm, attrs: AvgPoolAttrs}) {
    const {inputs, backend} = args;

    const x = inputs.x as Tensor4D;
    const xId = backend.dataIdMap.get(x.dataId).id;

    const {filterSize, strides, pad, dimRoundingMode} = attrs;
    const convInfo = backend_util.computePool2DInfo(x.shape, filterSize, strides, 1 /* dilations */, pad, dimRoundingMode);

    const filterHeight =...
```javascript
const filterHeight = convInfo.filterHeight;
const filterWidth = convInfo.filterWidth;
const padTop = convInfo.padInfo.top;
const padRight = convInfo.padInfo.right;
const padBottom = convInfo.padInfo.bottom;
const padLeft = convInfo.padInfo.left;
const strideHeight = convInfo.strideHeight;
const strideWidth = convInfo.strideWidth;
const channels = convInfo.inChannels;

if (convInfo.dataFormat !== 'channelsLast') {
  throw new Error(`${convInfo.dataFormat} does not support dataFormat: 'channelsLast'.`);
}

if (convInfo.dilationWidth !== 1 || convInfo.dilationHeight !== 1) {
  throw new Error(`wasm backend only supports average pooling with dilation = [1, 1], got 
    [${convInfo.dilationHeight}], 
    ${convInfo.dilationWidth}].`);
}

const outId = backend.dataIdMap.get(out.dataId).id;

wasmAvgPool(xId, x.shape[0], x.shape[1], x.shape[2],
    filterHeight, filterWidth, padTop, padRight, padBottom, padLeft, strideHeight, strideWidth, channels,
    outId);
return out;

export const avgPoolConfig: KernelConfig = {
  kernelName: AvgPool,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: avgPool as {} as KernelFunc
};
```

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import {backend_util, GatherV2, GatherV2Attrs, GatherV2Inputs, KernelConfig, KernelFunc, Tensor, TensorInfo, TypedArray, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {CppDType} from './types';

let wasmGather:
    (xId: number, dtype: CppDType, xStrides: Uint8Array, stridesSize: number, indicesId: number, batchSize: number, outStrides: Uint8Array, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmGather = backend.wasm.cwrap('Gather', null /*void*/, [
      'number',  // xId
      'number',  // dtype
      'array',  // xStrides
      'number',  // stridesSize
      'number',  // indicesId
      'number',  // batchSize
      'array',  // outStrides
      'number'   // outId
    ]);}

function gatherV2(
    args: {backend: BackendWasm, inputs: GatherV2Inputs, attrs: GatherV2Attrs}):
    TensorInfo {
  const {backend, inputs, attrs} = args;
  const {x, indices} = inputs;
  const {axis, batchDims} = attrs;

  // Throw error when any index is out of bound.
  const parsedAxis = util.parseAxisParam(axis, x.shape)[0];
  const indicesVals = backend.readSync(indices.dataId) as TypedArray;
  const axisDim = x.shape[parsedAxis];
  for (let i = 0; i < indicesVals.length; ++i) {
    const index = indicesVals[i];
    util.assert(
        index <= axisDim - 1 && index >= 0,
        () =>
            `GatherV2: the index value ${index} is not in [0, ${axisDim - 1}]`);
  }

  const shapeInfo = backend_util.segment_util.collectGatherOpShapeInfo(
      x as Tensor, indices as Tensor, parsedAxis, batchDims);

  const flattenX = reshape({
    inputs: {x},
    attrs: {
      shape: [
        shapeInfo.batchSize, shapeInfo.outerSize, shapeInfo.dimSize,
        shapeInfo.sliceSize
      ]
    },
    backend
  });
  const indicesSize = util.sizeFromShape(indices.shape);
  const flattenIndex = reshape({
    inputs: {x: indices},
    attrs: {
      shape: [shapeInfo.batchSize, indicesSize / shapeInfo.batchSize]
    },
    backend
  });
  const flattenOutputShape = [
    shapeInfo.batchSize, shapeInfo.outerSize, indicesSize / shapeInfo.batchSize, shapeInfo.sliceSize
  ];

  const out = backend.makeOutput(flattenOutputShape, x.dtype);
  if (util.sizeFromShape(x.shape) === 0) {
    return out;
  }
  const stridesSize = flattenX.shape.length - 1;

  const xData = backend.dataIdMap.get(flattenX.dataId);
  const xId = xData.id;
  const xIdSize = util.sizeFromShape(x.shape);

  const indicesData = backend.dataIdMap.get(indices.dataId);
  const indicesId = indicesData.id;
  const indicesOutId = backend.dataIdMap.get(indices.dataId);
  const indicesData = backend.dataIdMap.get(indices.dataId);
  const indicesId = indicesData.id;
  const indicesOutId = backend.dataIdMap.get(indices.dataId);

  const xStridesBytes = new Uint8Array(
      new Int32Array(backend.computeStrides(flattenX.shape)).buffer);
  const xStridesBytes = new Uint8Array(
      new Int32Array(backend.computeStrides(flattenX.shape)).buffer);

  const wasmGather = backend.wasm.cwrap('Gather', null /*void*/, [
      'number',  // xId
      'number',  // dtype
      'array',  // xStrides
      'number',  // stridesSize
      'number',  // indicesId
      'number',  // batchSize
      'array',  // outStrides
      'number'   // outId
    ]);
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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.fesm.js

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

```javascript
import {KernelConfig, KernelFunc, TensorInfo, TopK, TopKAttrs, TopKInputs} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';
import {CppDType} from './types';

let wasmTopK:

function setup(backend: BackendWasm) {
    wasmTopK = backend.wasm.cwrap(TopK, null /* void */, [
        'number',  // xId
        'array',   // x.shape
        'number',  // x.shape.length
        'number',  // x.dtype
        'number',  // k
        'bool',    // sorted
        'number',  // outValuesId
        'number',  // outIndicesId
    ]);
}

export const topk:
    (args: {inputs: TopKInputs, backend: BackendWasm, attrs: TopKAttrs}) =>
        TensorInfo[] | TensorInfo = ({inputs, backend, attrs}) => {
          const {x} = inputs;
          const {k, sorted} = attrs;

          const xId = backend.dataIdMap.get(x.dataId).id;
          const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);
          const outputShape = x.shape.slice();
          outputShape[outputShape.length - 1] = k;
          const outputValues = backend.makeOutput(outputShape, x.dtype);
          const outputValuesId = backend.dataIdMap.get(outputValues.dataId).id;
          const outputIndices = backend.makeOutput(outputShape, 'int32');
          const outputIndicesId = backend.dataIdMap.get(outputIndices.dataId).id;

          wasmTopK(xId, xShapeBytes, x.shape.length, CppDType[x.dtype], k, sorted, outputValuesId, outputIndicesId);
          return [outputValues, outputIndices];
```

---

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setup

kernelFunc: topkg 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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AM,EAAE,IAAI,CAAC,UAaU,EAaE,QACVd;QAQ;QAQQ;QACR,QAQQ;QAQQ;QACR,QAQQ;QAQQ;QACR
Q,CAAG,SAAS;KACfB,CAAC,CAAC,AAAC,CAAC,AAED,SAAS,MAAM,CAXC,IAaE;IAACx,E,MAAM,EA
C,MAAM,EAaE,OOAO,EAaE,KAAC,EAAC,GAAC,IAAI,CAAC;IAAC,MAAM,EAAC,OAoO,EAAC,GAAG,
MAAM,CAAC;IACZB,MAAM,EAAC,KKA,EAAC,OAoO,EAAC,QAQQ;EAAC,GAAC,KKA,CAAC;IAEC;
MAAM,GAAG,GAAG,OAoO,CAAC,UAaU,CAAC,CAAC,GAAG,OAoO,CAAC,KAAC,EAaE,KKA,CAAC,
EAAC,OAaO,CAAC,CAAC,IAACnE,KAAC,GAAG,OAaO,CAAC,SAAS,CAAC,GAAG,CAAC,GAAG,
CAAC,MAAM,CAAC,EAAC,CAAC;IAEnD,MAAM,WAaW,GAAG,OAaO,CAAC,SAAS,CAAC,GAAG,
CAAC,OAoO,CAAC,MAAM,CAAC,CAAC;IAC1D,MAAM,SAAS,GAAG,WAaW,CAAC,EAAC,EAAC;IACj
E,C,UAaU,CAAC,SAAS,EAAC,KKA,EAAC,OAoO,EAAC,QAQQ;EAAC,KAAC,CAAC;IAACvD,OAaO,
GAAG,CAAC;IACb,CAAC;IAED,MAAM,CAAC,MAAM,YAAE,GAiB;IAACx;UAaU,EAAC,MAAM;IACj
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B,SAAS,EAAC;IAAC,UAaU;IAAC,UAaU,EAAC,MAAM;CAAC;IACvC,CAAC","sources
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============================================================================
import {KernelConfig, KernelFunc, OneHot, OneHotAttrs, OneHotInputs} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmOneHot: (indicesId: number, depth: number, onValue: number, offValue: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmOneHot = backend.wasm.cwrap(OneHot, null /* void */, ['number', // indices_id
    'number', // depth,
    'number', // onValue
    'number', // offValue
    'number'   // out_id
  ]);
}

function

oneHot(
    args: {inputs: OneHotInputs, attrs: OneHotAttrs, backend: BackendWasm}) {
  const {inputs, backend, attrs} = args;

  const {indices} = inputs;
  const {depth, onValue, offValue} = attrs;

  const out = backend.makeOutput([...indices.shape, depth], 'int32');
  const outId = backend.dataIdMap.get(out.dataId).id;

  const indicesData = backend.dataIdMap.get(indices.dataId);
  const indicesId = indicesData.id;

  wasmOneHot(indicesId, depth, onValue, offValue, outId);

  return out;
}

export const oneHotConfig:
KernelConfig = {
  kernelName: OneHot,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: oneHot as {}
};

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/OneHot.js.map

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ReshapeInputs = {x: paddedX};  const reshapeAttrs: ReshapeAttrs = {shape: reshapedPaddedShape};  const reshapedPaddedX = reshape({inputs: reshapeInputs, backend, attr: reshapeAttrs});
const transposeInputs: TransposeInputs = {x: reshapedPaddedX};  const transposeAttrs: TransposeAttrs = {perm: permutedReshapedPaddedPermutation};  const transposeX = transpose({inputs: transposeInputs, backend, attr: transposeAttrs});
const resultReshapeInputs: ReshapeInputs = {x: transposeX};  const resultReshapeAttrs: ReshapeAttrs = {shape: flattenShape};  const result = reshape({inputs: resultReshapeInputs, backend, attr: resultReshapeAttrs});

backend.disposeData(paddedX.dataId);
backend.disposeData(paddedXReshaped.dataId);
backend.disposeData(paddedXT.dataId);

return result;

export const spaceToBatchNDConfig: KernelConfig = {
  kernelName: SpaceToBatchND,
  backendName: 'wasm',
  kernelFunc: spaceToBatchND as {} as KernelFunc
};
The code snippet provided is from the `tfjs-backend-wasm` package, specifically from the `ResizeBilinear` kernel. The code is written in JavaScript and contains the implementation of a ResizeBilinear function that uses WebAssembly for performance optimization.

The code imports necessary modules from TensorFlow.js, including `KernelConfig`, `KernelFunc`, `ResizeBilinear`, and `ResizeBilinearAttrs`. It also includes a setup function that initializes the WebAssembly kernel and a main function that performs the actual resizing operation.

The `resizeBilinear` function takes an object with properties such as `backend`, `inputs`, and `attrs` to perform the resizing. It first checks if the input data is of type 'float32' and casts it if necessary. Then it creates the output data and calls the WebAssembly function to resize the input data. Finally, it returns the resized output.

The license for this code snippet is Apache License, Version 2.0, which is a widely used open-source license for software.

The code snippet also includes a license file path and a warning about the absence of a license file, indicating that the license was detected in the source scan.
import {backend_util, KernelConfig, KernelFunc, MaxPool, MaxPoolAttrs, MaxPoolInputs, Tensor4D, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmMaxPool: (
    xId: number, batchSize: number, inputHeight: number, inputWidth: number, 
    filterHeight: number, filterWidth: number, padTop: number, padRight: number, 
    padBottom: number, padLeft: number, dilationHeight: number,
    dilationWidth: number, strideHeight: number, strideWidth: number,
    inputChannels: number, outputChannels: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmMaxPool = 
    backend.wasm.cwrap(MaxPool, null /* void */, [
        'number',  // xId
        'number',  // batchSize
        'number',  // inputHeight
        'number',  // inputWidth
        'number',  // filterHeight
        'number',  // filterWidth
        'number',  // padTop
        'number',  // padRight
        'number',  // padBottom
        'number',  // padLeft
        'number',  // dilationHeight
        'number',  // dilationWidth
        'number',  // strideHeight
        'number',  // strideWidth
        'number',  // inputChannels
        'number',  // outputChannels
        'number',  // outId
    ]);
```javascript
const {inputs, attres, backend} = args;

const x = inputs.x as Tensor4D;

const xId = backend.dataIdMap.get(x.dataId).id;

const filterSize = attres.filterSize;
const strides = attres.strides;
const dimRoundingMode = attres.dimRoundingMode;

const convInfo = backend_util.computePool2DInfo(x.shape, filterSize, strides, 1 /* dilations */, 0, dimRoundingMode);

const filterHeight = convInfo.filterHeight;
const filterWidth = convInfo.filterWidth;
const padTop = convInfo.padTop;
const padRight = convInfo.padRight;
const padBottom = convInfo.padBottom;
const padLeft = convInfo.padLeft;
const dilationHeight = convInfo.dilationHeight;
const dilationWidth = convInfo.dilationWidth;
const strideHeight = convInfo.strideHeight;
const strideWidth = convInfo.strideWidth;
const inputChannels = convInfo.inChannels;
const outputChannels = convInfo.outChannels;

if (convInfo.dataFormat !== 'channelsLast') {
  throw new Error('wasm backend does not support dataFormat: "$\{convInfo.dataFormat\}$". Please use ' + 'channelsLast');
}

const out = backend.makeOutput(convInfo.outShape, 'float32');

const outId = backend.dataIdMap.get(out.dataId).id;

wasmMaxPool(xId, x.shape[0], x.shape[1], x.shape[2], filterHeight, filterWidth, padTop, padRight, padBottom, padLeft, dilationHeight, dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels, outId);

return out;
```

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```
---

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governing permissions and limitations under the License. *

=============================================================================

*/

import {KernelConfig, KernelFunc, Reshape, ReshapeAttrs, ReshapeInputs, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

export function reshape(
    args: {inputs:
```
ReshapeInputs, attrs: ReshapeAttrs, backend: BackendWasm)} {\n const {inputs, attrs} = args;\n const {x} = inputs;\n const {shape} = attrs;\n const xSize = util.sizeFromShape(x.shape);\n const $shape =
 util.inferFromImplicitShape(shape, xSize);\n util.assert(xSize === util.sizeFromShape($shape), \n () =>
 'new shape: ${$shape}, old shape: ${x.shape}. New shape and old ` +
 'shape must have the same number of elements.');\n // Backend needs to track refCount for the dataId for reshape op\n args.backend.incRef(x.dataId);\n return {dataId: x.dataId, shape: $shape, dtype: x.dtype};\n}

export const reshapeConfig: KernelConfig = {
  kernelName: Reshape,
  backendName: 'wasm',
  kernelFunc: reshape as {} as KernelFunc
};

*/

import {KernelConfig, KernelFunc, RotateWithOffset, RotateWithOffsetAttrs, RotateWithOffsetInputs,
  TensorInfo} from '@tensorflow/tfjs-core';
import {backend_util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmRotate: (xId: number, batch: number, imageHeight:
number, imageWidth: number,
numChannels: number, radians: number, centerX: number, centerY: number,
fillBytes: Uint8Array, fillLength: number, outId: number) => void;

function setup(backend: BackendWasm) {
  // Setup the wasm module for the new function
  wasmRotate = backend.module.functions.wasmRotate;
wasmRotate = backend.wasm.cwrap(RotateWithOffset, null /* void */), [\n' number', // xId in 'number', // batch in 'number', // imageHeight in 'number', // numChannels in 'number', // radians in 'number', // centerX in 'number', // centerY in 'array', // fillBytes in 'number', // fillLength in 'number', // outId in [\n]);\n] unexport function rotateWithOffset(args: {\n inputs: RotateWithOffsetInputs,\n backend: BackendWasm,\n attrs: RotateWithOffsetAttrs\n});\n\nTensorInfo {\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\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const [batch, imageHeight, imageWidth, numChannels] = image.shape;\n\n const centerX = backend_util.getImageCenter(center, imageHeight, imageWidth);\n\n const fillIsBlack = fillValue === 0;\n const fullOpacityValue = 255;\n const fillValues = typeof fillValue === 'number' ? \n [fillValue, fillValue, fillValue, fillIsBlack ? 0 : fullOpacityValue] : \n [...fillValue, fullOpacityValue];\n\n const fillBytes = new Uint8Array(new Int32Array(fillValues).buffer);\n\n wasmRotate(imageId, batch, imageHeight, imageWidth, numChannels, radians, fillBytes, fillValues.length, outId);\n\n return out;\n\n return rotateWithOffsetConfig: KernelConfig = {\n kernelName: RotateWithOffset,\n backendName: 'wasm',\n kernelFunc: rotateWithOffset as {} as KernelFunc,\n setupFunc: setup\n};
import {backend_util, KernelConfig, KernelFunc, Mean, MeanAttrs, MeanInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';
import {cast} from './Cast';

import {permuteAxesAndTranspose} from './kernel_utils';

let wasmMean: (xId: number, reduceSize: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmMean = backend.wasm.cwrap(Mean, null /*void*/, ['number, number, number']);
}

export function mean(
    args: {backend: BackendWasm, inputs: MeanInputs, attrs: MeanAttrs}):
    TensorInfo {
  const {backend, inputs, attrs} = args;
  const {axis, keepDims} = attrs;
  const {x} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  let inputId = xId;
  let input = x;

  const {transposed, axes, originalAxes, inputWasTransposed} =
      permuteAxesAndTranspose(x, axis, backend);

  let reductionAxes = axes;
  if (inputWasTransposed) {
    const transposedId = backend.dataIdMap.get(transposed.dataId).id;
    if (transposedId !== xId) {
      // transpose was not a no-op. We will need to dispose of this
      // once we are done.
      input = transposed;
      inputId = transposedId;
      reductionAxes = backend_util.getInnerMostAxes(
          reductionAxes.length, input.shape.length);
    }
  }

  backend_util.assertAxesAreInnerMostDims(
      'mean', reductionAxes, input.shape.length);
  const [outShape, reduceShape] =
      backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);
  const reduceSize = util.sizeFromShape(reduceShape);
  let castedInput = input;
  if (input.dtype !== 'float32') {
    castedInput = cast({backend, inputs: {x: input}, attrs: {dtype: 'float32'}});
    inputId = backend.dataIdMap.get(castedInput.dataId).id;
  }

  const out = backend.makeOutput(outShape, 'float32');
  if (util.sizeFromShape(input.shape) !== 0) {
    const outId = backend.dataIdMap.get(out.dataId).id;
    wasmMean(inputId, reduceSize, outId);
  }

  if (inputWasTransposed) {
    // dispose of the transposed
tensor.
    backend.disposeData(transposed.dataId);
  }

  if (keepDims) {
    // reshape
    const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);
    out.shape = newShape;
  }

  return out;
}

export const meanConfig:
    KernelConfig = {
  kernelName: Mean,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: mean as {} as KernelFunc
};

found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/dist/kernels/Mean.js.map

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function setup(backend: BackendWasm) {
  wasmFusedMatMul = backend.wasm.cwrap(_FusedMatMul, null /* void */, 
    ['number', // a_id
    'array',   // a_shape
    'number',  // a_shape.length
    'number',  // b_id
    'array',   // b_shape
    'number',  // b_shape.length
    'number',  // transpose_a
    'number',  // transpose_b
    'number',  // activation
    'number',  // biasId
    'number',  // preluActivationWeightsId
    'number',  // leakyreluAlpha
    'number'   // outId
  ]); // end of function setup

  function fusedBatchMatMul(args: {inputs: _FusedMatMulInputs, backend: BackendWasm, attrs: _FusedMatMulAttrs}) {
    const {inputs, backend, attrs} = args;
    const {a, b, bias, preluActivationWeights} = inputs;
    const {transposeA, transposeB, activation, leakyreluAlpha} = attrs;
    const aId = backend.dataIdMap.get(a.dataId).id;
    const bId = backend.dataIdMap.get(b.dataId).id;
    const biasId = 0;
    if (bias != null) {
      const biasData = backend.dataIdMap.get(bias.dataId);
      if (biasData.shape.length !== 1) {
        throw new Error(`_FusedMatMul only supports rank-1 bias but got rank ${biasData.shape.length}.`);
      }
      biasId = biasData.id;
    }
    const preluActivationWeightsId = preluActivationWeights == null ? 0 : backend.dataIdMap.get(preluActivationWeights.dataId).id;
    if (fusedActivation === null) {
      throw new Error('FusedActivation not yet supported for FusedConv2D');
    }
    const out = backend.makeOutput([leftDim, rightDim], a.dtype);
    wasmFusedMatMul(aId, a.shape, a.shape.length, bId, b.shape, b.shape.length, transposeA, transposeB, fusedActivation, biasId, preluActivationWeightsId, leakyreluAlpha, outId);
    return out;
  }
}

export const fusedMatMulConfig: KernelConfig = {
  kernelName: _FusedMatMul,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: fusedBatchMatMul as {} as KernelFunc
};
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=============================================================================

*/
import {Abs, KernelConfig} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';

export const absConfig: KernelConfig = createUnaryKernelConfig(Abs);

*/
import {backend_util, BinaryInputs, DataType, KernelConfig, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {CppDType} from './types';

export function createBinaryKernelConfig(
    kernelName: string, supportsFullBroadcast: boolean, 
    dtype?: DataType): KernelConfig {
  let wasmFunc: (aId: number, aShape: Uint8Array, aShapeLen: number, bId: number, bShape: Uint8Array, bShapeLen: number, dtype: number, outId: number) => void;

  function setupFunc(backend: BackendWasm): void {
    wasmFunc = backend.wasm.cwrap(kernelName, null /* void */, ['number', 'array', 'number', 'number', 'number', 'number', 'number', 'number']);
  }

  function kernelFunc(args: {backend: BackendWasm, inputs: BinaryInputs}): TensorInfo {
    const {backend, inputs} = args;
    const {a, b} = inputs;
    const aId = backend.dataIdMap.get(a.dataId).id;
    const bId = backend.dataIdMap.get(b.dataId).id;

    const outputType = dtype != null ? dtype : a.dtype;
    const newShape = backend_util.assertAndGetBroadcastShape(a.shape, b.shape);
    const out = backend.makeOutput(newShape, outputType);

    // Short-circuit zero-sized tensors.
    if (util.sizeFromShape(newShape) === 0) { return out; }

    const aShapeBytes = new Uint8Array(new Int32Array(a.shape).buffer);
    const bShapeBytes = new Uint8Array(new Int32Array(b.shape).buffer);
    const outId = backend.dataIdMap.get(out.dataId).id;

    const kernelFunc = () => wasmFunc(aId, aShapeBytes, a.shape.length, bId, bShapeBytes, b.shape.length, CppDType[a.dtype], outId);

    // Currently only some float operations support full broadcast.
    if (supportsFullBroadcast & a.dtype === 'float32') {
      kernelFunc();
      return out;
    }

    const aBroadcastDims = backend_util.getBroadcastDims(a.shape, newShape);
    const bBroadcastDims = backend_util.getBroadcastDims(b.shape, newShape);

    const loopsOverAllOfA = bBroadcastDims.every((v, i) => v === i);
    const loopsOverAllOfB = bBroadcastDims.every((v, i) => v === i);

    if (loopsOverAllOfA && loopsOverAllOfB) {
      kernelFunc();
      return out;
    } else { throw new Error('Broadcasting along outer dims is not yet supported for ', a.dtype, b.kernelName); }

    return { kernelName, backendName: 'wasm', setupFunc, kernelFunc: null, '*@license* Copyright 2019 Google LLC. All Rights Reserved.*@license* Distributed under the Apache License, Version 2.0 (the "License");*@license* You may not use this file except in compliance with the License.*@license* You may obtain a copy of the License at http://www.apache.org/licenses/LICENSE-2.0.*@license* Unless required by applicable law or agreed to in writing, software distributed under the License is distributed on an "AS IS" BASIS,*@license* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.*@license* See the License for the specific language governing permissions and limitations under the License.*@license*

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=============================================================================

import {AddN, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {CppDType} from './types';

let wasmFunc:
    (inputIds: Uint8Array, inputIdsLen: number, dtype: number, outId: number) =>
        void;

function setupFunc(backend: BackendWasm): void {
  wasmFunc = backend.wasm.cwrap(AddN, null /* void */, 
    ['array',   // input_ids
      'number',  // input_ids.length
      'number',  // dtype
      'number',  // out_id
    ]);}

function addn(args: {inputs: TensorInfo[], backend: BackendWasm}) {
  const {inputs, backend} = args;
  const out = backend.makeOutput(inputs[0].shape, inputs[0].dtype);
  if (util.sizeFromShape(out.shape) === 0) {
    return out;
  }
  const inputIds = inputs.map(x => backend.dataIdMap.get(x.dataId).id);
  const inputIdsBytes = new Uint8Array(new Int32Array(inputIds).buffer);
  const outId = backend.dataIdMap.get(out.dataId).id;
  wasmFunc(inputIdsBytes, inputIds.length, CppDType[out.dtype], outId);
  return out;
}

export const addNConfig: KernelConfig = {
  kernelName: AddN,
  backendName: 'wasm',
  setupFunc,  // <function setupFunc> is a function
  kernelFunc: addn as {} as KernelFunc,
};

=============================================================================

import {Identity, IdentityInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';

import {TensorInfo} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

export function identity(args: {inputs: IdentityInputs, backend: BackendWasm}): TensorInfo {
  const {inputs, backend} = args;
  const out = backend.makeOutput(inputs[0].shape, inputs[0].dtype);
  const inVals = backend.typedArrayFromHeap(inputs[0].buffer);
  const outVals = backend.typedArrayFromHeap(out);  outVals.set(inVals);
  return out;
}

export const identityConfig: KernelConfig = {
  kernelName: Identity,
  backendName: 'wasm',
  kernelFunc: identity as {} as KernelFunc,
};

=============================================================================

import {KernelConfig, KernelFunc, TensorInfo, Transpose, TransposeAttrs, TransposeInputs} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {identity} from './Identity';
import {CppDType} from './types';

let wasmTranspose: (
    xId: number, xShape: Uint8Array, xShapeLength: number, dtype: CppDType,
    outId: number, perm: Uint8Array, permLength: number) =>
        void;

function setup(backend: BackendWasm) {
  wasmTranspose = backend.wasm.cwrap(Transpose, null /* void */, 
    ['number',  // xId
      'array',   // x.shape
      'number',  // x.shape.length
      'number',  // dtype
      'number',  // outId
      'array',   // perm
      'number',  // perm.length
    ]);}

export function transpose(
    args:
      {inputs: TransposeInputs, backend: BackendWasm, attrs: TransposeAttrs}):
      TensorInfo {
  const {inputs, backend, attrs} = args;
  const xId = inputs[0].dataId;
  const xShape = inputs[0].shape;
  const xShapeLength = inputs[0].shape.length;
  const dtype = CppDType[xShape[0].dtype];
  const xDataId = inputs[0].dataId;
  const xDataLoc = backend.dataIdMap.get(xDataId).location;
  const xShapeLoc = backend.dataIdMap.get(xShape).location;
  const xShapeLengthLoc = backend.dataIdMap.get(xShapeLength).location;
  const dtypeLoc = backend.dataIdMap.get(dtype).location;
  const outId = backend.dataIdMap.get(attrs.outId).id;
  const perm = backend.dataIdMap.get(attrs.perm).id;
  const permLength = backend.dataIdMap.get(attrs.permLength).id;
  const xIdBytes = new Uint8Array(new Int32Array([xId]).buffer);
  const xShapeBytes = new Uint8Array(new Int32Array(xShape).buffer);
  const xShapeLengthBytes = new Uint8Array(new Int32Array([xShapeLength]).buffer);
  const dtypeBytes = new Uint8Array(new Int32Array([dtype]).buffer);
  const outIdBytes = new Uint8Array(new Int32Array([outId]).buffer);
  const permBytes = new Uint8Array(new Int32Array(perm).buffer);
  const permLengthBytes = new Uint8Array(new Int32Array([permLength]).buffer);
  wasmTranspose(xIdBytes, xShapeBytes, xShapeLengthBytes, dtypeBytes, outIdBytes, permBytes, permLengthBytes);
  return out;
}

export const transposeConfig: KernelConfig = {
  kernelName: Transpose,
  backendName: 'wasm',
  setupFunc,  // <function setupFunc> is a function
  kernelFunc: transpose as {} as KernelFunc,
};

=============================================================================

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due to simpler memory access pattern.\n
const [reducedShape, perm] = removeOneSizeDims(inputs.x.shape, attr.perm);\n
let permIsNoOp = true; for (let i = 0; i < perm.length; i++) { if (perm[i] !== i) {\n

permIsNoOp = false; } } \n
const outShape = computeOutShape(inputs.x.shape, attr.perm);\n
const x = {\n
const cloned = identity({inputs, backend});\n
cloned.shape = outShape; return cloned; } \n
const out = backend.makeOutput(outShape, x.dtype);\n
const xId = backend.dataIdMap.get(x.dataId).id;\n
const outId = backend.dataIdMap.get(out.dataId).id;\n
const permBytes = new Uint8Array(new Int32Array(perm).buffer);\n
const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n
wasmTranspose(xId, xShapeBytes, x.shape.length, CppDType[x.dtype], outId, permBytes, x.perm.length); return out; } \n
\n
// Compute permutation axes and do a transpose if necessary. \n
const newPerm = number[]; for (let i = 0; i < shape.length; i++) { \n
if (shape[i] !== 1) { newShape.push(shape[i]); } } \n
if (shape[perm[i]] !== 1) { \n
newPerm.push(perm[i]); } \n
for (let j = 0; j < newPerm.length; j++) { \n
if (newPerm[j] >= i &&\n
minValIdx !== -1 &&\n
newPerm[minValIdx] > newPerm[j]) {\n
minValIdx = j; }\n
\n
newPerm[minValIdx] = i; }\n
\n
return newShape, newPerm; }\n
\n
// Exports \n
export const transposeConfig: KernelConfig = {\n
kernelName: Transpose,\n
backendName: 'wasm',\n
kernelFunc: transpose as {} as KernelFunc, setupFunc: setup, \n
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* http://www.apache.org/licenses/LICENSE-2.0\n
* Unless required by applicable law or agreed to in writing, software distributed under the License is distributed on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.* See the License for the specific language governing permissions and limitations under the License.* " */\n
import {backend_util, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {transpose} from './Transpose';\n
/** * Compute permutation axes and do a transpose if necessary. \n
const newPerm = number[]; for (let i = 0; i < shape.length; i++) { \n
if (shape[i] !== 1) { newShape.push(shape[i]); } } \n
if (shape[perm[i]] !== 1) { \n
newPerm.push(perm[i]); } \n
for (let j = 0; j < newPerm.length; j++) { \n
if (newPerm[j] >= i &&\n
minValIdx !== -1 &&\n
newPerm[minValIdx] > newPerm[j]) {\n
minValIdx = j; }\n
\n
newPerm[minValIdx] = i; }\n
\n
return newShape, newPerm; }\n
\n
export const transposable = false; \n
if (permutatedAxes != null) { \n
const newShape = construct newPermutationAxes(permutedAxes, xRank);\n
let newPerm = number[]; newPerm.push(permutedAxes[i]);\n
\n
let minValIdx = -1; \n
\n
for (let j = 0; j < newPerm.length; j++) { \n
if (newPerm[j] >= i &&\n
newPerm[minValIdx] > newPerm[j]) {\n
minValIdx = j; }\n
\n
newPerm[minValIdx] = i; }\n
\n
return newShape, newPerm; }\n
\n
export const transposeConfig: KernelConfig = {\n
kernelName: Transpose,\n
backendName: 'wasm',\n
kernelFunc: transpose as {} as KernelFunc, setupFunc: setup, \n
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* http://www.apache.org/licenses/LICENSE-2.0\n
* Unless required by applicable law or agreed to in writing, software distributed under the License is distributed on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.* See the License for the specific language governing permissions and limitations under the License.* " */\n
import {All, AllAttrs, AllInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util} from
import {ArgMax, ArgMaxAttrs, ArgMaxInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {permuteAxesAndTranspose} from './kernel_utils';
import {CppDType} from './types';

let wasmFunc: (xId: number, dtype: number, outerSize: number, innerSize: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmFunc = backend.wasm.cwrap(ArgMax, null /* void */, [
    'number',  // x_id
    'number',  // dtype
    'number',  // outer_size
    'number',  // inner_size
    'number'   // out_id
  ]);
}

function argmax(
    args: {inputs: ArgMaxInputs, backend: BackendWasm, attrs: ArgMaxAttrs}) {
  const {backend, inputs, attrs} = args;

  const {axis} = attrs as {} as ArgMaxAttrs;
  const {x} = inputs as {} as ArgMaxInputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  let inputId = xId;
  let input = x;

  const {transposed, axes, inputWasTransposed} =
      permuteAxesAndTranspose(x, axis, backend);

  if (inputWasTransposed) {
    const transposedId = backend.dataIdMap.get(transposed.dataId).id;
    if (transposedId !== xId) {
      // transpose
      // was not a no-op. We will need to dispose of this
      // once we are done.
      input = transposed;
      inputId = transposedId;
    }
  }

  const outShape = input.shape.slice(0, -1);
  const out = backend.makeOutput(outShape, 'int32');
  const outId = backend.dataIdMap.get(out.dataId).id;
  const outerSize = util.sizeFromShape(out.shape);
  const innerSize = input.shape[axes[0]];
  wasmFunc(inputId, dtype, outerSize, innerSize, outId);

  if (inputWasTransposed) {
    // dispose of the
    // transposed tensor.
    backend.disposeData(transposed.dataId);
  }

  return out;
}

export const argMaxConfig: KernelConfig = {
  kernelName: ArgMax,
  backendName: 'wasm',
  kernelFunc: argmax as {} as KernelFunc,
  setupFunc: setup
};
only supports average pooling with dilation = [1, 1].
${convInfo.dilationHeight},
${convInfo.dilationWidth});
  const outId = backend.dataIdMap.get(out.dataId).id;
  wasmAvgPool(outId);}  
  }

  const out = backend.makeOutput(convInfo.outShape, 'float32');
  const outId = backend.dataIdMap.get(out.dataId).id;
  return out;
}

export const avgPoolConfig: KernelConfig = {
  kernelName: AvgPool,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: avgPool as {} as KernelFunc
};

export function reshape(
    inputs: ReshapeInputs, attrs: ReshapeAttrs, backend: BackendWasm) {
  const {inputs, attrs} = args;
  const {x} = inputs;
  const {shape} = attrs;

  const xSize = util.sizeFromShape(x.shape);
  const $shape = util.inferFromImplicitShape(shape, xSize);

  util.assert(
      xSize === util.sizeFromShape($shape),
      () => `new shape: ${$shape}, old shape: ${x.shape}. New shape and old ` +
              `shape must have the same number of elements.`);

  // Backend needs to track refCount for the dataId for reshape op
  args.backend.incRef(x.dataId);

  return {dataId: x.dataId, shape: $shape, dtype: x.dtype};
}

export const reshapeConfig: KernelConfig = {
  kernelName: Reshape,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: reshape as {} as KernelFunc
};

import {BatchMatMul, BatchMatMulAttrs, BatchMatMulInputs, KernelConfig, KernelFunc, util} from
    '../../tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {reshape} from './Reshape';

let wasmBatchMatMul: (aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,
    bShape: Uint8Array, bShapeSize: number, transposeA: boolean,
    transposeB: boolean, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmBatchMatMul = backend.wasm.cwrap(BatchMatMul,
      null /* void */, 
      [ 'number',  // a_id
        'array',   // a_shape
        'number',  // a_shape.length
        'number',  // b_id
        'array',   // b_shape
        'number',  // b_shape.length
        'number',  // transpose_a
        'number',  // transpose_b
        'number'   // out_id
      ]);}

function batchMatMul(args: {
  inputs: BatchMatMulInputs,
  backend: BackendWasm,
  attrs: BatchMatMulAttrs
}) {
  const {inputs, backend, attrs} = args;
  const {a, b} = inputs;
  const {transposeA, transposeB} = attrs;

  if (a.dtype !== 'float32' || b.dtype !== 'float32') {
    throw new Error(`BatchMatMul for non-float32 tensors not yet supported.`);
  }

  const aRank = a.shape.length;
  const bRank = b.shape.length;

  const innerShapeA = a.shape[aRank - 2] * a.shape[aRank - 1];
  const innerShapeB = b.shape[bRank - 2] * b.shape[bRank - 1];

  if (innerShapeA !== innerShapeB) {
    throw new Error(`BatchMatMul for non-float32 tensors not yet supported.`);
  }

  if (aRank !== bRank) {
    throw new Error(`BatchMatMul for non-float32 tensors not yet supported.`);
  }

  const batchDimA = util.sizeFromShape(a.shape);
  const batchDimB = util.sizeFromShape(b.shape);

  const batchDimCompat = batchDimA === batchDimB || batchDimA === 1 || batchDimB === 1;

  if (!batchDimCompat) {
    throw new Error(`BatchMatMul for non-float32 tensors not yet supported.`);
  }

  const aBatchSize = util.sizeFromShape(a.shape.slice(0, aRank - 2));
  const bBatchSize = util.sizeFromShape(b.shape.slice(0, bRank - 2));

  const aShape = util.sizeFromShape(a.shape.slice(0, aRank - 2));
  const bShape = util.sizeFromShape(b.shape.slice(0, bRank - 2));

  const batchMatMul = backend.wasm.cwrap(BatchMatMul,
      null /* void */, 
      [ 'number',  // a_id
        'array',   // a_shape
        'number',  // b_id
        'array',   // b_shape
        'number',  // batchDim
        'number',  // out_id
      ]);}

  let out = backend.makeOutput(batchDimA, 'float32');
  let outId = backend.dataIdMap.get(out.dataId).id;
  return out;
}
const outShapeOuterDims = batchDimA > batchDimB ? a.shape.slice(0, -2) : b.shape.slice(0, -2);
const outShape = outShapeOuterDims.concat([outerShapeA, outerShapeB]);
util.assert(() => `Error in matMul: inner shapes (${innerShapeA}) and (${innerShapeB}) of Tensors with shapes ${a.shape} and ${b.shape} and transposeA=${transposeA} and transposeB=${transposeB} must match.`);
const a3dShape = transposeA ? [batchDimA, innerShapeA, outerShapeA] : [batchDimA, outerShapeA, innerShapeA];
const b3dShape = transposeB ? [batchDimB, outerShapeB, innerShapeB] : [batchDimB, innerShapeB, outerShapeB];
// The rest of the implementation is designed to operate on rank-3 tensors
const a3d = reshape({inputs: {x: a}, backend, attrs: {shape: a3dShape}});
const b3d = reshape({inputs: {x: b}, backend, attrs: {shape: b3dShape}});
const a3dId = backend.dataIdMap.get(a3d.dataId).id;
const b3dId = backend.dataIdMap.get(b3d.dataId).id;
const leftDim = transposeA ? a3d.shape[2] : a3d.shape[1];
const batchDim = Math.max(batchDimA, batchDimB);
const out = backend.makeOutput([batchDim, leftDim, rightDim], a3d.dtype);
const outId = backend.dataIdMap.get(out.dataId).id;
const aShapeBytes = new Uint8Array(new Int32Array(a3d.shape).buffer);
const bShapeBytes = new Uint8Array(new Int32Array(b3d.shape).buffer);
wasmBatchMatMul(a3dId, aShapeBytes, a3d.shape.length, b3dId, bShapeBytes, b3d.shape.length, transposeA, transposeB, outId, out.shape = outShape, return out, unexport const batchMatMulConfig = { kernelName: BatchMatMul, backendName: 'wasm', setupFunc: setup, kernelFunc: batchMatMul as {} as KernelFunc }
};

```

import { backend_util, util } from '@tensorflow/tfjs-core';
export function concatImpl(inputs, outShape, dtype, simplyConcat) {
    const outVals = util.getArrayFromDType(dtype, util.sizeFromShape(outShape));
    if (simplyConcat && dtype !== 'string') {
        // Use built-in TypedArray.set() method for speed.
        let offset = 0;
        inputs.forEach(input => {
            const size = util.sizeFromShape(input.shape);
            outVals.set(input.vals, offset);
            offset += size;
        });
    } else {
        let colOffset = 0;
        inputs.forEach(input => {
            const decodedData = dtype === 'string' ? backend_util.fromUint8ToStringArray(input.vals) : input.vals;
            let tIdx = 0;
            for (let row = 0; row < input.shape[0]; ++row) {
                const resIdx = row * outShape[1] + colOffset;
                for (let col = 0; col < input.shape[1]; ++col) {
                    outVals[resIdx + col] = decodedData[tIdx++];
                }
                colOffset += input.shape[1];
            }
        });
    }
    return outVals;
}
```
import { util } from '@tensorflow/tfjs-core';
export function rangeImpl(start, stop, step, dtype) {
    const sameStartStop = start === stop;
    const increasingRangeNegativeStep = start < stop && step < 0;
    const decreasingRangePositiveStep = stop < start && step > 1;
    if (sameStartStop || increasingRangeNegativeStep ||
        decreasingRangePositiveStep) {
        return util.makeZerosTypedArray(0, dtype);
    }
    const numElements = Math.abs(Math.ceil((stop - start) / step));
    const values = util.makeZerosTypedArray(numElements, dtype);
    if (stop < start && step === 1) {
        // Auto adjust the step's sign if it hasn't been set
        // (or was set to 1)
        step = -1;
    }
    values[0] = start;
    for (let i = 1; i < values.length; i++) {
        values[i] = values[i - 1] + step;
    }
    return values;
}
import { util, utilSlice, utilSliceNoComplex } from '@tensorflow/tfjs-util';
export function sliceImpl(vals, begin, size, shape, dtype) {
    const isContiguous = utilSlice.isContiguous(shape, begin, size);
    const length = util.sizeFromShape(size);
    const xStrides = util.computeStrides(shape);
    if (isContiguous) {
        const flatOffset = utilSlice.computeFlatOffset(begin, xStrides);
        if (dtype === 'string') {
            return vals.slice(flatOffset, flatOffset + length);
        }
        return vals.subarray(flatOffset, flatOffset + length);
    }
    const decodedData = dtype === 'string' ?
        utilSlice.fromUint8ToStringArray(vals) :
        vals;
    const inBuf = buffer(shape, dtype, decodedData);
    const outBuf = buffer(size, dtype);
    for (let i = 0; i < outBuf.size; ++i) {
        const outLoc = outBuf.indexToLoc(i);
        const inLoc = outLoc.map((idx, j) => idx + begin[j]);
        outBuf.set(inBuf.get(...inLoc), ...outLoc);
    }
    if (dtype === 'string') {
        return utilSlice.fromStringArrayToUint8(outBuf.values);
    }
    return outBuf.values;
}
export function slice(args) {
    const { inputs, backend, attrs } = args;
    const { x } = inputs;
    const { begin, size } = attrs;
    assertNotComplex(x, 'slice');
    const [begin, size] = utilSlice.parseSliceParams(x, begin, size);
    utilSlice.assertParamsValid(x, begin, size);
    const vals = backend.data.get(x.dataId).values;
    const outVals = sliceImpl(vals, begin, size, x.shape, x.dtype);
    return backend.makeTensorInfo(size, x.dtype, outVals);
}
export const sliceConfig = {
    kernelName: 'Slice',
    backendName: 'cpu',
    kernelFunc: slice
};
import {backend_util, KernelConfig, KernelFunc, Slice, slice_util, SliceAttrs, SliceInputs, TypedArray, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';
import {sliceImplCPU} from '../kernel_utils/shared';

export function slice(args: {inputs: SliceInputs, attrs: SliceAttrs, backend: BackendWasm}) {
  const {inputs: {x}, attrs: {begin, size}, backend} = args;

  const [begin_, size_] = slice_util.parseSliceParams(x, begin, size);

  const isContinous = slice_util.isSliceContinous(x.shape, begin_, size_);
  const xVals = backend.readSync(x.dataId);
  const out = backend.makeOutput(size_, x.dtype);
  const xStrides = util.computeStrides(x.shape);
  const outData = backend.dataIdMap.get(out.dataId);

  if (isContinous)
  {
    const flatOffset = slice_util.computeFlatOffset(begin_, xStrides);

    if (x.dtype === 'string') {
      outData.stringBytes = (xVals as Uint8Array[]).slice(flatOffset, flatOffset + util.sizeFromShape(size_));
    } else {
      const outVals = backend.typedArrayFromHeap(out);
      outVals.set((xVals as TypedArray).subarray(flatOffset, flatOffset + util.sizeFromShape(size_)));
    }

    return out;
  }

  if (x.dtype === 'string') {
    const res = sliceImplCPU(xVals, begin_, size_, x.shape, x.dtype);
    outData.stringBytes = res as Uint8Array[];
    return out;
  }

  const outVals = backend.typedArrayFromHeap(out);
  const rank = x.shape.length;
  if (rank === 2)
function slice2d(xVals: backend_util.TypedArray, xStride: number, outVals: backend_util.TypedArray, begin: [number, number], size: [number, number]): void {
    let outOffset = 0;
    const beginI = begin[0];
    const beginJ = begin[1];
    const endI = beginI + size[0];
    for (let i = beginI; i < endI; i++) {
        const xOffset = i * xStride + beginJ;
        outVals.set(xVals.subarray(xOffset, xOffset + size[1]), outOffset);
        outOffset += size[1];
    }
}

function slice3d(xVals: backend_util.TypedArray, xStride1: number, xStride2: number, outVals: backend_util.TypedArray, begin: [number, number, number], size: [number, number, number]): void {
    let outOffset = 0;
    const beginI = begin[0];
    const beginJ = begin[1];
    const beginK = begin[2];
    const endI = beginI + size[0];
    const endJ = beginJ + size[1];
    const endK = beginK + size[2];
    for (let i = beginI; i < endI; i++) {
        for (let j = beginJ; j < endJ; j++) {
            for (let k = beginK; k < endK; k++) {
                const xOffset = i * xStride1 + j * xStride2 + k * xStride3 + beginI;
                outVals.set(xVals.subarray(xOffset, xOffset + size[3]), outOffset);
                outOffset += size[3];
            }
        }
    }
}

function slice4d(xVals: backend_util.TypedArray, xStride1: number, xStride2: number, xStride3: number, outVals: backend_util.TypedArray, begin: [number, number, number, number], size: [number, number, number, number]): void {
    let outOffset = 0;
    const beginI = begin[0];
    const beginJ = begin[1];
    const beginK = begin[2];
    const beginL = begin[3];
    const endI = beginI + size[0];
    const endJ = beginJ + size[1];
    const endK = beginK + size[2];
    const endL = beginL + size[3];
    for (let i = beginI; i < endI; i++) {
        for (let j = beginJ; j < endJ; j++) {
            for (let k = beginK; k < endK; k++) {
                for (let l = beginL; l < endL; l++) {
                    const xOffset = i * xStride1 + j * xStride2 + k * xStride3 + l * xStride4 + beginI;
                    outVals.set(xVals.subarray(xOffset, xOffset + size[4]), outOffset);
                    outOffset += size[4];
                }
            }
        }
    }
}

export const sliceConfig: KernelConfig = {
    kernelName: Slice,
    backendName: 'wasm',
    kernelFunc: slice as {} as KernelFunc,
};

// tensorboard tfjs-core
import {backend_util, BatchToSpaceND, BatchToSpaceNDAttrs, BatchToSpaceNDInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';
import {reshape} from './Reshape';
import {slice} from './Slice';
import {transpose} from './Transpose';

function batchToSpaceND(args: {
    inputs: BatchToSpaceNDInputs,
    backend: BackendWasm,
    attrs: BatchToSpaceNDAttrs
}) {
    const {inputs, backend, attrs} = args;
    const {x} = inputs;
    const {blockShape, crops} = attrs;
    const prod = blockShape.reduce((a, b) => a * b);
    const reshaped = backend_util.getReshaped(x.shape, blockShape, prod);
    const permuted = backend_util.getPermuted(reshaped.length, blockShape.length);
    const reshapedPermuted = backend_util.getReshapedPermuted(x.shape, blockShape, prod);
    const sliceBeginCoords = backend_util.getSliceBeginCoords(crops, blockShape.length);
    const sliceSize = backend_util.getSliceSize(reshapedPermuted, crops, blockShape.length);
    const xReshaped = reshape({inputs: [x], backend, attrs: [shape: reshaped]});
    const xTransposed = transpose({inputs: [x: xReshaped], backend, attrs: [perm: permuted]});
    const xReshapedReshaped = reshape({inputs: [x: xTransposed], backend, attrs: [shape: reshapedPermuted]});
    const result = slice({inputs: [x: xTransposedReshaped], backend, attrs: [begin: sliceBeginCoords, size: sliceSize]});
    backend.disposeData(xReshapedReshaped.dataId);
    backend.disposeData(xReshaped.dataId);
    return result;
}
import {backend_util, Concat, ConcatAttrs, ConcatInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../../backend_wasm';
import {concatImplCPU} from '../kernel_utils/shared';
import {identity} from './Identity';
import {reshape} from './Reshape';

export function concat(
    args: {inputs: ConcatInputs, backend: BackendWasm, attrs: ConcatAttrs}) {
  const {inputs, backend} = args;
  const {attrs} = backend_util.get_config_transformer(backend);
  const {inputShape, outputShape, needsAlloc} = util.compute_output_shapes(inputs, attrs);

  if (needsAlloc) {
    backend_util.allocate_outputs(backend, outputShape);
  }

  const {shape} = inputShape[0];
  const inputCount = shape[0];

  let outShape = backend_util.computeOutShape(inputShape, attrs.axis);

  // Keep only non-empty tensors (ignore tensors with 0 in their shape).  
  const $inputs = inputs.filter(t => util.sizeFromShape(t.shape) > 0);  
  if ($inputs.length === 1) {
    return identity({inputs: $inputs[0], backend});
  }

  const out = backend.makeOutput(outShape, inputs[0].dtype);

  if (util.sizeFromShape(outShape) === 0) {
    return out;
  }

  const shapes = $inputs.map(t => t.shape);
  backend_util.assertParamsConsistent(shapes, attrs.axis);

  if ($inputs[0].dtype === 'string') {
    // Any concat of n-dimensional tensors across any axis can be reduced to
    // a concatenation of two-dimensional tensors across the axis 1 by first
    // partitioning the axes of the original tensors into those less than
    // the axis to be concatenated and the rest. Then reshape the tensors
    // into a two-dimensional tensor by collapsing these two sets of axes and
    // concatenating the resulting matrices across the axis 1, finally reshaping
    // the result to have the proper shape.
    const outShape = backend_util.computeOutShape(shapes, attrs.axis);
    const outShapeWithAxis = [1, outShape];
    const outShape2D = outShapeWithAxis.slice(1);
    const $inputs2D = $inputs.map(t => {
      const innerSize = util.sizeFromShape(t.shape.slice(attrs.axis));
      const shape = [-1, innerSize];
      return reshape({inputs: {x: t}, backend, attrs: {shape}});
    });

    const inputsValShapes = $inputs2D.map(t => {
      return {vals: backend.readSync(t.dataId), shape: t.shape};
    });

    // Concats 2d tensors along axis=1.  
    const outVals = concatImplCPU(inputsValShapes, outShape, inputs[0].dtype, true);

    // Finally reshape the concatenated values back to the proper shape.
    const finalOutShape = backend_util.computeOutShape($inputs.map(t => t.shape), attrs.axis);
    const outData = backend.dataIdMap.get(out.dataId);
    outData.stringBytes = backend_util.fromUint8Array(outVals, backend_util.toStringArray(outVals));

    $inputs2D.forEach(t => backend.disposeData(t.dataId));

    return out;
  }

  const batchDim = util.sizeFromShape($inputs[0].shape.slice(0, attrs.axis));
  let sumInnerDims = 0;
  const innerDims = $inputs.map(input => {
    const innerDim = util.sizeFromShape(input.shape.slice(attrs.axis));
    sumInnerDims += innerDim;
    return innerDim;
  });

  const inVals = $inputs.map(input => backend.typedArrayFromHeap(input));
  const outVals = backend.typedArrayFromHeap(outShape);  

  for (let b = 0; b < batchDim; b++) {
    const bInnerDim = innerDims[b];
    const inOffset = b * sumInnerDims;
    for (let i = 0; i < inVals.Length; i++) {
      const innerDim = innerDims[i];
      const inOffset = b * innerDim;
      const vals = inVals[i].subarray(inOffset, innerDim);
      outVals.set(vals, outOffset);
      outOffset += innerDim;
    }
  }

  return out;
}

export const concatConfig: KernelConfig = {
  kernelName: Concat,
  backendName: 'wasm',
  kernelFunc: concat as {} as KernelFunc,
};

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```javascript
window.wasmConv2d = backend.wasm.cwrap(Conv2D, null /* void */, [null, 'number', // xId
  'number', // batchSize
  'number', // inputHeight
  'number', // inputWidth
  'number', // filterHeight
  'number', // filterWidth
  'number', // padTop
  'number', // padRight
  'number', // padBottom
  'number', // padLeft
  'number', // isSamePad
  'number', // dilationHeight
  'number', // dilationWidth
  'number', // strideHeight
  'number', // strideWidth
  'number', // inputChannels
  'number', // outputChannels
  'number', // outputId
  'number', // outId
]);

function conv2d(
  args: {inputs: Conv2DInputs, backend: BackendWasm, attrs: Conv2DA attrs}) {
  const {inputs, attrs, backend} = args;

  const {x, filter} = inputs;

  const xId = backend.dataIdMap.get(x.dataId).id;
  const filterId = backend.dataIdMap.get(filter.dataId).id;

  const {strides, dilations, pad, dimRoundingMode, dataFormat} = attrs;

  const convInfo = backend_util.computeConv2DInfo(
    x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,, false,
    dataFormat);

  const filterHeight = convInfo.filterHeight;
  const filterWidth = convInfo.filterWidth;

  if (convInfo.dataFormat !== 'channelsLast') {
    throw new Error('wasm backend Conv2D does not support dataFormat: ' +AREST)
  }

  const out = backend.makeOutput(convInfo.outShape, 'float32');
  const outId = backend.dataIdMap.get(out.dataId).id;

  wasmConv2d(xId, x.shape[0], x.shape[1], x.shape[2], filterId, filterHeight, filterWidth, padTop, padBottom, padLeft, padRight, dataId, strideHeight, dilationHeight, dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels, outId);
}
```

---

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---

Opening a web page to view the full source code.
```
const {backend, inputs, attrs} = args;
const {dy, filter} = inputs;
const {strides, pad, dataFormat, dimRoundingMode, inputShape} = attrs;
const {dilations = 1, $dataFormat = backend_util.convertConv2DDataFormat(dataFormat)};
const convInfo = backend_util.computeConv2DInfo(inputShape, filter.shape as [number, number, number, number], strides, $dataFormat);
const topPad = filterHeight - 1 - convInfo.padInfo.top;
const leftPad = filterWidth - 1 - convInfo.padInfo.left;
const isChannelsLast = convInfo.dataFormat === 'channelsLast';
const xBatchStride = dxStrides[0];
const xRowStride = isChannelsLast ? dxStrides[1] : dxStrides[2];
const xColStride = isChannelsLast ? dxStrides[3] : 1;
const yBatchStride = dyStrides[0];
const yRowStride = isChannelsLast ? dyStrides[1] : dyStrides[2];
const yColStride = isChannelsLast ? dyStrides[3] : 1;
const out = backend.makeOutput(convInfo.inShape, 'float32');
const outId = backend.dataIdMap.get(out.dataId).id;
const dyId = backend.dataIdMap.get(dy.dataId).id;
const filterId = backend.dataIdMap.get(filter.dataId).id;
const xChannelStride = isChannelsLast ? 1 : dxStrides[3];
const yChannelStride = isChannelsLast ? 1 : dyStrides[3];

wasmConv2DBackpropInput(dyId, filterId, batchSize, filterHeight, filterWidth, inHeight, inWidth, outChannels, outHeight, outWidth, strideHeight, strideWidth, topPad, leftPad, fltS0, fltS1, fltS2) = util.computeStrides(filter.shape);

wasmConv2DBackpropInput(dyId, filterId, batchSize, filterHeight, filterWidth, inHeight, inWidth, outChannels, outHeight, outWidth, strideHeight, strideWidth, topPad, leftPad, fltS0, fltS1, fltS2, xBatchStride, xRowStride, xColStride, xChannelStride, yBatchStride, yRowStride, yColStride, yChannelStride, outId) = wasmConv2DBackpropInput(dyId, filterId, batchSize, filterHeight, filterWidth, inHeight, inWidth, outChannels, outHeight, outWidth, strideHeight, strideWidth, topPad, leftPad, fltS0, fltS1, fltS2, xBatchStride, xRowStride, xColStride, xChannelStride, yBatchStride, yRowStride, yColStride, yChannelStride, outId);

wasmConv2DBackpropInput(dyId, filterId, batchSize, filterHeight, filterWidth, inHeight, inWidth, outChannels, outHeight, outWidth, strideHeight, strideWidth, topPad, leftPad, fltS0, fltS1, fltS2, xBatchStride, xRowStride, xColStride, xChannelStride, yBatchStride, yRowStride, yColStride, yChannelStride, outId) = wasmConv2DBackpropInput(dyId, filterId, batchSize, filterHeight, filterWidth, inHeight, inWidth, outChannels, outHeight, outWidth, strideHeight, strideWidth, topPad, leftPad, fltS0, fltS1, fltS2, xBatchStride, xRowStride, xColStride, xChannelStride, yBatchStride, yRowStride, yColStride, yChannelStride, outId);
```

import {CropAndResize, CropAndResizeAttrs, CropAndResizeInputs, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {cast} from './Cast';

// Must match enum in CropAndResize.cc
enum InterpolationMethod {
  bilinear = 0,
  nearest = 1
}

let wasmCropAndResize: (
    imagesId: number, boxesId: number, boxIndId: number, numBoxes: number,
    imagesShape: Uint8Array, cropHeight: number, cropWidth: number, method: number,
    extrapolationValue: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmCropAndResize = backend.wasm.cwrap(CropAndResize, null /*void*/, 
  ['number',  // imagesId
   'number',  // boxesId
   'number',  // boxIndId
   'number',  // numBoxes
   'array',   // images shape
   'number',  // cropHeight
   'number',  // cropWidth
   'number',  // method
   'number',  // extrapolation value
   'number'   // outId
  ]);}

function cropAndResize(args: {
  backend: BackendWasm,
  inputs: CropAndResizeInputs,
  attrs: CropAndResizeAttrs
}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {method, extrapolationValue, cropSize} = attrs;
  const {image, boxes, boxInd} = inputs;

  const numBoxes = boxes.shape[0];

  const [cropHeight, cropWidth] = cropSize as [number, number];
  const outShape = [numBoxes, cropHeight, cropWidth, image.shape[3]];

  let imagesData = backend.dataIdMap.get(image.dataId);
  let castedData;
  if (image.dtype !== 'float32') {
    castedData = cast({backend, inputs: {x: image}, attrs: {dtype: 'float32'}});
    imagesData = backend.dataIdMap.get(castedData.dataId);
  }

  const imagesId = imagesData.id;
  const boxesId = backend.dataIdMap.get(boxes.dataId).id;
  const boxIndId = backend.dataIdMap.get(boxInd.dataId).id;

  const out = backend.makeOutput(outShape, 'float32');
  const outId = backend.dataIdMap.get(out.dataId).id;

  const imagesShapeBytes = new Uint8Array(new Int32Array(image.shape).buffer);

  wasmCropAndResize(imagesId, boxesId, boxIndId, numBoxes, imagesShapeBytes, cropHeight,
      cropWidth, InterpolationMethod[method as {} as keyof typeof InterpolationMethod],
      extrapolationValue, outId);

  if (castedData != null) {
    backend.disposeData(castedData.dataId);
  }

  return out;
}

export const cropAndResizeConfig: KernelConfig = {
  kernelName: CropAndResize,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: cropAndResize as {} as KernelFunc
};

import {backend_util, KernelConfig, KernelFunc, Cumsum, CumsumAttrs, CumsumInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {CppDType} from './types';

import {transpose} from './Transpose';

let wasmCumsum: (xId: number, exclusive: number, reverse: number,
                 finalDim: number, outId: number, dtype: CppDType) => void;

function setup(backend: BackendWasm) {
  wasmCumsum = backend.wasm.cwrap(Cumsum, null /*void*/,
                          ['number', // xId
                          'number', // exclusive
                          'number', // reverse
                          'number', // finalDim
                          'number', // outId
                          'number']  // dtype
                        );
}

export function cumsum(
  args: {inputs: CumsumInputs, backend: BackendWasm, attrs: CumsumAttrs}):
TensorInfo {
  const {inputs, backend, attrs} = args;
  const {x} = inputs;
  const {axis, exclusive, reverse} = attrs;
  const {backendName: BackendWasm} = backend;
  const xId = backend.dataIdMap.get(x.dataId).id;
  const xRank = x.shape.length;

  util.assert(x.dtype === 'float32' || x.dtype === 'int32', () => 'cumsum does not support ' + x.dtype + ' tensors in the WASM backend');

  xId = backend.makeOutput(x.shape, BackendWasm, x.dtype, xId, xRank, xId);
  let permutedX = x;

  if (permutation !== null) {
    let permutedAxes = permutation.map(axis => axis + xRank);
  }

  const cumsum = namespace('cumsum')(xId);
  let permutedAxis = backend.makeOutput(permutedX.shape, BackendWasm, x.dtype, xId, xRank, xId);
  let permutedOutId =
backend.dataIdMap.get(permutedOut.dataId);
  wasmCumsum(permutedXId, exclusive ? 1 : 0, reverse ? 1 : 0,
finalDim, permutedOutId, CppDType[x.dtype]);
// transpose data back if permuted
let out = permutedOut;
if (permutation !== null) {
  const undoPermutation = backend_util.getUndoAxesPermutation(permutation);
  out = transpose(
    {inputs: [x, permutedOut], attrs: {
      perm: undoPermutation, backend }});
  backend.disposeData(permutedX.dataId);
  backend.disposeData(permutedOut.dataId);
}

return out;
}

export const cumsumConfig: KernelConfig = {
  kernelName: Cumsum,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: cumsum as {} as KernelFunc
};

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 */

import {DepthToSpace, DepthToSpaceAttrs, DepthToSpaceInputs, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmDepthToSpace:
    (xId: number, blockSize: number, channelsLast: number, xStrides: Uint8Array,
    xStridesLength: number, outputShape: Uint8Array, outputStrides: Uint8Array,
    outSize: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmDepthToSpace = backend.wasm.cwrap(DepthToSpace, null
    /*void*/, 
    ['number',  // xId
     'number',  // blockSize
     'number',  // channelsLast
     'array',   // xStrides
     'number',  // xStridesLength
     'array',   // outputShape
     'array',   // outputStrides
     'number',  // outSize
     'number',  // outId
   ]);,
}

export function depthToSpace(args: {
  backend: BackendWasm,
  inputs: DepthToSpaceInputs,
  attrs: DepthToSpaceAttrs
}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {x} = inputs;
  const {blockSize, dataFormat} = attrs;

  const batchSize = x.shape[0];
  const inputHeight
  = (dataFormat === 'NHWC') ? x.shape[1] : x.shape[2];
  const inputWidth = (dataFormat === 'NHWC') ? x.shape[2] : x.shape[3];
  const inputDepth = (dataFormat === 'NHWC') ? x.shape[3] : x.shape[1];

  const outputHeight = inputHeight * blockSize;
  const outputWidth = inputWidth * blockSize;
  const outputDepth = inputDepth / (blockSize * blockSize);

  const batchSize, outputHeight, outputWidth, outputDepth :
  const xId = x.dataId;
  const xStridesBytes = x.dataIdMap.get(x.dataId);
  const xId = new Uint8Array(new Int32Array(xStridesBytes.buffer).length);
  const xData = new Uint8Array(xStridesBytes.buffer);

  return out;
}

export const depthToSpaceConfig: KernelConfig = {
  kernelName: DepthToSpace,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: depthToSpace as {} as KernelFunc
};

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 */

import {backend_util, DepthwiseConv2dNative, DepthwiseConv2dNativeAttrs, DepthwiseConv2dNativeInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';
let wasmDepthwiseConv2d =
  backend.wasm.cwrap(DepthwiseConv2dNative, null /* void */, 
    ['number',  // xId
     'number',  // batchSize
     'number',  // inputHeight
     'number',  // inputWidth
     'number',  // filterId
     'number',  // filterHeight
     'number',  // filterWidth
     'number',  // padTop
     'number',  // padRight
     'number',  // padBottom
     'number',  // padLeft
     'number',  // isSamePad
     'number',  // dilationHeight
     'number',  // dilationWidth
     'number',  // strideHeight
     'number',  // strideWidth
     'number',  // inputChannels
     'number',  // outputChannels
     'number'],  // outId
  function(xId, batchSize, inputHeight, inputWidth, filterId, filterHeight, filterWidth, 
    padTop, padRight, padBottom, padLeft, isSamePad, dilationHeight, dilationWidth, strideHeight, 
    strideWidth, inputChannels, outputChannels, outId) {
    wasmDepthwiseConv2d(xId, batchSize, inputHeight, inputWidth, filterId, filterHeight, filterWidth, 
      padTop, padRight, padBottom, padLeft, isSamePad, dilationHeight, dilationWidth, strideHeight, 
      strideWidth, inputChannels, outputChannels, outId);}

}
import {FlipLeftRight, FlipLeftRightInputs, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-core';

export const flipLeftRightConfig: KernelConfig = {
  kernelName: FlipLeftRight,
  backendName: 'wasm',
  kernelFunc: flipLeftRight as {} as KernelFunc,
  setupFunc: setup
};
backend.dataIdMap.get(mean.dataId).id;
  const varianceId = backend.dataIdMap.get(variance.dataId).id;
  const offsetId = offset != null ? backend.dataIdMap.get(offset.dataId).id : 0;
  const scaleId = scale != null ? backend.dataIdMap.get(scale.dataId).id : 0;

  const out = backend.makeOutput(x.shape, x.dtype);
  // Short-circuit zero-sized tensors.
  if (util.sizeFromShape(x.shape) === 0) {
    return out;
  }

  const outId = backend.dataIdMap.get(out.dataId).id;

  wasmBatchNorm(
      xId, meanId, varianceId, offsetId, scaleId,
      varianceEpsilon, outId);
  return out;
}

export const fusedBatchNormConfig: KernelConfig = {
  kernelName: FusedBatchNorm,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: fusedBatchNorm as {} as KernelFunc
};

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 *
=============================================================================
*/

import {backend_util, FusedConv2D, FusedConv2DAttrs, FusedConv2DInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {FusableActivation} from './types';

let wasmFusedConv2d:
    (xId: number, batchSize: number, inputHeight: number, inputWidth: number,
     filterId: number, filterHeight: number, filterWidth: number,
     biasId: number, padTop: number, padRight: number, padBottom: number, padLeft: number,
     dilationHeight: number, dilationWidth: number, strideHeight: number, strideWidth: number,
     inputChannels: number, outputChannels: number, activation: number,
     preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>
        void;

function setup(backend: BackendWasm) {
    wasmFusedConv2d = backend.wasm.cwrap(FusedConv2D, null /* void */, 
    'number',  // xId
    'number',  // batchSize
    'number',  // inputHeight
    'number',  // inputWidth
    'number',  // filterId
    'number',  // filterHeight
    'number',  // filterWidth
    'number',  // biasId
    'number',  // padTop
    'number',  // padRight
    'number',  // padBottom
    'number',  // padLeft
    'number',  // dilationHeight
    'number',  // dilationWidth
    'number',  // strideHeight
    'number',  // strideWidth
    'number',  // inputChannels
    'number',  // outputChannels
    'number',  // activation
    'number',  // preluActivationWeightsId
    'number',  // leakyreluAlpha
    'number',  // outId
  
});

function fusedConv2d(args: {
  inputs: FusedConv2DInputs,
  backend: BackendWasm,
  attrs: FusedConv2DAttrs
}) {
  const {inputs, backend, attrs} = args;
  const {x, filter, bias, preluActivationWeights} = inputs;
  const {
    strides, pad, dilations, dataFormat, dimRoundingMode, activation, leakyreluAlpha
  } = attrs;

  const convInfo = backend_util.computeConv2DInfo((x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,
      pad, dimRoundingMode);

  const fusedActivation =
    dense.fusedActivation[activation as {} as keyof typeof dense.fusedActivation];
  if (fusedActivation == null) {
    throw new Error(
        `${activation} activation not yet supported for FusedConv2D ` +
        `in the wasm backend.`);
  }

  const xId = backend.dataIdMap.get(x.dataId).id;
  const filterId = backend.dataIdMap.get(filter.dataId).id;
  const biasId = backend.dataIdMap.get(bias.dataId).id;
  const outId = backend.dataIdMap.get(out.dataId).id;

  try {
    const outputChannels = convInfo.outChannels;
    if (outputChannels < 1) throw new Error(`
      FusedConv2D only supports rank-1 bias but got ` +
      `rank ${biasData.shape.length} != 1`);

    const biasData = biasData.id;
    if (bias != null) {
      try {
        const biasData = biasData.id;
      } catch (e) {
        throw new Error(`
          FusedConv2D only supports rank-1 bias but got ` +
          `rank ${biasData.shape.length} != 1`);
      }
    }

    const outputChannels = convInfo.outChannels;
    const biasId = bias.id;
    const filterHeight = convInfo.filterHeight;
    const filterWidth = convInfo.filterWidth;
    const padTop = convInfo.padTop;
    const padRight = convInfo.padRight;
    const padBottom = convInfo.padBottom;
    const padLeft = convInfo.padLeft;
    const dilationHeight = convInfo.dilationHeight;
    const dilationWidth = convInfo.dilationWidth;
    const strideHeight = convInfo.strideHeight;
    const strideWidth = convInfo.strideWidth;
    const inputChannels =
  } finally {
    if (bias != null)
      if (bias != null) {
        const biasData = biasData.id;
      } catch (e) {
        throw new Error(`
          FusedConv2D only supports rank-1 bias but got ` +
          `rank ${biasData.shape.length} != 1`);
      }
    const outputChannels = convInfo.outChannels;
    const biasId = bias.id;
    const filterHeight = convInfo.filterHeight;
    const filterWidth = convInfo.filterWidth;
    const padTop = convInfo.padTop;
    const padRight = convInfo.padRight;
    const padBottom = convInfo.padBottom;
    const padLeft = convInfo.padLeft;
    const dilationHeight = convInfo.dilationHeight;
    const dilationWidth = convInfo.dilationWidth;
    const strideHeight = convInfo.strideHeight;
    const strideWidth = convInfo.strideWidth;
    const inputChannels =
  }
}
(biasData.shape) does not match the number of output channels (outputChannels); biasId = biasData.id; const filterHeight = convInfo.filterHeight; const filterWidth = convInfo.filterWidth; const padTop = convInfo.padInfo.top; const padRight = convInfo.padInfo.right; const padBottom = convInfo.padInfo.bottom; const padLeft = convInfo.padInfo.left; const dilationHeight = convInfo.dilationHeight; const dilationWidth = convInfo.dilationWidth; const strideHeight = convInfo.strideHeight; const strideWidth = convInfo.strideWidth; const inputChannels = convInfo.inChannels; const isSamePad = convInfo.padInfo.type === 'SAME'; batchSize = convInfo.batchSize; const inHeight = convInfo.inHeight; const inWidth = convInfo.inWidth; if (dataFormat !== 'NHWC') throw new Error('wasm backend FusedDepthwiseConv2D does not support dataFormat: ' + $\{dataFormat\}'. Please use 'NHWC'.') const outId = backend.makeOutput(convInfo.outShape, \'float32\'); const outId = backend.dataIdMap.get(out.dataId).id; const preluActivationWeightsId = preluActivationWeights == null ? backend.dataIdMap.get(preluActivationWeights.dataId).id : 0; backend.dataIdMap.get(preluActivationWeights.dataId).id; wasmFusedDepthwiseConv2d(xId, batchSize, inHeight, inWidth, filterId, filterHeight, filterWidth, biasId, padTop, padRight, padBottom, padLeft, isSamePad, dilationHeight, dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels, fusedActivation, preluActivationWeightsId, leakyreluAlpha || 0, outId); backend.makeOutput(convInfo.outShape, \'float32\'); const outId = backend.dataIdMap.get(out.dataId).id; const preluActivationWeightsId = preluActivationWeights == null ? backend.dataIdMap.get(preluActivationWeights.dataId).id : 0; backend.dataIdMap.get(preluActivationWeights.dataId).id; wasmFusedDepthwiseConv2d(xId, batchSize, inHeight, inWidth, filterId, filterHeight, filterWidth, biasId, padTop, padRight, padBottom, padLeft, isSamePad, dilationHeight, dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels, fusedActivation, preluActivationWeightsId, leakyreluAlpha || 0, outId); return out; backend.makeOutput(convInfo.outShape, \'float32\'); const outId = backend.dataIdMap.get(out.dataId).id; const preluActivationWeightsId = preluActivationWeights == null ? backend.dataIdMap.get(preluActivationWeights.dataId).id : 0; backend.dataIdMap.get(preluActivationWeights.dataId).id; wasmFusedDepthwiseConv2d(xId, batchSize, inHeight, inWidth, filterId, filterHeight, filterWidth, biasId, padTop, padRight, padBottom, padLeft, isSamePad, dilationHeight, dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels, fusedActivation, preluActivationWeightsId, leakyreluAlpha || 0, outId); return out;
```typescript
// Open Source Used In Cisco Meeting Server (formerly Acano Server) 3.4

import {backend_util, GatherV2, GatherV2Attrs, GatherV2Inputs, KernelConfig, Tensor, TensorInfo, TypedArray, util} from '@tensorflow/tfjs-core';

import {KernelConfig, TensorInfo} from '@tensorflow/tfjs-backend-wasm';

// import {backend_wasm} from './backend_wasm';

let wasmGather:
    (xId: number, dtype: CppDType, xStrides: Uint8Array, stridesSize: number,
    indicesId: number, batchSize: number, outStrides: Uint8Array,
    outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmGather = backend.wasm.cwrap('Gather', null /*void*/, [
    'number',  // xId
    'number',  // dtype
    'array',   // xStrides
    'number',  // stridesSize
    'number',  // indicesId
    'number',  // batchSize
    'array'    // outStrides
  ]);}

function gatherV2(args: {backend: BackendWasm, inputs: GatherV2Inputs, attrs: GatherV2Attrs}: GatherV2Config): boolean {
  const {backend, inputs, attrs} = args;
  const {x, indices} = inputs;
  const {axis, batchDims} = attrs;

  // Throw error when any index is out of bound.
  const parsedAxis = util.parseAxisParam(axis, x.shape)[0];
  const indicesShape = backend.readSync(indices.dataId) as
    (0: number) => Promise<Tensor>
  ;
  const flattenX = reshape({
    inputs: {x},
    attrs: {
      shape: 
    },
    backend
  });
  const indicesSize = util.sizeFromShape(indices.shape);
  const flattenIndex = reshape({
    inputs: {x: indices},
    attrs: {
      shape: 
    },
    backend
  });

  const out = backend.makeOutput(flattenOutputShape, x.dtype);
}

export const gatherV2Config: KernelConfig = {
  kernelName: 'GatherV2',
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: gatherV2 as {} as KernelFunc
};
```

---

```typescript
import {Greater, KernelConfig} from '@tensorflow/tfjs-core';

import {createBinaryKernelConfig} from './binary_kernel';

const supportsFullBroadcast = false;
export const greaterConfig: KernelConfig =
  createBinaryKernelConfig(Greater, supportsFullBroadcast, 'bool');
```

---

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---

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```
import {GreaterEqual, KernelConfig} from '@tensorflow/tfjs-core';

import {createBinaryKernelConfig} from './binary_kernel';

const supportsFullBroadcast = false;

export const greaterEqualConfig: KernelConfig = createBinaryKernelConfig(GreaterEqual, supportsFullBroadcast, 'bool');

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 */

import {KernelConfig, KernelFunc, LeakyRelu, LeakyReluAttrs, LeakyReluInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {CppDType} from './types';

let wasmFunc: (xId: number, dtype: number, leakyreluAlpha: number, outId: number) => void;

function setupFunc(backend: BackendWasm): void {
  wasmFunc = backend.wasm.cwrap(LeakyRelu,
    null /* void */, 
    [ 'number',  // x_id
          'number',  // dtype
          'number',  // leakyrelu_alpha
          'number',  // out_id
    ]);}

export function leakyRelu(
    args: 
        {inputs: LeakyReluInputs, attrs: LeakyReluAttrs,
          backend: BackendWasm}):
    TensorInfo {
  const {inputs: {x}, attrs: {alpha}, backend} = args;

  const xId = backend.dataIdMap.get(x.dataId).id;
  // According to TF API, LeakyRelu returns float32 when input is either
  // float32 // or int32.
  // const out = backend.makeOutput(x.shape, 'float32');
  // if (util.sizeFromShape(x.shape)
  // !== 0) {
    const outId = backend.dataIdMap.get(out.dataId).id;
    wasmFunc(xId, CppDType[x.dtype], alpha,
      outId);

  return out;
}

export const leakyReluConfig: KernelConfig = {
  kernelName: LeakyRelu,
  backendName: 'wasm',
  setupFunc,
  kernelFunc: leakyRelu as {} as KernelFunc,
};

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 */

import {KernelConfig, Less} from '@tensorflow/tfjs-core';

import {createBinaryKernelConfig} from './binary_kernel';

export const lessConfig: KernelConfig = createBinaryKernelConfig(Less, supportsFullBroadcast, 'bool');

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 */

import {KernelConfig, LessEqual} from '@tensorflow/tfjs-core';

import {createBinaryKernelConfig} from './binary_kernel';

export const lessEqualConfig: KernelConfig = createBinaryKernelConfig(LessEqual, supportsFullBroadcast, 'bool');

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=============================================================================

*/

import {KernelConfig, Log} from '@tensorflow/tfjs-core';

export const logConfig: KernelConfig = createUnaryKernelConfig(Log);

=============================================================================

*/

import {KernelConfig, LogicalAnd} from '@tensorflow/tfjs-core';

export const logicalAndConfig: KernelConfig =
createBinaryKernelConfig(LogicalAnd, supportsFullBroadcast, 'bool');

=============================================================================

*/

import {backend_util, KernelConfig, KernelFunc, Max, MaxAttrs, MaxInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

export const maxConfig: KernelConfig = {
  kernelName: Max,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: max as {} as KernelFunc
};
import {KernelConfig, Maximum} from '@tensorflow/tfjs-core';

import {createBinaryKernelConfig} from './binary_kernel';
const supportsFullBroadcast = false;
export const maximumConfig: KernelConfig =
createBinaryKernelConfig(Maximum, supportsFullBroadcast);

import {backend_util, KernelConfig, KernelFunc, MaxPool, MaxPoolAttrs, MaxPoolInputs, Tensor4D, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmMaxPool: (
    xId: number, batchSize: number, inputHeight: number, inputWidth: number, filterHeight: number, filterWidth: number, padTop: number, padRight: number, padBottom: number, padLeft: number, dilationHeight: number, dilationWidth: number, strideHeight: number, strideWidth: number, inputChannels: number, outputChannels: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmMaxPool = backend.wasm.cwrap(MaxPool, null /* void */, 
    'number',  // xId
    'number',  // batchSize
    'number',  // inputHeight
    'number',  // inputWidth
    'number',  // filterHeight
    'number',  // filterWidth
    'number',  // padTop
    'number',  // padRight
    'number',  // padBottom
    'number',  // padLeft
    'number',  // dilationHeight
    'number',  // dilationWidth
    'number',  // strideHeight
    'number',  // strideWidth
    'number',  // inputChannels
    'number',  // outputChannels
    'number',  // outId
  );
}

function maxPool(
    args: {inputs: MaxPoolInputs, backend: BackendWasm, attrs: MaxPoolAttrs}) {
  const {inputs, attrs, backend} = args;

  const x = inputs.x as Tensor4D;
  const xId = backend.dataIdMap.get(x.dataId).id;

  // TF API supports int32 input. CPU and WebGL backend also support int32
  // input. WASM backend doesn't support it because it uses xnnpack which only
  // supports float32 input.
  //
  // Add the following assert only for the WASM backend instead of at core op
  // level.
  //
  // TODO: add support for int32 input.
  util.assert(
      x.dtype === 'float32',
      () =>
          `Error in MaxPool: only float32 input is supported. Got ${x.dtype}.`);

  const {filterSize, strides, pad, dimRoundingMode} = attrs;
  const convInfo = backend_util.computePool2DInfo(
    x.shape, filterSize, strides, pad, dimRoundingMode);

  const filterHeight = convInfo.filterHeight;
  const filterWidth = convInfo.filterWidth;
  const padTop = convInfo.padTop;
  const padRight = convInfo.padRight;
  const padBottom = convInfo.padBottom;
  const padLeft = convInfo.padLeft;
  const dilationHeight = convInfo.dilationHeight;
  const dilationWidth = convInfo.dilationWidth;
  const strideHeight = convInfo.strideHeight;
  const strideWidth = convInfo.strideWidth;
  const inputChannels = convInfo.inChannels;
  const outputChannels = convInfo.outChannels;

  const out = backend.makeOutput(convInfo.outShape, 'float32');
  const outId = backend.dataIdMap.get(out.dataId).id;

  wasmMaxPool(xId, x.shape[0], x.shape[1], x.shape[2], filterHeight, filterWidth, padTop, padRight, padBottom, padLeft, dilationHeight, dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels, outId);

  return out;}

export const maxPoolConfig: KernelConfig = {
  kernelName: MaxPool,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: maxPool
};
```javascript
import {backend_util, KernelConfig, KernelFunc, Mean, MeanAttrs, MeanInputs, TensorInfo, util} from '@tensorflow/tfjs-core';
import {backend_wasm} from '../backend_wasm';

let wasmMean: (xId: number, reduceSize: number, outId: number) => void;

function mean(args: {backend: BackendWasm, inputs: MeanInputs, attrs: MeanAttrs}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {axis, keepDims} = attrs;
  const {x} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  let inputId = xId;
  let input = x;

  const {transposed, axes, originalAxes, inputWasTransposed} = permuteAxesAndTranspose(x, axis, backend);

  let reductionAxes = axes;
  if (inputWasTransposed) {
    const transposedId = backend.dataIdMap.get(transposed.dataId).id;
    if (transposedId !== xId) {
      // transpose was not a no-op. We will need to dispose of this input tensor.
      input = transposed;
      inputId = transposedId;
      reductionAxes = backend_util.getInnerMostAxes(reductionAxes.length, input.shape.length);
    }
  }

  backend_util.assertAxesAreInnerMostDims('mean', reductionAxes, input.shape.length);
  const [outShape, reduceShape] = backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);
  const reduceSize = util.sizeFromShape(reduceShape);

  let castedInput = input;
  if (input.dtype !== 'float32') {
    castedInput = cast({backend, inputs: {x: input}, attrs: {dtype: 'float32'}});
    inputId = backend.dataIdMap.get(castedInput.dataId).id;
  }

  const out = backend.makeOutput(outShape, 'float32');
  if (util.sizeFromShape(input.shape) !== 0) {
    const outId = backend.dataIdMap.get(out.dataId).id;
    wasmMean(inputId, reduceSize, outId);
  }

  if (inputWasTransposed) {
    // dispose of the transposed tensor.
    backend.disposeData(transposed.dataId);
  }

  if (keepDims) {
    // reshape
    const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);
    out.shape = newShape;
  }

  if (input.dtype !== 'float32') {
    backend.disposeData(castedInput.dataId);
  }

  return out;
}

export const meanConfig: KernelConfig = {
  kernelName: Mean,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: mean as {} as KernelFunc
};
```

---

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---

```javascript
import {backend_util, KernelConfig, KernelFunc, Min, MinAttrs, MinInputs, TensorInfo, util} from '@tensorflow/tfjs-core';
import {backend_wasm} from '../backend_wasm';

let wasmMin: (xId: number, dtype: number, reduceSize: number, outId: number) => void;

function min(args: {backend: BackendWasm, inputs: MinInputs, attrs: MinAttrs}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {axis, keepDims} = attrs;
  const {x} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  let inputId = xId;
  let input = x;

  const {transposed, axes, originalAxes, inputWasTransposed} = permuteAxesAndTranspose(x, axis, backend);

  let reductionAxes = axes;
  if (inputWasTransposed) {
    const transposedId = backend.dataIdMap.get(transposed.dataId).id;
    if (transposedId !== xId) {
      // transpose was not a no-op. We will need to dispose of this input tensor.
      input = transposed;
      inputId = transposedId;
    }
  }

  backend_util.assertAxesAreInnerMostDims('min', reductionAxes, input.shape.length);
  const [outShape, reduceShape] = backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);
  const reduceSize = util.sizeFromShape(reduceShape);

  let castedInput = input;
  if (input.dtype !== 'float32') {
    castedInput = cast({backend, inputs: {x: input}, attrs: {dtype: 'float32'}});
    inputId = backend.dataIdMap.get(castedInput.dataId).id;
  }

  const out = backend.makeOutput(outShape, 'float32');
  if (util.sizeFromShape(input.shape) !== 0) {
    const outId = backend.dataIdMap.get(out.dataId).id;
    wasmMin(inputId, castedInput.dataId, reduceSize, outId);
  }

  if (inputWasTransposed) {
    // dispose of the transposed tensor.
    backend.disposeData(transposed.dataId);
  }

  if (keepDims) {
    // reshape
    const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);
    out.shape = newShape;
  }

  if (input.dtype !== 'float32') {
    backend.disposeData(castedInput.dataId);
  }

  return out;
}

export const minConfig: KernelConfig = {
  kernelName: Min,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: min as {} as KernelFunc
};
```
axes);\nconst reduceSize = util.sizeFromShape(reduceShape);\nconst out = backend.makeOutput(outShape, input.dtype);\nif (util.sizeFromShape(input.shape) !== 0) {\n  const outId = backend.dataIdMap.get(out.dataId).id;\n  wasmMin(inputId, CppDType[x.dtype], reduceSize, outId);\n} if (inputWasTransposed) {\n  // dispose of the transposed tensor.\n  backend.disposeData(transposed.dataId);\n} if (keepDims) {\n  // reshape\n  const newShape = backend.util.expandShapeToKeepDim(out.shape, originalAxes);\n  out.shape = newShape;\n} return out;\n}\n
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import {KernelConfig, Minimum} from '@tensorflow/tfjs-core';

import {createBinaryKernelConfig} from './binary_kernel';

const supportsFullBroadcast = false;
export const minimumConfig: KernelConfig = createBinaryKernelConfig(Minimum, supportsFullBroadcast);

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import {KernelConfig, KernelFunc, MirrorPad, MirrorPadAttrs, MirrorPadInputs} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {CppDType} from './types';

// Must match enum in MirrorPad.cc
enum MirrorPaddingMode {
  reflect = 0,
  symmetric = 1
}

let wasmMirrorPad: (xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype: number,
    prePaddingsBytes: Uint8Array, postPaddingsBytes: Uint8Array, mode: number,
    outId: number) => void;

function setup(backend: BackendWasm) {
  wasmMirrorPad = backend.wasm.cwrap(MirrorPad, null /* void */, [
    'number',  // xId
    'array',   // x.shape
    'number',  // x.shape.length
    'number',  // x.dtype
    'array',   // pre-paddings
    'array',   // post-paddings
    'number',  // mode
    'number',  // outId
  ]);\n}

function mirrorPad(args: {
  inputs: MirrorPadInputs,
  backend: BackendWasm,
  attrs: MirrorPadAttrs
}) {
  const {inputs: {x}, backend, attrs: {paddings, mode}} = args;

  const outShape = paddings.map((p, i) => p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);
  const xId = backend.dataIdMap.get(x.dataId).id;
  const out = backend.makeOutput(outShape, x.dtype);
  const outId = backend.dataIdMap.get(out.dataId).id;

  const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);
  const prePaddingsFlat = paddings.map((padTuple) => padTuple[0]);
  const postPaddingsFlat = paddings.map((padTuple) => padTuple[1]);

  wasmMirrorPad(xId, xShapeBytes, x.shape.length, CppDType[x.dtype],
      prePaddingsFlat, postPaddingsFlat, MirrorPaddingMode[mode], outId);
  return out;
}

export const mirrorPadConfig: KernelConfig = {
  kernelName: MirrorPad,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: mirrorPad as {} as KernelFunc\n};
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=============================================================================

*/

import {KernelConfig, Multiply} from '@tensorflow/tfjs-core';

import {createBinaryKernelConfig} from './binary_kernel';

const supportsFullBroadcast = true;

export const multiplyConfig: KernelConfig = createBinaryKernelConfig(Multiply, supportsFullBroadcast);

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=============================================================================

*/

import {KernelConfig, Neg} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';

export const negConfig: KernelConfig = createUnaryKernelConfig(Neg);

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=============================================================================

*/

import {BackendWasm} from '../backend_wasm';

// Analogous to `struct Result` in `non_max_suppression_impl.h`.
interface Result {
  pSelectedIndices: number;
  selectedSize: number;
  pSelectedScores: number;
  pValidOutputs: number;
  pValidOutputs: number;
}

/**
 * Parse the result of the c++ method, which has the shape equivalent to
 * `Result`.
 */
export function parseResultStruct(
  backend: BackendWasm,
  resOffset: number): Result {
  const result = new Int32Array(backend.wasm.HEAPU8.buffer, resOffset, 4);
  const pSelectedIndices = result[0];
  const selectedSize = result[1];
  const pSelectedScores = result[2];
  const pValidOutputs = result[3];
  // Since the result was allocated on the heap, we have to delete it.
  backend.wasm._free(resOffset);
  return {pSelectedIndices, selectedSize, pSelectedScores,
    pValidOutputs};
}

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=============================================================================

*/

import {KernelConfig, KernelFunc, NonMaxSuppressionV3, NonMaxSuppressionV3Attrs,
  NonMaxSuppressionV3Inputs, TensorInfo} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {parseResultStruct} from './NonMaxSuppression_util';

let wasmFunc: function(args: {
  backend: BackendWasm,
  inputs: NonMaxSuppressionV3Inputs,
  attrs: NonMaxSuppressionV3Attrs
}): TensorInfo;

function setup(backend: BackendWasm): void {
  wasmFunc = backend.wasm.cwrap(
    NonMaxSuppressionV3,
    'number',  // Result*
    'number',  // boxesId
    'number',  // scoresId
    'number',  // maxOutputSize
    'number',  // iouThreshold
    'number',  // scoreThreshold
    [number, number, number, number, number, number]);
}

function kernelFunc(args: {
  backend: BackendWasm,
  inputs: NonMaxSuppressionV3Inputs,
  attrs: NonMaxSuppressionV3Attrs
}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const iouThreshold,
function setup(backend: BackendWasm): void {
  wasmFunc = backend.wasm.cwrap(NonMaxSuppressionV5, 'number', // Result*
      ['number', // boxesId
        'number', // scoreId
        'number', // maxOutputSize
        'number', // iouThreshold
        'number', // scoreThreshold
        'number', // softNmsSigma
      ], 'number');
}

function kernelFunc(args: {
  backend: BackendWasm,
  inputs: NonMaxSuppressionV5Inputs,
  attrs: NonMaxSuppressionV5Attrs
}): TensorInfo[] {
  const {backend, inputs, attrs} = args;
  const {iouThreshold, maxOutputSize, scoreThreshold, softNmsSigma} = attrs;
  const {boxes, scores} = inputs;
  const boxesId = backend.dataIdMap.get(boxes.dataId).id;
  const scoresId = backend.dataIdMap.get(scores.dataId).id;
  const resOffset = wasmFunc(boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold, softNmsSigma);
  const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} = parseResultStruct(backend, resOffset);
  // Since we are not using validOutputs for V5, we have to delete it from the heap
  backend.wasm._free(pValidOutputs);
  const selectedIndicesTensor = backend.makeOutput([selectedSize], 'int32', pSelectedIndices);
  const selectedScoresTensor = backend.makeOutput([selectedSize], 'float32', pSelectedScores);
  return [selectedIndicesTensor, selectedScoresTensor];
}

export const nonMaxSuppressionV5Config: KernelConfig = {
  kernelName: NonMaxSuppressionV5,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: kernelFunc as {} as KernelFunc,
};
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*/

import {KernelConfig, KernelFunc, OnesLike, OnesLikeInputs} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

function onesLike(args: {inputs: OnesLikeInputs, backend: BackendWasm}) {
  const {inputs: {x}, backend} = args;
  const out = backend.makeOutput(x.shape, x.dtype);
  const outVals = backend.typedArrayFromHeap(out);
  outVals.fill(1);
  return out;
}

export const onesLikeConfig: KernelConfig = {
  kernelName: OnesLike,
  backendName: 'wasm',
  kernelFunc: onesLike as {} as KernelFunc,
};

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*/

import {KernelConfig, KernelFunc, Pack, PackAttrs, PackInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {concat} from './Concat';
import {expandDims} from './ExpandDims';

export function pack(
    args: {inputs: PackInputs, backend: BackendWasm, attrs: PackAttrs}):
    TensorInfo {
  const {inputs, backend, attrs} = args;
  const {axis} = attrs;

  if (inputs.length === 1) {
    return expandDims(
        {inputs: {input: inputs[0]}, backend, attrs: {dim: axis}});
  }

  const shape = inputs[0].shape;
  const dtype = inputs[0].dtype;

  inputs.forEach(t => {
    util.assertShapesMatch(
        shape, t.shape,
        'All tensors passed to pack must have matching shapes');
    util.assert(
        dtype === t.dtype,
        () => 'All tensors passed to pack must have matching dtypes');
  });

  const intermediateTensorInfos: TensorInfo[] = [];
  const expandedTensors = inputs.map(t => {
    const expandedT =
        expandDims({inputs: {input: t}, backend, attrs: {dim: axis}});
    intermediateTensorInfos.push(expandedT);
    return expandedT;
  });

  const result = concat({inputs: expandedTensors, backend, attrs: {dim: axis}});

  intermediateTensorInfos.forEach(t =>
    backend.disposeData(t.dataId));
  return result;
}

export const packConfig: KernelConfig = {
  kernelName: Pack,
  backendName: 'wasm',
  kernelFunc: pack as {} as KernelFunc,
  backend: BackendWasm,
  attrs: PackAttrs,
};

import {KernelConfig, KernelFunc, PadV2, PadV2Attrs, PadV2Inputs, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {fill} from './Fill';

import {CppDType} from './types';

let wasmPadV2: (xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype: number, prePaddingsBytes: Uint8Array, postPaddingsBytes: Uint8Array, constantValue: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmPadV2 = backend.wasm.cwrap(PadV2, null /* void */,
    [ 'number', // xId
      'array',   // x.shape
      'number',  // x.shape.length
      'number',  // x.dtype
      'array',   // pre-paddings
      'array',   // post-paddings
      'number',  // constantValue
      'number',  // outId
    ]);
}

function pad(
    args: {inputs: PadV2Inputs, backend: BackendWasm, attrs: PadV2Attrs}) {
  const {inputs: {x}, backend, attrs} = args;
  const outShape = padV2(x.shape, x.dtype, attrs)
  return outShape;
}

export const padConfig: KernelConfig = {
  kernelName: PadV2,
  backendName: 'wasm',
  kernelFunc: pad as {} as KernelFunc,
  backend: BackendWasm,
  attrs: PadV2Attrs,
};
p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);\n\nif (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    attr: {shape: outShape, value: constantValue, dtype: x.dtype}\n  });\n}\n\nconst xId = backend.dataIdMap.get(x.dataId).id;\n\nconst out = backend.makeOutput(outShape, x.dtype);\nconst outTensorData = backend.dataIdMap.get(out.dataId);\nconst outId = outTensorData.id;\nconst xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n\nconst prePaddingsFlat = paddings.map(padTuple => padTuple[0]);\n\nconst postPaddingsFlat = paddings.map(padTuple => padTuple[1]);\n\nconst prePaddingsBytes = new Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n\nconst postPaddingsBytes = new Uint8Array(new Int32Array(postPaddingsFlat).buffer);\n\nconst wasmPadV2 = \nnew wasm.PadV2(xId, xShapeBytes, x.shape.length,\n    CppDType[x.dtype], prePaddingsBytes, postPaddingsBytes, constantValue, outId);\n\nreturn wasmPadV2(outId, outShape, x.dtype,\n    xId, xShapeBytes, x.dtype);\n\nexport const padV2Config: KernelConfig = {
  kernelName: PadV2,\n  backendName: 'wasm',\n  kernelFunc: pad as {} as KernelFunc,\n  setupFunc: setup\n};

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 */

import {KernelConfig, Pow} from '@tensorflow/tfjs-core';

import {createBinaryKernelConfig} from './binary_kernel';

const supportsFullBroadcast = false;
export const powConfig: KernelConfig =
createBinaryKernelConfig(Pow, supportsFullBroadcast);

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 */

import {KernelConfig, KernelFunc, Prelu, PreluInputs} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {cast} from './Cast';

let wasmPrelu: (xId: number,\n    weightsId: number,\n    outId: number) => void;

function setup(backend: BackendWasm) {
  wasmPrelu = \nbackend.wasm.cwrap(Prelu, null /* void */, [\n    'number',  // x_id
    'number',  // weights_id
    'number'   // out_id
  ]);\n}

function prelu(args: {inputs: PreluInputs, backend: BackendWasm}) {
  const {inputs, backend} = args;
  const {x, alpha} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  const weightsId = backend.dataIdMap.get(alpha.dataId).id;

  let inputId = xId;\n  let castedInput = x;\n  if (input.dtype !== 'float32') {
    castedInput = cast({backend, inputs: {x}, attrs: {dtype: 'float32'}});\n    inputId = backend.dataIdMap.get(castedInput.dataId).id;\n  }

  const out = backend.makeOutput(x.shape, 'float32');\n  \n  const castInput = cast({\n    backend,\n    inputs: {x},\n    attrs: {\n      dtype: 'float32'\n    }\n  });\n  \n  const outId = backend.dataIdMap.get(out.dataId).id;\n  \n  \n  const castedOutId = castInput.dataId;\n  \n  const castedOutId = backend.dataIdMap.get(castedOutId).id;\n  \n  const wasmPrelu = wasmPrelu(inputId, weightsId, outId);\n
  \n  if (input.dtype !== 'float32') {
    backend.disposeData(castedInput.dataId);
  }
  \n  return out;
}\n
export const preluConfig: KernelConfig = {
  kernelName: Prelu,\n  backendName: 'wasm',\n  kernelFunc: prelu as {} as KernelFunc,\n  setupFunc: setup\n};
import {backend_util, KernelConfig, KernelFunc, Prod, ProdAttrs, ProdInputs, TensorInfo, util} from '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';
import {permuteAxesAndTranspose} from './kernel_utils';
import {types} from './types';

let wasmProd: (xId: number, reduceSize: number, dtype: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmProd = backend.wasm.cwrap(Prod, null /*void*/, [
    'number',
    'number',
    'number',
    'number'
  ]);
}

function prod(args: {
  backend: BackendWasm,
  inputs: ProdInputs,
  attrs: ProdAttrs
}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {axis, keepDims} = attrs;
  const {x} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  let inputId = xId;
  let input = x;

  const {transposed, axes, originalAxes, inputWasTransposed} =
      permuteAxesAndTranspose(x, axis, backend);
  const reductionAxes = axes;
  if (inputWasTransposed) {
    const transposedId =
        backend.dataIdMap.get(transposed.dataId).id;
    if (transposedId !== xId) {
      input = transposed;
      inputId = transposedId;
      reductionAxes = backend_util.getInnerMostAxes(
          reductionAxes.length, input.shape.length);
    }
  }

  backend_util.assertAxesAreInnerMostDims(
      'prod', reductionAxes, input.shape.length);
  const [outShape, reduceShape] =
      backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);
  const reduceSize = util.sizeFromShape(reduceShape);
  const out = backend.makeOutput(outShape, input.dtype);
  if (util.sizeFromShape(input.shape) !== 0) {
    const outId = backend.dataIdMap.get(out.dataId).id;
    wasmProd(inputId, reduceSize, CppDType[out.dtype], outId);
  }

  if (inputWasTransposed) {
    backend.disposeData(transposed.dataId);
  }

  if (keepDims) {
    const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);
    out.shape = newShape
  }

  return out;
}

export const prodConfig: KernelConfig = {
  kernelName: Prod,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: prod as {} as KernelFunc
};

import {KernelConfig, RealDiv} from '@tensorflow/tfjs-core';

import {createBinaryKernelConfig} from './binary_kernel';

const supportsFullBroadcast = true;
export const realDivConfig: KernelConfig =
    createBinaryKernelConfig(RealDiv, supportsFullBroadcast);

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 */

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import {KernelConfig, Relu} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';
export const reluConfig: KernelConfig = createUnaryKernelConfig(Relu);

import {KernelConfig, Relu6} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';
export const relu6Config: KernelConfig = createUnaryKernelConfig(Relu6);

import {KernelConfig, KernelFunc, ResizeBilinear, ResizeBilinearAttrs, ResizeBilinearInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {cast} from './Cast';

let wasmResizeBilinear: (xId: number, batch: number, oldHeight: number, oldWidth: number, numChannels: number, newHeight: number, newWidth: number, alignCorners: number, halfPixelCenters: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmResizeBilinear = backend.wasm.cwrap(ResizeBilinear, null /*void*/, 
    'number', // xId
    'number', // batch
    'number', // oldHeight
    'number', // oldWidth
    'number', // numChannels
    'number', // newHeight
    'number', // newWidth
    'number', // alignCorners
    'number', // halfPixelCenters
    'number' // outId
  );
}

function resizeBilinear(args: {
  backend: BackendWasm,
  inputs: ResizeBilinearInputs,
  attrs: ResizeBilinearAttrs
}): TensorInfo {
  const {backend, inputs, attrs} = args;

  const {images} = inputs;
  const {alignCorners, halfPixelCenters, size} = attrs;
  const [newHeight, newWidth] = size;

  const [batch, oldHeight, oldWidth, numChannels] = images.shape;
  const outShape = [batch, newHeight, newWidth, numChannels];

  let xData = backend.dataIdMap.get(images.dataId);
  let castedData;
  if (xData.dtype !== 'float32') {
    castedData = cast({backend, inputs: {x: images}, attrs: {dtype: 'float32'}});
    xData = backend.dataIdMap.get(castedData.dataId);
  }
  const xId = xData.id;

  const out = backend.makeOutput(outShape, 'float32');
  if (util.sizeFromShape(images.shape) === 0) {
    return out;
  }

  const outId = backend.dataIdMap.get(out.dataId).id;

  wasmResizeBilinear(xId, batch, oldHeight, oldWidth, numChannels, newHeight, newWidth, alignCorners ? 1 : 0, halfPixelCenters ? 1 : 0, outId);

  if (castedData != null) {
    backend.disposeData(castedData.dataId);
  }

  return out;
}

export const resizeBilinearConfig: KernelConfig = {
  kernelName: ResizeBilinear,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: resizeBilinear as {} as KernelFunc
};

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============================================================================
import {KernelConfig, KernelFunc, Reverse, ReverseAttrs, ReverseInputs, TensorFlowInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {identity} from './Identity';
import {reshape} from './Reshape';

let wasmReverse: (xId: number, axes: Uint8Array, axesLength: number, outShape: Uint8Array, outShapeLength: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmReverse = backend.wasm.cwrap(Reverse, null, ['number', 'array', 'number', 'array', 'number', 'number']);
}

export function reverse(args: {inputs: ReverseInputs, backend: BackendWasm, attrs: ReverseAttrs}): TensorInfo {
  const {inputs, backend, attrs} = args;
  const {x} = inputs;
  const {dims} = attrs;

  const axes = util.parseAxisParam(dims, x.shape);

  if (x.shape.length === 0) {
    return identity({inputs: {x}, backend});
  }

  const out = backend.makeOutput(x.shape, x.dtype);
  const xId = backend.dataIdMap.get(x.dataId).id;
  const outId = backend.dataIdMap.get(out.dataId).id;

  const axesBytes = new Uint8Array(new Int32Array(axes).buffer);
  const outShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);

  wasmReverse(xId, axesBytes, axes.length, outShapeBytes, x.shape.length, outId);
  const reshaped = reshape({inputs: {x: out}, attrs: {shape: x.shape}, backend});

  backend.disposeData(out.dataId);
  return reshaped;
}

export const reverseConfig: KernelConfig = {
  kernelName: Reverse,
  backendName: 'wasm',
  kernelFunc: reverse as {} as KernelFunc,
  setupFunc: setup
};

import {KernelConfig, KernelFunc, RotateWithOffset, RotateWithOffsetAttrs, RotateWithOffsetInputs, TensorFlowInfo} from '@tensorflow/tfjs-core';
import {backend_util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmRotate: (xId: number, batch: number, imageHeight: number, imageWidth: number, numChannels: number, radians: number, centerX: number, centerY: number, fillBytes: Uint8Array, fillLength: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmRotate = backend.wasm.cwrap(RotateWithOffset, null /* void */, ['number', // xId
    'number', // batch
    'number', // imageHeight
    'number', // imageWidth
    'number', // numChannels
    'number', // radians
    'number', // centerX
    'number', // centerY
    'array', // fillBytes
    'number', // fillLength
    'number', // outId
  ]);}

export function rotateWithOffset(args: {inputs: RotateWithOffsetInputs, backend: BackendWasm, attrs: RotateWithOffsetAttrs}): TensorInfo {
  const {inputs, backend, attrs} = args;
  const {image} = inputs;
  const {radians, fillValue, center} = attrs;

  const out = backend.makeOutput(image.shape, image.dtype);
  const imageId = backend.dataIdMap.get(image.dataId).id;
  const outId = backend.dataIdMap.get(out.dataId).id;
  const imageShape = image.shape;
  const [centerX, centerY] = center;
  const fillIsBlack = fillValue === 0;
  const fullOpacityValue = 255;
  const fillValues = typeof fillValue === 'number' ? [fillValue, fillValue, fillValue, fillIsBlack ? 0 : fullOpacityValue] : [...fillValue, fullOpacityValue];

  wasmRotate(imageId, batch, imageHeight, imageWidth, numChannels, radians, centerX, centerY, fillBytes, fillValues.length, outId);

  return outId;
}

export const rotateWithOffsetConfig: KernelConfig = {
  kernelName: RotateWithOffset,
  backendName: 'wasm',
  kernelFunc: rotateWithOffset as {} as KernelFunc,
  setupFunc: setup
};
kernelName: RotateWithOffset, backendName: 'wasm', kernelFunc: rotateWithOffset as {} as KernelFunc,
setupFunc: setup as {} as *license
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import {KernelConfig, Round} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';

export const roundConfig: KernelConfig = createUnaryKernelConfig(Round);

import {KernelConfig, Rsqrt} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';

export const rsqrtConfig: KernelConfig = createUnaryKernelConfig(Rsqrt);

import {KernelConfig, KernelFunc, scatter_util, ScatterNd, ScatterNdAttrs, ScatterNdInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {CppDType} from './types';

let wasmScatterNd: (
    indicesId: number, updatesId: number, dtype: CppDType, sliceRank: number,
    numUpdates: number, sliceSize: number, strides: Uint8Array,
    outputSize: number, outId: number)
=> void;

function setup(backend: BackendWasm): void {
  wasmScatterNd = backend.wasm.cwrap(ScatterNd, null /*void*/, [
    'number',  // indicesId
    'number',  // updatesId
    'number',  // dtype
    'number',  // sliceRank
    'number',  // numUpdates
    'number',  // sliceSize
    'array',   // strides
    'number',  // outputSize
    'number'   // outId
  ]);  
}

function scatterNd(
    args:
        {backend: BackendWasm, inputs: ScatterNdInputs, attrs: ScatterNdAttrs}):
    TensorInfo {
  const {backend, inputs, attrs} = args;
  const {indices, updates} = inputs;
  const {shape} = attrs;

  const out = backend.makeOutput(shape, updates.dtype);
  if (util.sizeFromShape(shape) === 0) {
    return out;
  }

  const {sliceRank, numUpdates, sliceSize, strides, outputSize} =
      scatter_util.calculateShapes(updates, indices, shape);

  const indicesData = backend.dataIdMap.get(indices.dataId);
  const updatesData =
    backend.dataIdMap.get(updates.dataId);
  const stridesBytes = new Uint8Array(new Int32Array(strides).buffer);

  wasmScatterNd(indicesId, updatesId, CppDType[updates.dtype], sliceRank, numUpdates,
    sliceSize, stridesBytes, outputSize, outId);

  return out;
}

export const scatterNdConfig: KernelConfig = {
  kernelName: ScatterNd, backendName: 'wasm', setupFunc: setup as {} as KernelFunc, scatterNd as {} as KernelFunc
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=============================================================================

import {KernelConfig, KernelFunc, Select, SelectInputs, util} from '@tensorflow/tfjs-core';

 türlü wasmSelect: (conditionId: number, tId: number, eId: number, offset: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmSelect = backend.wasm.cwrap('SelectV2', null, ['number', '\_conditionId', 'number', '\_tId', 'number', '\_eId', 'number', '\_offset', 'number', '\_outId', 'number']);
}

function select(args: {inputs: SelectInputs, backend: BackendWasm}) {
  const {inputs, backend} = args;
  const {condition, t, e} = inputs;

  const conditionId = backend.dataIdMap.get(condition.dataId).id;
  const tId = backend.dataIdMap.get(t.dataId).id;
  const eId = backend.dataIdMap.get(e.dataId).id;
  const outId = backend.dataIdMap.get(out.dataId).id;
  const tRank = t.shape.length;
  const cRank = condition.shape.length;

  const offset = cRank === 0 || cRank > 1 || tRank === 1 ? 1 : util.sizeFromShape(t.shape.slice(1));

  wasmSelect(conditionId, tId, eId, offset, outId);
  return out;
}

export const selectConfig: KernelConfig = {
  kernelName: Select,
  backendName: 'wasm',
  kernelFunc: select as {} as KernelFunc,
  setupFunc: setup
};

=============================================================================

import {KernelConfig, KernelFunc, Sigmoid, SigmoidInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

function sigmoid(args: {backend: BackendWasm, inputs: SigmoidInputs}: TensorInfo) {
  const {backend, inputs: {x}} = args;
  const xId = backend.dataIdMap.get(x.dataId).id;
  const outId = backend.dataIdMap.get(out.dataId).id;
  const out = backend.makeOutput(x.shape, x.dtype);
  const outId = backend.dataIdMap.get(outId.dataId).id;

  if (util.sizeFromShape(out.shape) === 0) {
    return out;
  }

  backend.wasm.cwrap('Sigmoid', null /* void */, ['number', 'number']);

  backend.dataIdMap.get(xId.dataId).id;

  const outId = backend.dataIdMap.get(outId.dataId).id;
  // Short-circuit zero-sized tensors.

  return out;
}

export const sigmoidConfig: KernelConfig = {
  kernelName: 'Sigmoid',
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: sigmoid as {} as KernelFunc,
  setupFunc: setup,
  kernelFunc: sigmoid as {} as KernelFunc
};

=============================================================================

import {createUnaryKernelConfig} from './unary_kernel';

export const sinConfig: KernelConfig = createUnaryKernelConfig(Sin);

=============================================================================

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* \n
import { KernelConfig, KernelFunc, Softmax, SoftmaxAttrs, SoftmaxInputs, TensorInfo, util } from '@tensorflow/tfjs-core';

import { BackendWasm } from '../backend_wasm';

let wasmFunc: (xId: number, outId: number, batch: number) => void;

wasmFunc = backend.wasm.cwrap(Softmax, null, null, [xId, number, outId, number, batch, number] =>
    wasmFunc(xId, outId, batch));

TensorInfo { const [backend, inputs: [logits], atttrs: [dim]] =
    const xId = backend.dataIdMap.get(logits.dataId).id;
    const out = backend.makeOutput(logits.shape, logits.dtype);
    const batch = util.sizeFromShape(logits.shape) / channels;
    if (util.sizeFromShape(out.shape) === 0) {
        return out;
    }
    wasmFunc(xId, outId, channels, batch);
    return out;
}

export const softmaxConfig: KernelConfig = {
    kernelName: Softmax,
    backendName: 'wasm',
    setupFunc: setup,
    kernelFunc: softmax as {} as KernelFunc
};

import { backend_util, KernelConfig, KernelFunc, ReshapeAttrs, ReshapeInputs, SpaceToBatchND, SpaceToBatchNDInputs, TensorInfo, TransposeAttrs, TransposeInputs, util } from '@tensorflow/tfjs-core';

import { BackendWasm } from '../backend_wasm';

import { padV2Config } from './PadV2';
import { reshape } from './Reshape';
import { transpose } from './Transpose';

function spaceToBatchND(args: {
    inputs: SpaceToBatchNDInputs,
    backend: BackendWasm,
    attrs: SpaceToBatchNDAttrs
}) {
    const { inputs, backend, attrs } = args;
    const x = inputs;
    const blockShape, paddings = attrs;
    const prod = util.sizeFromShape(blockShape);
    const completePaddings: Array<[number, number]> = [[0, 0]];
    completePaddings.push(...(paddings as Array<[number, number]>));
    for (let i = 1 + blockShape.length; i < x.shape.length; ++i) {
        completePaddings.push([0, 0]);
    }
    const paddedX = padV2Config.kernelFunc({
        inputs: {x},
        backend,
        attrs: {paddings: completePaddings, constantValue: 0}
    }) as TensorInfo;
    const reshapedPaddedShape = backend_util.getReshaped(paddedX.shape, blockShape, prod, false);
    const permutedReshapedPaddedPermutation = backend_util.getPermuted(reshapedPaddedShape.length, blockShape.length, false);
    const result = reshape({ inputs: reshapedPaddedShape, backend, attr: permutedReshapedPaddedPermutation });
    backend.disposeData(paddedX.dataId);
    backend.disposeData(reshapedPaddedShape.dataId);
    backend.disposeData(permutedReshapedPaddedPermutation.dataId);
    return result;
}

export const spaceToBatchNDConfig: KernelConfig = {
    kernelName: SpaceToBatchND,
    backendName: 'wasm',
    setupFunc: setup,
    kernelFunc: spaceToBatchND as {} as KernelFunc
};

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=============================================================================

*/

import {KernelConfig, KernelFunc, SplitV, SplitVAttrs, SplitVInputs, util} from '@tensorflow/tfjs-core';
import {backend_util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {slice} from './Slice';

export function splitV(
    args: {inputs: SplitVInputs, attrs: SplitVAttrs, backend: BackendWasm}) {
  const {inputs, attrs, backend} = args;
  const {x} = inputs;
  const {numOrSizeSplits, axis} = attrs;

  const $axis = util.parseAxisParam(axis, x.shape)[0];

  const splitSizes = backend_util.prepareSplitSize(x, numOrSizeSplits, $axis);
  const begin = new Array(x.shape.length).fill(0);

  const size = x.shape.slice();
  return splitSizes.map(s => {
    const xSliceSize = [...size];
    xSliceSize[$axis] = s;
    const xSlice =
        slice({inputs: {x}, attrs: {begin, size: xSliceSize}, backend});
    begin[$axis] += s;
    return xSlice;
  });
}

export const splitVConfig: KernelConfig = {
  kernelName: SplitV,
  backendName: 'wasm',
  kernelFunc: splitV as {} as KernelFunc
};

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 *
=============================================================================

*/

import {KernelConfig, Sqrt} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';
export const sqrtConfig: KernelConfig = createUnaryKernelConfig(Sqrt);

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 *
=============================================================================

*/

import {KernelConfig, Square} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';
export const squareConfig: KernelConfig = createUnaryKernelConfig(Square);

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 *
=============================================================================

*/

import {KernelConfig, SquaredDifference} from '@tensorflow/tfjs-core';
import {createBinaryKernelConfig} from './binary_kernel';
supportsFullBroadcast = true;
export const squaredDifferenceConfig: KernelConfig
    = createBinaryKernelConfig(SquaredDifference, supportsFullBroadcast);

*/

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 */
```javascript
import {KernelConfig, KernelFunc, Step, StepAttrs, StepInputs, TensorInfo} from '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';
import {CppDType} from './types';

let wasmStep:
    (xId: number, alpha: number, dtype: number, outId: number) =>
    void;

function setup(backend: BackendWasm): void {
  wasmStep = backend.wasm.cwrap(Step, null /*void*/,
    ['number',  // x_id
    'number',  // alpha
    'number',  // dtype
    'number',  // out_id
  ]);}

function step(args: {
    backend: BackendWasm, inputs: StepInputs, attrs: StepAttrs
}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {alpha} = attrs;
  const {x} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;

  const out = backend.makeOutput(x.shape, x.dtype);
  const outId = backend.dataIdMap.get(out.dataId).id;
  wasmStep(xId, alpha, CppDType[x.dtype], outId);
  return out;
}

export const stepConfig: KernelConfig = {
  kernelName: Step,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: step as {} as KernelFunc
};

import {KernelConfig, KernelFunc, slice_util, StridedSlice, StridedSliceAttrs, StridedSliceInputs, TensorInfo, util} from '@tensorflow/tfjs-core';
import {reshape} from './Reshape';
import {slice} from './Slice';

let wasmStridedSlice: (
    xId: number, xStridesBytes: Uint8Array,
    xRank: number,
    beginBytes: Uint8Array, endBytes: Uint8Array, stridesBytes: Uint8Array,
    outShapeBytes: Uint8Array, outStridesBytes: Uint8Array,
    outShapeLength: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmStridedSlice = backend.wasm.cwrap(StridedSlice, null /*void*/,
    ['number',  // xId
    'array',   // xStrides
    'number',  // xRank
    'array',   // begin
    'array',   // end
    'array',   // strides
    'array',   // outShape
    'array',   // outStrides
    'number',  // outShapeLength
    'number',  // outId
  ]);}

export function stridedSlice(args: {
    backend: BackendWasm,
    inputs: StridedSliceInputs,
    attrs: StridedSliceAttrs
}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {x} = inputs;

  const {
    begin, end, strides,
    beginMask, endMask, ellipsisMask,
    newAxisMask, shrinkAxisMask
  } = slice_util.sliceInfo(
    x.shape, begin, end, strides, beginMask, endMask, ellipsisMask,
    newAxisMask, shrinkAxisMask);

  let result;

  if (isIdentity) {
    // Optimization #1, slice is a no-op plus reshape
    result = reshape({inputs: [x], backend, attrs: {shape: finalShape}});
  } else if (sliceDim0) || isSimpleSlice {
    // Optimization #2, slice is memory contiguous (only occurs in dim 0)
    util.assert(
      x.shape.length >= 1,
      () => `Input must have rank at least 1, got: ${x.shape.length}`);

    const size = slice_util.computeOutShape($begin, $end, $strides);
    // To tolerate begin[0] > end[0] (a 0-output slice), we min(begin.end).
    const sliced = slice({inputs: {x}, backend, attrs: {begin: $begin, size}});
    result = reshape({inputs: {x: sliced}, backend, attrs: {shape: finalShape}});
  }

  backend.disposeData(sliced.dataId);
  backend.disposeData(result.dataId);
}
```
```javascript
import {createBinaryKernelConfig} from './binary_kernel';
const supportsFullBroadcast = true;
export const subConfig: KernelConfig = createBinaryKernelConfig(Sub, supportsFullBroadcast);
```

```javascript
import {backend_util, KernelConfig, KernelFunc, Sum, SumAttrs, SumInputs, TensorInfo, util} from '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';
import {permuteAxesAndTranspose} from './kernel_utils';
import {CppDType} from './types';

let wasmSum: (xId: number, reduceSize: number, dtype: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmSum = backend.wasm.cwrap(Sum, null /*void*/, [
    'number',  // input_id
    'number',  // reduce_size
    'number',  // dtype
    'number',  // out_id
  ]);}

function sum(args: {backend: BackendWasm, inputs: SumInputs, attrs: SumAttrs}):
    TensorInfo {
  const {backend, inputs, attrs} = args;
  const {axis, keepDims} = attrs;
  const {x} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  let inputId = xId;
  let input = x;

  const {transposed, axes, originalAxes, inputWasTransposed} = permuteAxesAndTranspose(x, axis, backend);

  let reductionAxes = axes;
  if (inputWasTransposed) {
    const transposedId = backend.dataIdMap.get(transposed.dataId).id;
    if (transposedId !== xId) {
      // transpose was not a no-op. We will need to dispose of this once we are done.
      input = transposed;
      inputId = transposedId;
      reductionAxes = backend_util.getInnerMostAxes(reductionAxes.length, input.shape.length);
    }
  }

  backend_util.assertAxesAreInnerMostDims('sum', reductionAxes, input.shape.length);
  const [outShape, reduceShape] = backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);
  const reduceSize = util.sizeFromShape(reduceShape);
  const out = backend.makeOutput(outShape, input.dtype);
  if (util.sizeFromShape(input.shape) !== 0) {
    const outId = backend.dataIdMap.get(out.dataId).id;
    wasmSum(inputId, reduceSize, CppDType[out.dtype], outId);
    if (inputWasTransposed) {
      // dispose of the transposed tensor.
      backend.disposeData(transposed.dataId);
    }
    if (keepDims) {
      // reshape
      const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);
      out.shape = newShape;
    }
  }
  return out;
}
```
/*\n* An import [KernelConfig, Tan] from '@tensorflow/tfjs-core';\n* An import [createUnaryKernelConfig] from './unary_kernel';\n* export const tanConfig: KernelConfig = createUnaryKernelConfig(Tan);\n* Copyright 2019 Google LLC. All Rights Reserved.\n* Licensed under the Apache License, Version 2.0 (the 'License');\n* you may not use this file except in compliance with the License.\n* You may obtain a copy of the License at http://www.apache.org/licenses/LICENSE-2.0\n* Unless required by applicable law or agreed to in writing, software\n* distributed under the License is distributed on an 'AS IS' BASIS,\n* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n* See the License for the specific language governing permissions and limitations under the License.\n*/

import {KernelConfig, Tan} from '@tensorflow/tfjs-core';\n
export const tanConfig: KernelConfig = createUnaryKernelConfig(Tan);

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import {KernelConfig, Tanh} from '@tensorflow/tfjs-core';\n
export const tanhConfig: KernelConfig = createUnaryKernelConfig(Tanh);

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import {KernelConfig, Tile, TileAttr, TileInputs} from '@tensorflow/tfjs-core';\n
export const tileConfig: KernelConfig = {
  kernelName: Tile,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: tile as {} as KernelFunc
};

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import {KernelConfig, KernelFunc, TopK, TopKAttr, TopKInputs} from '@tensorflow/tfjs-core';\n
export const topk:
  (args: {inputs: TopKInputs, backend: BackendWasm,\n    attrs: TopKAttr}) => void;

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attrs: TopKAttrs) =>
  const TensorInfo[] | TensorInfo = {inputs, backend, attrs}) =>
  (const [x] = inputs;
  const [k, sorted] = attrs;
  const xId = backend.dataIdMap.get(x.dataId.id);
  const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);
  const outputShape = x.shape.slice();
  const outputValuesId = backend.dataIdMap.get(outputValues.dataId.id);
  const outValues = backend.makeOutput(outputShape, x.dtype);
  const outIndicesId = backend.dataIdMap.get(outIndices.dataId.id);
  const outIndices = backend.makeOutput('int32');
  wasmTopK(xId, xShapeBytes, x.shape.length,
      CppDType[x.dtype], k, sorted, outValuesId, outIndicesId);
  return [outValues, outIndices];

export const topKConfig: KernelConfig = {
  kernelName: TopK,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: topk as {} as KernelFunc,
};

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 */

import {KernelConfig, KernelFunc, TensorInfo, Transform, TransformAttrs, TransformInputs, util} from
    '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmTransform: (imageId: number, transformsId: number, isBatchTransform: boolean,
  batch: number, outHeight: number, outWidth: number, numChannels: number, imageWidth: number, imageHeight: number, strides: Uint8Array, stridesLength: number, interpolationModeId: number, fillModeId: number, fillValue: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmTransform = backend.wasm.cwrap(Transform,
      null /*void*/, [
          'number',  // imageId
          'number',  // transformsId
          'bool',    // isBatchTransform
          'number',  // batch
          'number',  // outHeight
          'number',  // outWidth
          'number',  // numChannels
          'number',  // imageWidth
          'number',  // imageHeight
          'array',   // strides
          'number',  // stridesLength
          'number',  // interpolationModeId
          'number',  // fillModeId
          'number',  // fillValue
          'number'   // outId
      ]);}

function transform(inputs: TransformInputs, attrs: TransformAttrs): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {image, transforms} = inputs;
  const {interpolation, fillMode, fillValue, outputShape} = attrs;
  const [batch, imageHeight, imageWidth, numChannels] = image.shape;
  const [outHeight, outWidth] = outputShape;

  const out = backend.makeOutput([batch, outHeight, outWidth, numChannels] as
      [number, number, number, number,] as number[]);
  const strides = new Uint8Array(new
      Int32Array(util.computeStrides(image.shape)).buffer);

  const outDataId = backend.dataIdMap.get(out.dataId.id);
  const outputValuesId = backend.dataIdMap.get(outputValues.dataId.id);
  const outValues = backend.makeOutput(outputShape, image.dtype);
  const outIndicesId = backend.dataIdMap.get(outIndices.dataId.id);
  const outIndices = backend.makeOutput('int32');

  const imageData = backend.dataIdMap.get(image.dataId.id);
  const imageId = imageData.id;

  const transformsData = backend.dataIdMap.get(transforms.dataId.id);
  const transformsId = transformsData.id;

  wasmTransform(imageId, transformsId, (transforms.shape[0] > 1), batch, outHeight,
      outWidth, numChannels, imageWidth, imageHeight, strides, image.shape.length - 1,
      interpolationModeId, fillModeId, fillValue, outId);

  return out;
}

export const transformConfig: KernelConfig = {
  kernelName: Transform,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: transform as {} as KernelFunc,
};

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 */

let wasmTransform: (imageId: number, transformsId: number, isBatchTransform: boolean,
  batch: number, outHeight: number, outWidth: number, numChannels: number, imageWidth: number, imageHeight: number, strides: Uint8Array, stridesLength: number, interpolationModeId: number, fillModeId: number, fillValue: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmTransform = backend.wasm.cwrap(Transform,
      null /*void*/, [
          'number',  // imageId
          'number',  // transformsId
          'bool',    // isBatchTransform
          'number',  // batch
          'number',  // outHeight
          'number',  // outWidth
          'number',  // numChannels
          'number',  // imageWidth
          'number',  // imageHeight
          'array',   // strides
          'number',  // stridesLength
          'number',  // interpolationModeId
          'number',  // fillModeId
          'number',  // fillValue
          'number'   // outId
      ]);}

function transform(inputs: TransformInputs, attrs: TransformAttrs): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {image, transforms} = inputs;
  const {interpolation, fillMode, fillValue, outputShape} = attrs;
  const [batch, imageHeight, imageWidth, numChannels] = image.shape;
  const [outHeight, outWidth] = outputShape;

  const out = backend.makeOutput([batch, outHeight, outWidth, numChannels] as
      [number, number, number, number,] as number[]);
  const strides = new Uint8Array(new
      Int32Array(util.computeStrides(image.shape)).buffer);

  const outDataId = backend.dataIdMap.get(out.dataId.id);
  const outputValuesId = backend.dataIdMap.get(outputValues.dataId.id);
  const outValues = backend.makeOutput(outputShape, image.dtype);
  const outIndicesId = backend.dataIdMap.get(outIndices.dataId.id);
  const outIndices = backend.makeOutput('int32');

  wasmTransform(imageId, transformsId, (transforms.shape[0] > 1), batch, outHeight,
      outWidth, numChannels, imageWidth, imageHeight, strides, image.shape.length - 1,
      interpolationModeId, fillModeId, fillValue, outId);

  return out;
}

export const transformConfig: KernelConfig = {
  kernelName: Transform,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: transform as {} as KernelFunc,
};
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=============================================================================

import {KernelConfig, KernelFunc, TensorInfo, Unpack, UnpackAttrs, UnpackInputs} from
 '@tensorflow/tfjs-core';\n
import {BackendWasm} from '../backend_wasm';\n
import {slice} from './Slice';\n
function unpack(args: {inputs: UnpackInputs, backend: BackendWasm, attrs: UnpackAttrs}):\n TensorInfo[] {
  const {inputs, backend, attrs} = args;
  const {value} = inputs;
  let {axis} = attrs;

  if (axis < 0) {\n    axis += value.shape.length;\n  }\n  const numOutputs = value.shape[\axis];\n  const rank = value.shape.length;\n
  const outShape: number[] = new Array(rank - 1);\n  let outIndex = 0;\n  for (let i = 0; i < rank; 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}));
}

export const unpackConfig: KernelConfig = {
  kernelName: Unpack,
  backendName: 'wasm',
  kernelFunc: unpack as {} as KernelFunc,
};

import {KernelConfig, KernelFunc, ZerosLike, ZerosLikeInputs} from '@tensorflow/tfjs-core';\n
import {BackendWasm} from '../backend_wasm';\n
function zerosLike(args: {inputs: ZerosLikeInputs, backend: BackendWasm}) {\n  const {inputs: {x}, backend} = args;
  const out = backend.makeOutput(x.shape, x.dtype);

  const outVals = backend.typedArrayFromHeap(out);
  outVals.fill(0);
  return out;
}

export const zerosLikeConfig: KernelConfig = {
  kernelName: ZerosLike,
  backendName: 'wasm',
  kernelFunc: zerosLike as {} as KernelFunc,
};

import {KernelConfig, registerKernel} from '@tensorflow/tfjs-core';\n
import {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 {cropAndResizeConfig} from
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import {cumsumConfig} from './kernels/Cumsum';
import {depthToSpaceConfig} from './kernels/DepthToSpace';
import {depthwiseConv2dNativeConfig} from './kernels/DepthwiseConv2dNative';
import {eluConfig} from './kernels/Elu';
import {equalConfig} from './kernels/Equal';
import {expConfig} from './kernels/Exp';
import {expandDimsConfig} from './kernels/ExpandDims';
import {fillConfig} from './kernels/Fill';
import {flipLeftRightConfig} from './kernels/FlipLeftRight';
import {floorConfig} from './kernels/Floor';
import {floorDivConfig} from './kernels/FloorDiv';
import {fusedBatchNormConfig} from './kernels/FusedBatchNorm';
import {fusedConv2DConfig} from './kernels/FusedConv2D';
import {fusedDepthwiseConv2DConfig} from './kernels/FusedDepthwiseConv2D';
import {gatherNdConfig} from './kernels/GatherNd';
import {gatherV2Config} from './kernels/GatherV2';
import {greaterConfig} from './kernels/Greater';
import {greaterEqualConfig} from './kernels/GreaterEqual';
import {identityConfig} from './kernels/Identity';
import {identityConfig} from './kernels/Identity';
import {leakyReluParamConfig} from './kernels/LeakyReluParam';
import {lessConfig} from './kernels/Less';
import {lessEqualConfig} from './kernels/LessEqual';
import {logConfig} from './kernels/Log';
import {logicalAndConfig} from './kernels/LogicalAnd';
import {maxConfig} from './kernels/Max';
import {maximumConfig} from './kernels/Maximum';
import {maxPoolConfig} from './kernels/MaxPool';
import {meanConfig} from './kernels/Mean';
import {minConfig} from './kernels/Min';
import {minimumConfig} from './kernels/Minimum';
import {mirrorPadConfig} from './kernels/MirrorPad';
import {multiplyConfig} from './kernels/Multiply';
import {negConfig} from './kernels/Neg';
import {notEqualConfig} from './kernels/NotEqual';
import {onesLikeConfig} from './kernels/OnesLike';
import {packConfig} from './kernels/Pack';
import {padV2Config} from './kernels/PadV2';
import {powConfig} from './kernels/Pow';
import {preluConfig} from './kernels/Prelu';
import {prodConfig} from './kernels/Prod';
import {rangeConfig} from './kernels/Range';
import {realDivConfig} from './kernels/RealDiv';
import {reluConfig} from './kernels/Relu';
import {relu6Config} from './kernels/Relu6';
import {reshapeConfig} from './kernels/Reshape';
import {resizeBilinearConfig} from './kernels/ResizeBilinear';
import {reverseConfig} from './kernels/Reverse';
import {rotatedWithOffsetConfig} from './kernels/RotatedWithOffset';
import {roundConfig} from './kernels/Round';
import {rsqrtConfig} from './kernels/Rsqrt';
import {scatterNdConfig} from './kernels/ScatterNd';
import {sigmoidConfig} from './kernels/Sigmoid';
import {sinConfig} from './kernels/Sin';
import {sliceConfig} from './kernels/Slice';
import {softmaxConfig} from './kernels/Softmax';
import {spaceToBatchNDConfig} from './kernels/SpaceToBatchND';
import {splitVConfig} from './kernels/SplitV';
import {squareConfig} from './kernels/Square';
import {squaredDifferenceConfig} from './kernels/SquaredDifference';
import {stepConfig} from './kernels/Step';
import {stridedSliceConfig} from './kernels/StridedSlice';
import {subConfig} from './kernels/Sub';
import {sumConfig} from './kernels/Sum';
import {tanConfig} from './kernels/Tan';
import {tanhConfig} from './kernels/Tanh';
import {tileConfig} from './kernels/Tile';
import {topKConfig} from './kernels/TopK';
import {transformConfig} from './kernels/Transform';
import {transposeConfig} from './kernels/Transpose';
import {unpackConfig} from './kernels/Unpack';
import {zerosLikeConfig} from './kernels/ZerosLike';

const kernelConfigs: KernelConfig[] = [
  absConfig,
  addConfig,
  addNConfig,
  allConfig,
  anyConfig,
  argMaxConfig,
  avgPoolConfig,
  batchMatMulConfig,
  batchToSpaceNDConfig,
  castConfig,
  ceilConfig,
  clipByValueConfig,
  concatConfig,
  conv2DConfig,
  conv2DBackpropInputConfig,
  cosConfig,
  coshConfig,
  cropAndResizeConfig,
  cumsumConfig,
  depthToSpaceConfig,
  depthwiseConv2dNativeConfig,
  eluConfig,
  equalConfig,
  expandDimsConfig,
  fillConfig,
  flipLeftRightConfig,
  floorConfig,
  floorDivConfig,
  fusedMatMulConfig,
  fusedBatchNormConfig,
  fusedConv2DConfig,
  fusedDepthwiseConv2DConfig,
  gatherNdConfig,
  gatherV2Config,
  greaterConfig,
  greaterEqualConfig,
  identityConfig,
  leakyReluParamConfig,
  lessConfig,
  lessEqualConfig,
  logConfig,
logicalAndConfig, maxConfig, maximumConfig, maxPoolConfig, meanConfig, minConfig, minimumConfig, mirrorPadConfig, multiplyConfig, negConfig, nonMaxSuppressionV3Config, nonMaxSuppressionV4Config, nonMaxSuppressionV5Config, notEqualConfig, oneHotConfig, onesLikeConfig, packConfig, padV2Config, powConfig, preluConfig, prodConfig, rangeConfig, realDivConfig, reluConfig, relu6Config, reshapeConfig, resizeBilinearConfig, reverseConfig, rotateWithOffsetConfig, rsqrtConfig, roundConfig, scatterNdConfig, selectConfig, sigmoidConfig, sinConfig, sliceConfig, softmaxConfig, spaceToBatchNDConfig, splitVConfig, sqrtConfig, squareConfig, squaredDifferenceConfig, stepConfig, stridedSliceConfig, subConfig, sumConfig, tanConfig, tanhConfig, tileConfig, topKConfig, transformConfig, transposeConfig, unpackConfig, zerosLikeConfig;

for (const kernelConfig of kernelConfigs) {
  registerKernel(kernelConfig);
}

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 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
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 * limitations under the License.
 */

import {env} from '@tensorflow/tfjs-core';

const ENV = env();

/**
 * True if SIMD is supported.
 */
// From: https://github.com/GoogleChromeLabs/wasm-feature-detect
ENV.registerFlag('WASM_HAS_SIMD_SUPPORT', async () => WebAssembly.validate(new Uint8Array([0, 97, 115, 109, 1, 0, 0, 1, 4, 1, 96, 0, 0, 3, 2, 1, 0, 10, 9, 1, 7, 0, 65, 0, 253, 15, 26, 11])));

/**
 * True if threads are supported.
 */
// From: https://github.com/GoogleChromeLabs/wasm-feature-detect
ENV.registerFlag('WASM_HAS_MULTITHREAD_SUPPORT', async () => {
  try {
    // Test for transferability of SABs (needed for Firefox)
    // https://groups.google.com/forum/#!msg/mozilla.dev.platform/IHkBZIHTpA/dwsMNchW EQAJ
    new MessageChannel().port1.postMessage(new SharedArrayBuffer(1));
    // This typed array is a WebAssembly program containing threaded
    // instructions.
    return WebAssembly.validate(new Uint8Array([0, 97, 115, 109, 1, 0, 0, 1, 4, 1, 96, 0, 0, 3, 2, 1, 0, 10, 9, 1, 7, 0, 65, 0, 254, 16, 2, 0, 26, 11])));
  } catch (e) {
    return false;
  }
});

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\']=

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++]=128|u&63}else{if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63}}heap[outIdx]=0;return outIdx-startIdx}function
stringToUTF8(str, outPtr, maxBytesToWrite){return
stringToUTF8Array(str,GROWABLE_HEAP_U8(),outPtr,maxBytesToWrite)}function lengthBytesUTF8(str){var
len=0;for(var i=0;i<str.length;++i){var
u=str.charCodeAt(i);if(u>=55296&&u<=57343)u=65536+(u&1023)<<10|str.charCodeAt(++i)&1023;if(u<=127)+
+len;else if(u<=2047)len+=2;else if(u<=65535)len+=3;else len+=4}return len}function
writeArrayToMemory(array,buffer){GROWABLE_HEAP_I8().set(array,buffer)}function
alignUp(x,multiple){if(x%multiple>0){x+=multiple-x%multiple}return x}var
buffer,HEAP8,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=
WebAssembly.Memory({"initial":INITIAL_MEMORY/65536,"maximum":2147483648/65536,"shared":false});
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){wasmMemory={buffer:Module["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;var runtimeExited=false;if(ENVIRONMENT_IS_PTHREAD)__ATINIT__.push({func:function(){___wasm_call_ctors()}});function preRun(){if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATPRERUN__)}function
preMain(){if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATMAIN__)}function
postRun(){if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATMAIN__)}function
postMain(){if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATMAIN__)}function
exitRuntime(){if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATEXIT__)}function
runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;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"];function removeRunDependenc
y(id){runDependencies--;
if(Module["monitorRunDependencies"])Module["monitorRunDependencies"];}function addRunDependenc
ies(id){assert(!ENVIRONMENT_IS_PTHREAD,"addRunDependency cannot be used in a
pthread
worker");runDependencies++;}
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callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()}} Module[
"preloadedImages"]={}; Module[
"preloadedAudios"]={}; function abort(what){if(Module["onAbort"]){ Module["onAbort"][what]}; if(ENVIRONMENT_IS_PTHREAD) {console.err(\"Pthread aborting at \"+\" NEW Error\")}; what+=\"\"; err(\"\".abort(\"\"+\"\")\" mines. 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); abort(\"err\")} }; function getBinaryPromise(){ if(!wasmBinary&& (ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER) && 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+\"\"}); response.arrayBuffer().then(function(response){ return getBinary(response) })} ) 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\"][\"IV\"]}; 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 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(output){ receiveInstance(output, module) }))}) } else { return instantiateArrayBuffer(receiver); receiveBinaryPromise().then(function(response){ receiveBinary(response) })} }; function 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.call(func,0)} else {wasmTable.call(func, callback.arg)} } else {func(callback.arg===undefined?null:callback.arg)} } }
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```javascript
functionetrics_memcpy_big(dest, src, num) {
    GROWABLE_HEAP_U8().copyWithin(dest, src, src + num);
}

function emscripten_num_logical_cores() {
    return require('os').cpus().length;
}

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[i + 2];
        GROWABLE_HEAP_F64()[b + i] = arg;
    }
    var
```
targetThread=GROWABLE_HEAP_132((canvas.canvasSharedPtr+8)>>2);

function

function _emscripten_set_offscreen_canvas_size(target, width, height)

function _emscripten_set_canvas_element_size(target, width, height)

var

canvas=findCanvasEventTarget(target); if(canvas)

function _emscripten_set_current_thread_status(newStatus)

function _emscripten_set_thread_name(threadId, name)

function __webgl_enable_ANGLE_instanced_arrays(ctx)

function __webgl_enable_OES_vertex_array_object(ctx)

function __webgl_enable_WEBGL_draw_buffers(ctx)

function __webgl_enable_WEBGL_multi_draw(ctx)

var

GL={counter:1,buffers:[],programs:[],framebuffers:[],renderbuffers:[],textures:[],uniforms:[],shaders:[],vaos:[],contexts:{},offscreenCanvases:{},timerQueriesEXT:[],programInfos:{},stringCache:{},unpackAlignment:4,recordError:

function recordError(errorCode)

function getNewId(table)

function createContext(canvas,webGLContextAttributes)

function registerContext(ctx,webGLContextAttributes)

function makeContextCurrent(contextHandle)

function createContext(glContextType)

function createContext(glContextType)

function createContext(glContextType)

function createContext(glContextType)

function createContext(glContextType)

function createContext(glContextType)

function createContext(glContextType)
function(context){if(!context)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};varutable=ptable.uniforms;var
numUniforms=GLctx.getProgramParameter(p,35718);for(var i=0;i<numUniforms;++i){var
u=GLctx.getActiveUniform(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);ptable.uniforms[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)],"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(fd,offset_low,offset_high,whence,newOffset,1);var
ptr=GROWABLE_HEAP_I32()[fd+
_fd_close(fd)][iov+i*8+2];var len=GROWABLE_HEAP_I32()[iov+i*8+4+2];for(var
j=0;j<iovcnt;++j){SYSCALLS.printChar(fd,GROWABLE_HEAP_U8()[(ptr+j)]);num+=len}GROWABLE_HEAP_I32
()[num+++=2];return 0}function
 pthread_cleanup_pop(execute){var
routine=PThread.threadExitHandlers.pop();if(execute)return()routine(arg)}function
 pthread_cleanup_push(routine,arg){PThread.threadExitHandlers.push(function(){washtable.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.newWorker();if(worker.ptyThread!==undefined)throw"Internal
"+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("pthread_join attempted on thread ""+thread+", which was already detached!");return
ERRNO_CODES.EINVAL}
if(block){_emscripten_check_blocking_allowed();for(;;){
threadStatus=Atomics.load(GROWABLE_HEAP_U32[thread+0>>2]);if(threadStatus==1){
threadExitCode=Atomics.load(GROWABLE_HEAP_U32[thread+4>>2]);if(status)GROWABLE_HEAP_I32[thread+sta

tus>>2]=threadExitCode;}
if(block){_emscripten_check_blocking_allowed();else postMessage({"cmd":"cleanupThread","thread":thread});
return
}}}

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:

asmLibraryArg={"e":___assert_fail,"r":___call_main,"x":__emscripten_notify_thread_queue,"b":_abort,"y":
dule["wasmMemory"],"z":_pthread_cleanup_pop,"k":_pthread_cleanup_push,"h":_pthread_create,"m":_pthr
ead_join,"t":_sysconf;asm=createWasm();

___wasm_call_ctors=Module["___wasm_call_ctors"]=function(){return(___wasm_call_ctors=Module["___wasm
_call_ctors"]=Module["asm"]||Module["wasmBinary"]).apply(null,arguments)};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,}"d":__emscripten_futex_wake,"c":__emscripten_futex_get_now,}

"w":_emscripten_set_webgl_create_context,"h":_fd_close,"f":_fd_write,"c":_fd_seek,"v":_fd_close_on_main_thread_js,"F":_data_decoder_async_create,"k":_data_decoder_async_read,"v":_platform_get_current_thread_name,"w":_wasmMemory||Module["wasmMemory"],"o":initPthreadsJS,"a":wasmMemory||Mo
dule["wasmMemory"],"z":_pthread_cleanup_pop,"k":_pthread_cleanup_push,"h":_pthread_create,"m":_pthr
ead_join,"v":__sysconf;asm=createWasm();var

__wasm_callctors=Module["__wasm_callctors"]=function(){return(__wasm_callctors=Module["__wasm
_callctors"]=Module["asm"]||Module["wasmBinary"]).apply(null,arguments)};var

_init=Module["__init"]=function(){return(_init=Module["__init"]=Module["asm"]||Module["Cl"]].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"]||Module["DataDecoderAsync"]).apply(null,arguments)};var

_get_threads_count=Module["__get_threads_count"]=function(){return(_get_threads_count=Module["__get_threads_count"]=Mo
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 throwError};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.version==="\'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 ready = readAsync, readBinary, setTimeout;\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["normalizen"]\[filename\];return
nodeFS["readFileSync"](filename,\"binary\",\"utf8\")};readBinary=function readBinary(filename)\{var
ret=read_(filename,\true\);if(ret.buffer)ret=new Uint8Array(ret.buffer);return
ret\};[if(process["argv"][0])thisProgram=process["argv"][0].replace(/\\/g,"/\");arguments_=[\"";\]
[typeof
process.version==="\'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 ready = readAsync, readBinary, setTimeout;\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["normalizen"]\[filename\];return
nodeFS["readFileSync"](filename,\"binary\",\"null\",\"utf8\")};readBinary=function readBinary(filename)\{var
ret=read_(filename,\true\);if(ret.buffer)ret=new Uint8Array(ret.buffer);return
ret\};[if(process["argv"][0])thisProgram=process["argv"][0].replace(/\\/g,"/\");arguments_=[\"";\]
[typeof
process.version==="\'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 ready = readAsync, readBinary, setTimeout;\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["normalizen"]\[filename\];return
nodeFS["readFileSync"](filename,\"binary\",\"null\",\"utf8\")};readBinary=function readBinary(filename)\{var
ret=read_(filename,\true\);if(ret.buffer)ret=new Uint8Array(ret.buffer);return
ret\};[if(process["argv"][0])thisProgram=process["argv"][0].replace(/\\/g,"/\");arguments_=[\"";\]
[typeof
process.version==="\'string\'";ENVIRONMENT_IS_SHELL!=!ENVIRONMENT_IS_WEB&&!ENVIRONM
ENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var scriptDirectory="/\'./\"function
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dirname(scriptDirectory)+"/"}else{scriptDirectory=__dirname+"/"}}read_=function
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nodeFS["readFileSync"](filename,\"binary\",\"null\",\"utf8\")};readBinary=function readBinary(filename)\{var
ret=read_(filename,\true\);if(ret.buffer)ret=new Uint8Array(ret.buffer);return
ret\};[if(process["argv"][0])thisProgram=process["argv"][0].replace(/\\/g,"/\");arguments_=[\"";\]
[typeof
process.version==="\'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 ready = readAsync, readBinary, setTimeout;\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["normalizen"]\[filename\];return
nodeFS["readFileSync"](filename,\"binary\",\"null\",\"utf8\")};readBinary=function readBinary(filename)\{var
ret=read_(filename,\true\);if(ret.buffer)ret=new Uint8Array(ret.buffer);return
ret\};[if(process["argv"][0])thisProgram=process["argv"][0].replace(/\\/g,"/\");arguments_=[\"";\]
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process.version==="\'string\'";ENVIRONMENT_IS_SHELL!=!ENVIRONMENT_IS_WEB&&!ENVIRONM
ENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var scriptDirectory="/\'./\"function
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ret=read_(filename,\true\);if(ret.buffer)ret=new Uint8Array(ret.buffer);return
ret\};[if(process["argv"][0])thisProgram=process["argv"][0].replace(/\\/g,"/\");arguments_=[\"";\]
[typeof
process.version==="\'string\'";ENVIRONMENT_IS_SHELL!=!ENVIRONMENT_IS_WEB&&!ENVIRONM
ENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var scriptDirectory="/\'./\"function
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nodeFS["readFileSync"](filename,\"binary\",\"null\",\"utf8\")];readBinary=function readBinary(filename)\{var
ret=read_(filename,\true\);if(ret.buffer)ret=new Uint8Array(ret.buffer);return
ret\};[if(process["argv"][0])thisProgram=process["argv"][0].replace(/\\/g,"/\");arguments_=[\"";\]
[typeof
process.version==="\'string\'";ENVIRONMENT_IS_SHELL!=!ENVIRONMENT_IS_WEB&&!ENVIRONM
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scriptDirectory+path]\var ready = readAsync, readBinary, setTimeout;\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["normalizen"]\[filename\];return
nodeFS["readFileSync"](filename,\"binary\",\"null\",\"utf8\")];readBinary=function readBinary(filename)\{var
ret=read_(filename,\true\);if(ret.buffer)ret=new Uint8Array(ret.buffer);return
ret\};[if(process["argv"][0])thisProgram=process["argv"][0].replace(/\\/g,"/\");arguments_=[\"";\]
[typeof
process.version==="\'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 ready = readAsync, readBinary, setTimeout;\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["normalizen"]\[filename\];return
nodeFS["readFileSync"](filename,\"binary\",\"null\",\"utf8\")];readBinary=function readBinary(filename)\{var
ret=read_(filename,\true\);if(ret.buffer)ret=new Uint8Array(ret.buffer);return
ret\};[if(process["argv"][0])thisProgram=process["argv"][0].replace(/\\/g,"/\");arguments_=[\"";\]

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){
func=Module["_"+ident];func=assert(func,"Cannot call unknown function "+ident+".", make sure it is exported");
return func;
}

function ccallback(ident,returnType,argTypes,args,opts){
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 func=Module["_"+ident];assert(func,"Cannot call unknown function "+ident+".", make sure it is exported");
return func;
}

function cwrap(ident,returnType,argTypes,opts){
numericArgs=argTypes.every(function(type){return type=="number"});
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 UTF8ToString(ptr,maxBytesToRead){
return stringToUTF8Array(str,heap,outPtr,maxBytesToWrite); }

function stringToUTF8Array(str,heap,outPtr,maxBytesToWrite){

HEAP8.set(array,buffer);HEAPU8.set(array,buffer);HEAP16.set(array,buffer);HEAP32.set(array,buffer);HEAPU16.set(array,buffer);HEAPU32.set(array,buffer);HEAPF32.set(array,buffer);HEAPF64.set(array,buffer);
Float32Array(buf);Module["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"].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(Module["preloadedImages"]){}function getBinary(file){try{if(file==wasmBinaryFile&&wasmMemory){return new Uint8Array(wasmMemory)}if(readBinary){return readBinary(file)}else{throw"both async and sync fetching of the wasm failed"}}catch(err){abort(err)}}var fileURIprefix="file://";function isFileURI(filename){return hasPrefix(filename,fileURIprefix)}var wasmBinaryFile="tfjs-backend-wasm.wasm";if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof fetch==="function"&&!isDataURI(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)})}else if(readAsync){return new Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new Uint8Array(response))},reject)})}getBinary(wasmBinaryFile))}}function createWasm(){var info={"a":asmLibraryArg};function receiveInstance(instance,module){var exports=instance.exports;Module["asm"]=exports;wasmMemory=Module["asm"]["j"];updateGlobalBufferAnd Views(wasmMemory.buffer);wasmTable=Module["asm"]["r"];removeRunDependency("wasm-instantiate");function receiveInstantiatedSource(output){receiveInstance(output,"instance")}function instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return WebAssembly.instantiate(binary,info).then(function(instance){return receiveInstantiatedSource(output)(receiveInstance(output,"instance"))})})}function instantiateAsync(){if(!wasmBinary&&typeof WebAssembly.instantiateStreaming==="function"&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFile)){return getBinaryPromise().then(function(binary){return WebAssembly.instantiateStreaming(fetch(wasmBinaryFile),info).then(function(instance){return receiveInstantiatedSource(output)(receiveInstance(output,"instance"))})})}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)})}else if(readAsync){return new Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new Uint8Array(response))},reject)})}getBinary(wasmBinaryFile))}function createWasm(){var info={"a":asmLibraryArg};function receiveInstance(instance,module){var exports=instance.exports;Module["asm"]=exports;wasmMemory=Module["asm"]["j"];updateGlobalBufferAnd Views(wasmMemory.buffer);wasmTable=Module["asm"]["r"];removeRunDependency("wasm-instantiate");function receiveInstantiatedSource(output){receiveInstance(output,"instance")}function instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return WebAssembly.instantiate(binary,info).then(function(instance){return receiveInstantiatedSource(output)(receiveInstance(output,"instance"))})})}function instantiateAsync(){if(!wasmBinary&&typeof WebAssembly.instantiateStreaming==="function"&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFile)){return getBinaryPromise().then(function(binary){return WebAssembly.instantiateStreaming(fetch(wasmBinaryFile),info).then(function(instance){return receiveInstantiatedSource(output)(receiveInstance(output,"instance"))})})}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)})}else if(readAsync){return new Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new Uint8Array(response))},reject)})}getBinary(wasmBinaryFile))}}
c) & & typeof fetch !== "function" || return fetch(wasmBinaryFile, { credentials: "same-origin" }).then((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()); }); if (Module["instantiateWasm"])(try { var exports = Module["instantiateWasm"](info, receiveInstance); return exports; } catch(e) { err("Module.instantiateWasm callback failed with error: "+e); return instantiateAsync(); }); }) || instantiateArrayBuffer(receiveInstantiatedSource()); } else { return instantiateArrayBuffer(receiveInstantiatedSource()); }

SYSCALLS = { mappings: {}, buffers: [null, [], []], printChar: (function (stream, curr) {
  buffer = SYSCALLS.buffers[stream];
  curr = curr ? curr : 0;
  curr = curr !== 0 ? curr : 10;
  (stream === 1 ? out : err)(UTF8ArrayToString(buffer, 0));
  buffer.length = 0;
} )

if (Module["instantiateWasm"])
  try{
    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)}
    }
  }
}

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){
    return 0;
  }
}

function _emscripten_resize_heap(requestedSize){
  var new_size=Math.min(Math.max(requestedSize,overGrownHeapSize),65536);
  var replacement=emscripten_realloc_buffer(new_size);
  if(replacement){
    return replacement;
  }
  return true;
}

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])
    }
  }
  return 0;
}

function __pthread_create(){
  return 6;
}

function __pthread_join(){
  return 28;
}

setErrNo(value);

setErrNo(28);
return -1;
}

var asmLibraryArg={"a":_abort,"d":_emscripten_memcpy_big,"e":_emscripten_resize_heap,"f":_fd_close,"g":_fd_write,"h":_pthread_create","i":_pthread_join}

setErrNo(value);

HEAP32[__errno_location__()>>2]=value;
return value;

function __sysconf(name){
  switch(name){
    case 30: return 16384;
    case 31: return 32;
    case 32: return 2147483647;
    case 33: return 2048;
    case 34: return 47839;
    case 35: return 99;
    case 36: return 2048;
    case 37: return 92;
    case 38: return 100;
    case 39: return 64;
    case 40: return 4;
    case 41: return 8;
  }

  return 0;
}

var asmLibraryArg={"a":_abort,"d":_emscripten_memcpy_big,"e":_emscripten_resize_heap,"f":_fd_close,"g":_fd_write,"h":_pthread_create","i":_pthread_join}

setErrNo(28);
return -1;

var asmLibraryArg={"a":_abort,"d":_emscripten_memcpy_big,"e":_emscripten_resize_heap,"f":_fd_close,"g":_fd_write,"h":_pthread_create}

asm=createWasm();

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otherwise.
* @param dataId
* @oaram force Optional, remove the data regardless of refCount
* @param disposeData(dataId: DataId, force = false): boolean
| if (this.dataIdMap.has(dataId))
| const data = this.dataIdMap.get(dataId);
| if (!force && data.refCount > 0) return false;
| this.wasm._free(data.memoryOffset);
| this.wasm.tfjs.disposeData(dataId);
| this.dataIdMap.delete(dataId);
| return true;
| */

** Return refCount of a 'TensorData'. *

* @param refCount(dataId: DataId): number
| if (this.dataIdMap.has(dataId))
| const data = this.dataIdMap.get(dataId);
| data.refCount--;
| if (!force && data.refCount > 0) return false;
| this.wasm._free(data.memoryOffset);
| this.wasm.tfjs.disposeData(dataId);
| this.dataIdMap.delete(dataId);
| return true;
| */

** Make a tensor info for the output of an op. If `memoryOffset` is not defined, this method allocates memory on the WASM heap. If `memoryOffset` is not defined, the memory was allocated elsewhere (in c++) and we just record the pointer where that memory lives. *

* @param makeOutput(shape: number[], dtype: DataType, memoryOffset?: number): TensorInfo
| let dataId = this.write(null /* values */, shape, dtype);
| this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype, refCount: 1});
| const size = util.sizeFromShape(shape);
| this.wasm.HEAPU8.buffer;
| this.dataIdMap.get(dataId);
| const size = util.sizeFromShape(shape);
| this.wasm.registerTensor(id, size, dtype);
Blob([response], {type: 'application/javascript'}); 
return URL.createObjectURL(blob);
}

if (path.endsWith('.wasm')) {
  return getPathToWasmBinary(
      simdSupported as boolean, threadsSupported as boolean,
      wasmPathPrefix != null ? wasmPathPrefix : prefix);
}

let initialized = false;
factoryConfig.onAbort = () => {
  if (initialized) {
    // Emscripten already called console.warn so no need to
    // double log.
    return;
  }
  if (initAborted) {
    // Emscripten calls 'onAbort' twice, resulting in double
    // error messages.
    return;
  }
  initAborted = true;
  const rejectMsg =
      'Make sure the server can serve the `.wasm` file relative to the ' +
    'bundle.js file. For more details see
    https://github.com/emscripten-core/emscripten/blob/2bca083cbbd5a4133db61fbd74d04f7f6eccf9a07/tests/manual_wasmInstantiate.html#L170

  reject({message: rejectMsg});
}

wasm.then((module) => {
  initialized = true;
  initAborted = false;

  const voidReturnType: string = null;
  module.tfjs = {
    init: module.cwrap('init', null, ['number']),
    initWithThreadsCount:
      module.cwrap('init_with_threads_count', null, ['number']),
    getThreadsCount: module.cwrap('get_threads_count', 'number', []),
    registerTensor:
      module.cwrap('register_tensor', null, ['number', 'number', 'number']),
    disposeData: module.cwrap('dispose_data', voidReturnType, ['number']),
    dispose: module.cwrap('dispose', voidReturnType, []),
  };

  resolve({wasm: module});
});

function typedArrayFromBuffer(
  buffer: ArrayBuffer, dtype: DataType): backend_util.TypedArray {
  switch (dtype) {
    case 'float32':
      return new Float32Array(buffer);
    case 'int32':
      return new Int32Array(buffer);
    case 'bool':
      return new Uint8Array(buffer);
    default:
      throw new Error(`Unknown dtype ${dtype}`);
  }
}

const wasmBinaryNames = ['tfjs-backend-wasm.wasm', 'tfjs-backend-wasm-simd.wasm', 'tfjs-backend-wasm-threaded-simd.wasm']

let isWasmPathSupported = false;

/**
 * Configures the locations of the WASM binaries.
 * ```
 * setWasmPaths({
 *  'tfjs-backend-wasm.wasm': 'renamed.wasm',
 *  'tfjs-backend-wasm-simd.wasm': 'renamed-simd.wasm',
 *  'tfjs-backend-wasm-threaded-simd.wasm': 'renamed-threaded-simd.wasm'
 * });
 * tf.setBackend('wasm');
 * ```
 *
 * @param prefixOrFileMap This can be either a string or object:
 *  - (string) The path to the directory
where the WASM binaries are located.

Note that this prefix will be used to load each binary (vanilla, SIMD-enabled, threading-enabled, etc.).

Mapping from names of WASM binaries to custom full paths specifying the locations of those binaries. This is useful if your WASM binaries are not all located in the same directory, or if your WASM binaries have been renamed.

@param usePlatformFetch optional boolean to use platform fetch to download the wasm file, default to false.

* @doc {heading: 'Environment', namespace: 'wasm'}

export function setWasmPaths(prefixOrFileMap: string|{
    wasmPath: string
}, usePlatformFetch = false): void {
  if (initAborted) {
    throw new Error('The WASM backend was already initialized. Make sure you call
      `tf.backend()` or before you call
      `tf.setBackend()` or
      `tf.ready()`);\n  }\n
  if (typeof prefixOrFileMap === 'string') {
    wasmPathPrefix = prefixOrFileMap;\n  } else {
    wasmFileMap = prefixOrFileMap;
  }\n
  const missingPaths =\n    wasmBinaryNames.filter(name => wasmFileMap[name] == null);\n  if (missingPaths.length > 0) {
    throw new Error(`There were no entries found for the following binaries: ` +
      `${missingPaths.join(',')} Please either call setWasmPaths with a ` +
      `map providing a path for each binary, or with a string indicating` +
      `\n
    the directory where all the binaries can be found.`);\n  }\n
    \n}

// This code is auto-generated, do not modify this file!
const version = '3.11.0';
export {version};
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Open Source Used in Cisco Meeting Server (formerly Acano Server) 3.4 5423
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5429
Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/tf-backend-wasm.es2017.js.map

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* ===================================================================*/

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/Ceil.cc
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/Elu.cc
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/Transform.cc
* /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/sin_cos_workaround.h
* /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/kernels/Any.cc
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```javascript
import {backend_util, KernelConfig, KernelFunc, Sum, SumAttrs, SumInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

```
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```javascript
function sum(args: {backend: BackendWasm, inputs: SumInputs, attrs: SumAttrs}):
    TensorInfo {
  const {backend, inputs, attrs} = args;
  const {axis, keepDims} = attrs;
  const {x} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  let inputId = xId;
  let input = x;

  const {transposed, axes, inputWasTransposed} =
    permuteAxesAndTranspose(x, axis, backend);

  let reductionAxes = axes;
  if (inputWasTransposed) {
    const transposedId = backend.dataIdMap.get(transposed.dataId).id;
    if (transposedId !== xId) {
      // transpose was not a no-op. We will need to dispose of this
      // once we are done.
      input = transposed;
      inputId = transposedId;
      reductionAxes = backend_util.getInnerMostAxes(reductionAxes.length,
        input.shape.length);
    }
  }

  backend_util.assertAxesAreInnerMostDims('sum', reductionAxes,
    input.shape.length);
  const [outShape, reduceShape] =
    backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);
  const reduceSize =
    util.sizeFromShape(reduceShape);
  const out = backend.makeOutput(outShape, input.dtype);
  if (util.sizeFromShape(input.shape) !== 0) {
    const outId = backend.dataIdMap.get(out.dataId).id;
    wasmSum(inputId, reduceSize, CppDType[out.dtype], outId);
  }

  if (inputWasTransposed) {
    // dispose of the transposed tensor.
    backend.disposeData(transposed.dataId);
  }

  if (keepDims) {
    // reshape
    const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);
    out.shape = newShape;
  }

  return out;
}

export const sumConfig: KernelConfig = {
  kernelName: Sum,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: sum as {} as KernelFunc
};
```

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 *
=============================================================================

/*
 * This enum must align with the enum defined in cc/backend.h.
 */

export enum CppDType {
  float32 = 0,
  int32 = 1,
  bool = 2,
  string = 3,
  complex64 = 4
}
```

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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

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"version":3,"file":"Prod.js","sourceRoot":"","sources":null,"names":null,"mappings":null

```javascript
import {backend_util, KernelConfig, KernelFunc, Prod, ProdAttrs, ProdInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {permuteAxesAndTranspose} from './kernel_utils';

import {CppDType} from './types';

let wasmProd: (xId: number, reduceSize: number,
    dtype: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmProd = backend.wasm.cwrap(Prod, null /*void*/, 
    ['number',
    'number',
    'number',
    'number']);
}

function prod(args: {
  backend: BackendWasm,
  inputs: ProdInputs,
  attrs: ProdAttrs
}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {axis, keepDims} = attrs;
  const {x}
```
```javascript
const xId = backend.dataIdMap.get(x.dataId).id;
let inputId = xId;
let input = x;

const transposed = backend.dataIdMap.get(transposed.dataId).id;
if (transposed !== xId) {
  // transpose was not a no-op. We will need to dispose of this once we are done.
  input = transposed;
  inputId = transposedId;
}

backend_util.assertAxesAreInnerMostDims('prod', reductionAxes, input.shape.length);
const [outShape, reduceShape] = backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);
const reduceSize = util.sizeFromShape(reduceShape);

const out = backend.makeOutput(outShape, input.dtype);
if (util.sizeFromShape(input.shape) !== 0) {
  const outId = backend.dataIdMap.get(out.dataId).id;
  wasmProd(inputId, reduceSize, CppDType[out.dtype], outId);
}

if (inputWasTransposed) {
  // dispose of the transposed tensor.
  backend.disposeData(transposed.dataId);
}

if (keepDims) {
  // reshape
  const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);
  out.shape = newShape;
}

return out;

export const prodConfig: KernelConfig = {
  kernelName: Prod,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: prod as {} as KernelFunc
};
```

CAAC","sourcesContent":"

****

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=============================================================================

```javascript
import {Identity, IdentityInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';
import {TensorInfo} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

export function identity(args: {inputs: IdentityInputs, backend: BackendWasm}):
    TensorInfo {
  const {inputs: {x}, backend} = args;
  const out = backend.makeOutput(x.shape, x.dtype);
  const inVals = backend.typedArrayFromHeap(x);
  const outVals = backend.typedArrayFromHeap(out);
  outVals.set(inVals);
  return out;
}

export const identityConfig: KernelConfig = {
  kernelName: Identity,
  backendName: 'wasm',
  kernelFunc: identity as {} as KernelFunc,
};
```

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Identity.js.map

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ppings":null}
```

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 *=============================================================================
 */

import {Cast, CastAttrs, CastInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';
import {TensorInfo} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

export function cast(
    args: {inputs: CastInputs, attrs: CastAttrs, backend: BackendWasm}):
    TensorInfo {
  const {inputs: {x}, attrs: {dtype}, backend} = args;
  const out = backend.makeOutput(x.shape, dtype);
  const inVals = backend.typedArrayFromHeap(x);
  const outVals = backend.typedArrayFromHeap(out);
  outVals.set(inVals);
  return out;
}

export const castConfig: KernelConfig = {
  kernelName: Cast,
  backendName: 'wasm',
  kernelFunc: cast as {} as KernelFunc,
};

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-dist/kernels/Cast.js.map
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---

```typescript
import {backend_util, DepthwiseConv2dNative, DepthwiseConv2dNativeAttrs, DepthwiseConv2dNativeInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmDepthwiseConv2d: (
    xId: number, batchSize: number,
    inputHeight: number, inputWidth: number,
    filterId: number, filterHeight: number, filterWidth: number, padTop: number,
    padRight: number, padBottom: number, padLeft: number, isSamePad: number,
    dilationHeight: number, dilationWidth: number, strideHeight: number, strideWidth: number, inputChannels: number, outputChannels: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmDepthwiseConv2d = backend.wasm.cwrap(DepthwiseConv2dNative, null /* void */, [
    'number',  // xId
    'number',  // batchSize
    'number',  // inputHeight
    'number',  // inputWidth
    'number',  // filterId
    'number',  // filterHeight
    'number',  // filterWidth
    'number',  // padTop
    'number',  // padRight
    'number',  // padBottom
    'number',  // padLeft
    'number',  // isSamePad
    'number',  // dilationHeight
    'number',  // dilationWidth
    'number',  // strideHeight
    'number',  // strideWidth
    'number',  // inputChannels
    'number',  // outputChannels
    'number'  // outId
  ]);}

function depthwiseConv2d(args: {
  inputs: DepthwiseConv2dNativeInputs,
  backend: BackendWasm,
  attrs: DepthwiseConv2dNativeAttrs
}) {
  const {inputs, attrs, backend} = args;

  const {x, filter} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  const filterId = backend.dataIdMap.get(filter.dataId).id;

  const {strides, dilations, pad, dimRoundingMode} = attrs;

  const $dilations = dilations == null ? [1, 1] : dilations;

  const convInfo = backend_util.computeConv2DInfo((x as Tensor4D).shape, (filter as Tensor4D).shape, strides, ($dilations as number | [number, number]), pad, dimRoundingMode);

  const filterHeight = convInfo.filterHeight;
  const filterWidth = convInfo.filterWidth;
  const padTop = convInfo.padInfo.top;
  const padRight = convInfo.padInfo.right;
  const padBottom = convInfo.padInfo.bottom;
  const padLeft = convInfo.padInfo.left;
  const dilationHeight = convInfo.dilationHeight;
  const dilationWidth = convInfo.dilationWidth;
  const strideHeight = convInfo.strideHeight;
  const strideWidth = convInfo.strideWidth;
  const inputChannels = convInfo.inChannels;
  const outputChannels = convInfo.outChannels;
  const isSamePad = convInfo.padInfo.type === 'SAME';

  if (convInfo.dataFormat !== 'channelsLast') {
    throw new Error(`wasm backend DepthwiseConv2dNative does not support dataFormat: '${convInfo.dataFormat}'. Please use 'channelsLast'.`);
  }

  const out = backend.makeOutput(convInfo.outShape, 'float32');
  const outId = backend.dataIdMap.get(out.dataId).id;
  const filterHeight = convInfo.filterHeight;
  const filterWidth = convInfo.filterWidth;
  const padTop = convInfo.padInfo.top;
  const padRight = convInfo.padInfo.right;
  const padBottom = convInfo.padInfo.bottom;
  const padLeft = convInfo.padInfo.left;
  const dilationHeight = convInfo.dilationHeight;
  const dilationWidth = convInfo.dilationWidth;
  const strideHeight = convInfo.strideHeight;
  const strideWidth = convInfo.strideWidth;

  if (inputChannels !== outputChannels) {
    throw new Error(`Input and output channels must be the same: ${inputChannels} != ${outputChannels}.`);
  }

  // Call the backend function
  wasmDepthwiseConv2d(xId, x.shape[0], x.shape[1], x.shape[2], filterId, filterHeight, filterWidth, padTop, padRight, padBottom, padLeft, isSamePad, dilationHeight, dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels, outId);

  return out;
}

export const depthwiseConv2dNativeConfig: KernelConfig = {
  kernelName: DepthwiseConv2dNative,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: depthwiseConv2d as {} as KernelFunc
};
```

---

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Therefore, the current page contains a snippet from a codebase related to a specific TensorFlow function, `depthwiseConv2d`, which is used for depthwise convolution in neural networks. The code provides a detailed representation of how this function is set up and called within a WebAssembly backend. This function is part of a larger framework that facilitates the use of TensorFlow operations in environments that support WebAssembly, allowing for more efficient execution in environments like the cloud or browser-based applications.
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 *
 *=============================================================================

import {Any, AnyAttrs, AnyInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util} from
'@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import
{permuteAxesAndTranspose} from './kernel_utils';

let wasmAny: (xId: number, reduceSize: number, outId:
number) => void;

function setup(backend: BackendWasm): void {
  wasmAny = backend.wasm.cwrap(Any,
null /*void*/, 
['number, number, number']);
}

function any(args: {backend: BackendWasm, inputs: AnyInputs,
attrs: AnyAttrs}):
  TensorInfo {
  const {backend, inputs, attrs} = args;
  const {axis, keepDims} = attrs;
  const {x} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  let inputId = xId;
  let input = x;

  const {transposed, axes, originalAxes, inputWasTransposed} =
      permuteAxesAndTranspose(x, axis,
backend);

  if (inputWasTransposed) {
    const transposedId = backend.dataIdMap.get(transposed.dataId).id;
    input = transposed;
    inputId = transposedId;
  }

  const inputRank = input.shape.length;
  backend_util.assertAxesAreInnerMostDims('any', axes, inputRank);
  const [outShape, reduceShape] =
backend_util.computeOutAndReduceShapes(input.shape, axes);
  const reduceSize =
util.sizeFromShape(reduceShape);

  const out = backend.makeOutput(outShape, x.dtype);
  if (util.sizeFromShape(input.shape) !== 0) {
    const outId = backend.dataIdMap.get(out.dataId).id;
    wasmAny(inputId, reduceSize, outId);
  }

  if (inputWasTransposed) {
    // dispose of the transposed tensor.
    backend.disposeData(transposed.dataId);
  }

  if (keepDims) {
    // reshape
    const newShape =
backend_util.expandShapeToKeepDim(outShape, originalAxes);
    out.shape = newShape;
  }

  return
out;
}

export const anyConfig: KernelConfig = {
  kernelName: Any,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: any as {} as KernelFunc
};
```

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```javascript

---

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm/dist/kernels/kernel_utils.js.map

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-dist/kernels/Any.js.map

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 */

import {KernelConfig, KernelFunc, NonMaxSuppressionV5, NonMaxSuppressionV5Attrs, NonMaxSuppressionV5Inputs, TensorInfo} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {parseResultStruct} from './NonMaxSuppression_util';

let wasmFunc:
  (boxesId: number, scoresId: number, maxOutputSize: number,
   iouThreshold: number, scoreThreshold: number,
   softNmsSigma: number) =>
    number;

function setup(backend: BackendWasm): void {
  wasmFunc =
    backend.wasm.cwrap(
      NonMaxSuppressionV5,
      'number',  // Result*
      ['number',  // boxesId
        'number',  // scoresId
        'number',  // maxOutputSize
        'number',  // iouThreshold
        'number',  // scoreThreshold
        'number'],  // softNmsSigma
    );
}

function kernelFunc(args: {
  backend: BackendWasm,
  inputs: NonMaxSuppressionV5Inputs,
  attrs: NonMaxSuppressionV5Attrs
}): TensorInfo[] {
  const {backend, inputs, attrs} = args;
  const {iouThreshold, maxOutputSize, scoreThreshold, softNmsSigma} = attrs;
  const {boxes, scores} = inputs;
  const boxesId = backend.dataIdMap.get(boxes.dataId).id;
  const scoresId = backend.dataIdMap.get(scores.dataId).id;
  const resOffset = wasmFunc(boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold, softNmsSigma);
  const pSelectedIndicesTensor = backend.makeOutput([selectedSize], 'int32', pSelectedIndices);
  const selectedScoresTensor = backend.makeOutput([selectedSize], 'float32', pSelectedScores); return
  [pSelectedIndicesTensor, selectedScoresTensor];
}

export const nonMaxSuppressionV5Config: KernelConfig =
  { kernelName: NonMaxSuppressionV5, backendName: 'wasm', setupFunc: setup, kernelFunc: kernelFunc as { } as KernelFunc[]; }n
```
import {KernelConfig, KernelFunc, Prelu, PreluInputs} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {cast} from './Cast';

let wasmPrelu: (xId: number, weightsId: number, outId: number) => void;  

function setup(backend: BackendWasm) {
  wasmPrelu = backend.wasm.cwrap(Prelu, null /* void */, 
    ['number', // x_id
    'number',  // weights_id
    'number']  // out_id
  );
}

function prelu(args: {inputs: PreluInputs, backend: BackendWasm}) {
  const {inputs, backend} = args;
  const {x, alpha} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  const weightsId = backend.dataIdMap.get(alpha.dataId).id;

  let inputId = xId;
  const input = x;
  let castedInput = input;
  if (input.dtype !== 'float32') {
    castedInput = cast({backend, inputs: {x}, attrs: {dtype: 'float32'}});
    inputId = backend.dataIdMap.get(castedInput.dataId).id;
  }

  const out = backend.makeOutput(x.shape, 'float32');
  const outId = backend.dataIdMap.get(out.dataId).id;
  wasmPrelu(inputId, weightsId, outId);

  if (input.dtype !== 'float32') {
    backend.disposeData(castedInput.dataId);
  }
  return out;
}

export const preluConfig: KernelConfig = {
  kernelName: Prelu,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: prelu as {} as KernelFunc
};
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=============================================================================

*/

import './register_all_kernels'; export * from './base';

---

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 *=============================================================================
 */

import {backend_util, FusedDepthwiseConv2D, FusedDepthwiseConv2DAttrs,
FusedDepthwiseConv2DInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {FusableActivation} from './types';

let
wasmFusedDepthwiseConv2d:
    (xId: number, batchSize: number, inputHeight: number, inputWidth: number,
filterId: number, filterHeight: number, filterWidth: number,
biasId: number, padTop: number, padRight: number, padBottom: number,
padLeft: number, isSamePad: number, dilationHeight: number,
dilationWidth: number, dilationHeight: number, strideHeight: number, strideWidth: number, inputChannels: number, outputChannels: number, activation: number, preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>
void;

function setup(backend: BackendWasm) {
  wasmFusedDepthwiseConv2d =
backend.wasm.cwrap(FusedDepthwiseConv2D, null /* void */, 
[  'number',  // xId
  'number',  // batchSize
  'number',  // inputHeight
  'number',  // inputWidth
  'number',  // filterId
  'number',  // filterHeight
  'number',  // filterWidth
  'number',  // biasId
  'number',  // padTop
  'number',  // padRight
  'number',  // padBottom
  'number',  // padLeft
  'number',  // isSamePad
  'number',  // dilationHeight
  'number',  // dilationWidth
  'number',  // strideHeight
  'number',  // strideWidth
  'number',  // inputChannels
  'number',  // outputChannels
  'number',  // activation
]);
function fusedDepthwiseConv2d(args: {
  inputs: FusedDepthwiseConv2DInputs,
  backend: BackendWasm,
  attrs:
    FusedDepthwiseConv2DAttrs
}) {
  const { inputs, attrs, backend } = args;
  const { x, filter, bias, preluActivationWeights } = inputs;
  const { strides, pad, dilations, dataFormat, dimRoundingMode, activation, leakyreluAlpha } = attrs;
  const convInfo = backend_util.computeConv2DInfo(x as Tensor4D).shape,
    (filter as Tensor4D).shape, strides, dilations, pad, dimRoundingMode,
    true /* depthwise */
  const fusedActivation = $activation
    ? FusableActivation[activation as {}] : fusedActivation; /* activation not yet supported for FusedDepthwiseConv2D */
  const xId = backend.dataIdMap.get(x.dataId).id;
  const filterId = backend.dataIdMap.get(filter.dataId).id;
  const outputChannels = convInfo.outChannels;
  if (biasId == 0) {
    const biasData = backend.dataIdMap.get(bias.dataId);
    if (biasData.shape.length !== 1) {
      throw new Error(
        `FusedDepthwiseConv2D bias shape (${biasData.shape}) does not ` +
        `match the number of output channels (${outputChannels})`);
    }
    biasId = biasData.id;
  }
  const filterHeight = convInfo.filterHeight;
  const filterWidth = convInfo.filterWidth;
  const padTop = convInfo.padInfo.top;
  const padRight = convInfo.padInfo.right;
  const padBottom = convInfo.padInfo.bottom;
  const padLeft = convInfo.padInfo.left;
  const dilationHeight = convInfo.dilationHeight;
  const dilationWidth = convInfo.dilationWidth;
  const strideHeight = convInfo.strideHeight;
  const strideWidth = convInfo.strideWidth;
  const inputChannels = convInfo.inChannels;
  const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;
  const batchSize = convInfo.batchSize;
  const inHeight = convInfo.inHeight;
  const inWidth = convInfo.inWidth;
  if (dataFormat !== 'NHWC') {
    throw new Error(
      `wasm backend FusedDepthwiseConv2D does not support ` +
      `dataFormat:'` + dataFormat + `'`. Please use 'NHWC'.`);
  }
  const out = backend.makeOutput(convInfo.outShape, 'float32');
  const outId = backend.dataIdMap.get(out.dataId).id;
  const preluActivationWeightsId = preluActivationWeights == null ? 0 : backend.dataIdMap.get(preluActivationWeights.dataId).id;
  const wasmFusedDepthwiseConv2d = xId, batchSize, inHeight, inWidth, filterId, filterHeight, filterWidth,
    biasId, padTop, padRight, padBottom, padLeft,
    isSamePad, dilationHeight, dilationWidth, strideHeight, strideWidth, inputChannels,
    outputChannels, fusedActivation, preluActivationWeightsId, leakyreluAlpha || 0, outId;
  const return_output = w
  const fusedDepthwiseConv2DConfig: KernelConfig = {
    kernelName: FusedDepthwiseConv2D,
    backendName: 'wasm',
    setupFunc: setup,
    kernelFunc: fusedDepthwiseConv2d as {} as KernelFunc
  };

@export colas/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/FusedDepthwiseConv2D.js.map
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 *
 *=============================================================================
 */

import {env} from '@tensorflow/tfjs-core';

const ENV = env();

/**
 * True if SIMD is supported.
 */
// From: https://github.com/GoogleChromeLabs/wasm-feature-detect
ENV.registerFlag('WASM_HAS_SIMD_SUPPORT', async () => WebAssembly.validate(new Uint8Array(
  [ 0, 97, 115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3, 2, 1, 0, 5, 4, 1, 3, 1, 10, 11, 1, 9, 0, 65, 0, 253, 15, 26, 11 ]
));

/**
 * True if threads are supported.
 */
// From: https://github.com/GoogleChromeLabs/wasm-feature-detect
ENV.registerFlag('WASM_HAS_MULTITHREAD_SUPPORT', async () => {
  // Test for transferability of SABs (needed for Firefox)
  // Test for WebAssembly program containing threads
  return WebAssembly.validate(new Uint8Array(
    [ 0, 97, 115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3, 2, 1, 0, 5, 4, 1, 3, 1, 10, 11, 1, 9, 0, 65, 0, 253, 15, 26, 11 ]
  ));
})

// This typed array passed in to WebAssembly.validate is WebAssembly binary code. In this case it is a small program that contains SIMD instructions.

// This typed array is a WebAssembly program containing threaded instructions.
```

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/flags_wasm.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
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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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```javascript

import {FlipLeftRight, FlipLeftRightInputs, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-core';

export function flipLeftRight(args: {inputs: FlipLeftRightInputs, backend: BackendWasm}): TensorInfo {
    const {inputs, backend} = args;
    // Code for flipLeftRight...
}

```
const {image} = inputs;

const out = backend.makeOutput(image.shape, image.dtype);
const imageId = backend.dataIdMap.get(image.dataId).id;
const outId = backend.dataIdMap.get(out.dataId).id;

const [batch, imageHeight, imageWidth, numChannels] = image.shape;
const wasmFlipLeftRight = backendFunc.batch, imageHeight, imageWidth, numChannels);

wasmFlipLeftRight(imageId, batch, imageHeight, imageWidth, numChannels, outId);
return out;
}

export const flipLeftRightConfig:

KernelConfig = {
  kernelName: FlipLeftRight,
  backendName: 'wasm',
  kernelFunc: llvm as {} as
  KernelFunc,
  setupFunc: setup
};

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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-dist/kernels/FlipLeftRight.js.map

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"version":3,"file":"Elu.js","sourceRoot":","sources":[".././src/kernels/Elu.ts"],"names":[],"mappings":
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;;;;;;;;GAeG;AACH,OAAO,EAAC,GAAG,EEAe,MAAM,UBAABU,CAAC,AAExD,OAAC,EAAC,UBAABU,EAAC
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 */
import {Elu, KernelConfig} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from
'./unary_kernel';

export const eluConfig: KernelConfig = createUnaryKernelConfig(Elu);

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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-dist/kernels/Elu.js.map

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"version":3,"file":"Neg.js","sourceRoot":","sources":[".././src/kernels/Neg.ts"],"names":[],"mappings":
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;;;;;;;;;;GAeG;AACH,OAAO,EAAe,GAAG,EAAC,MAAM,UBAABU,CAAC,AAEvD,OAAC,EAAC,UBAABU,EAAC
MAAM,GBAABG,CAAC,AAEvD,MAAM,CAAC,MAAM,SAAS,GAAIB,UBAABU,CAAC,GAAG,CAAC,CAAC","sourcesContent":"
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 */
import {KernelConfig, Neg} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from
'./unary_kernel';

export const negConfig: KernelConfig = createUnaryKernelConfig(Neg);

Found in path(s):
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*/
import {KernelConfig, Sin} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';
export const sinConfig: KernelConfig = createUnaryKernelConfig(Sin);
```

Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Sin.js.map

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*/
import {KernelConfig, Square} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';
export const squareConfig: KernelConfig = createUnaryKernelConfig(Square);
```

Found in path(s):

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*/
import {KernelConfig, Minimum} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';
export const minimumConfig: KernelConfig = createUnaryKernelConfig(Minimum);
```

Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Minimum.js.map

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=============================================================================

*/
import {KernelConfig, Minimum} from '@tensorflow/tfjs-core';

import {createBinaryKernelConfig} from './binary_kernel';

const supportsFullBroadcast = false;

export const minimumConfig: KernelConfig =

createBinaryKernelConfig(Minimum, supportsFullBroadcast);

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wasm/dist/kernels/Minimum.js.map

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{"version":3,"file":"Tan.js","sourceRoot":"","sources":['../../src/kernels/Tan.ts'"],"names":[],"mappings":"AADA;;;;;AADA;;;;;;;;;;;;;;;GAeG;AACH,OAAO,EAae,GAAG,EAAC,MAAM,BAoB,CAAC:AEXD,OAAM,EAAC,BAAoB,EA AC,MAAM,GAAbB,CAAC:AAcD,MAAM,CAAC,MAAM,SAAS,GAAb,BAoB,CAAC,GAAG,CAAC,CA AC",""sourcesContent":"

*/
import {KernelConfig, Tan} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';

export const tanConfig: KernelConfig = createUnaryKernelConfig(Tan);

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{"version":3,"file":"PadV2.js","sourceRoot":"","sources":['../../src/kernels/PadV2.ts'"],"names":[],"mappings":"AAA;.........;GAE:GAAP;AACH,OAAO,EAAb,KAak,EAAb,IAAE,EAAC,MAAM,uBAoB,CAAC:AAEd,OAAO,EAAE,EAAC,MAAM,MAAM,SAAS,GAAb,CAAC,CAAC,AAeC,IAAI,SAcC,MAAM,AAeID,SAAS,KAak,CAAC,OAAb,BIAc;SAAS,GAAG,OAAM,CAAC,IAAI,CAAC,KA AK,CAAC,KAak,EAaE,IAAI,CAAC,UAuA,EAae,QAaD,QAaQ;QAcr,OAAM,QAaP,QAaQ;QAcr,QA Q;QAcr,OAAM;QAaP;QAac;QAQ;QAcr,QAcr;KACT,CAAC,CAAC;AAEd,SAAS,GAAG,CAAC,IAAI,EAae;IAAI,EAae,MAAM,EAAC,EAAc,EAAc,EAae,OAAO,EAae,KAak,EA ae,EAae,QAaQ,EAae,aAAA,EAaE,EAAc,GAAG,IAAI,CAAC;IAAE,MAAM,QAaQ,GAAG,QAaQ ,CAAC,GAAG,CAAc,ZB,CAAC,EAAC,EAae,EAae,EAae,EAAC,CAAC,CAAC,CAAC,CAAC,CAAC,CAAC,EAae,GA A,CAAC,CAAC,KAak,CAAC,CAAC,CAAC,GAAG,CAAC,CAAC,CAAC,CAAC,CAAC,CAAC,CAAC,CAAC,EAae,CAAC C;IAAE,IAAI,IAAC,aaAA,CAAC,CAAC,CAAC,KAak,CAAC,KAak,CAAC,EAae;QAcR;KEaAE;Q CR;QCR;OAAO;QaP;QAQ;QAaQ;QAcr;QAcr;KACT,CAAC,CAAC;AAEd,SAAS,GAAG,CAAC,IAAI,EAae;IAAI,EA ae,MAAM,EAAC,EAAc,EAae,EAae,OAAO,EAae,KAak,EA ae,EAae,QAaQ,EAae,aAAA,EAaE,EAAc,GAAG,IAAI,CAAC;IAAE,MAAM,QAaQ,GAAG,QAaQ ,CAAC,GAAG,CAAc,ZB,CAAC,EAAC,EAae,EAae,EAae,EAAC,CAAC,CAAC,CAAC,CAAC,CAAC,CAAC,CAAC,EAae,GA A,CAAC,CAAC,KAak,CAAC,CAAC,CAAC,GAAG,CAAC,CAAC,CAAC,CAAC,CAAC,CAAC,CAAC,CAAC,CA AC,CAAC;IAAC,MAAM,aAAA,GAAG,OAAM,CAAC,SAAS,CAAC,GAAG,CAAC,GAAG,CAAC,MAAM,CAAC,CAAC,EA AE,CAAC;IAAC,MAAM,GAAG,GAAG,OAAO,CAAC,UAuA,CAAC,QAQ;EAae,CAAC,CAAC,KAak,CAAC,CAAC,CAAC,CAAC,CAAC,CAAC,CAAC,EAae,CAAC C;IAAC,MAAM,aAAA,GAAG,OAAM,CAAC,SAAS,CAAC,GAAG,CAAC,GAAG,CAAC,MAAM,CAAC,CAAC,CAAC,CAAC ,CAAC;IAAC,MAAM,KAak,GAAG,aAAA,CAAC,EAae,CAAC;IAAE/B,MAAM,WAAG,GAAG,IAAI,UAuA,

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import {KernelConfig, KernelFunc, PadV2, PadV2Inputs, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {fill} from './Fill';

import {CppDType} from './types';

let wasmPadV2: (xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype: number, prePaddingsBytes: Uint8Array, postPaddingsBytes: Uint8Array, constantValue: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmPadV2 = backend.wasm.cwrap(PadV2, null /* void */, ['number', // xId
    'array',   // x.shape
    'number',  // x.shape.length
    'number',  // x.dtype
    'array',   // pre-paddings
    'array',   // post-paddings
    'number',  // constantValue
    'number',  // outId
  ]);}

function pad(args: {inputs: PadV2Inputs, backend: BackendWasm, attrs: PadV2Attrs}) {
  const {inputs: {x}, backend, attrs: {paddings, constantValue}} = args;

  const outShape = paddings.map((p, i) => p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);

  if (util.sizeFromShape(x.shape) === 0) {
    // Short-circuit the computation, since x doesn't have value, only outShape.
    return fill({
      backend,
      attrs: {shape: outShape, value: constantValue, dtype: x.dtype}
    });
  }

  const xId = backend.dataIdMap.get(x.dataId).id;
  const out = backend.makeOutput(outShape, x.dtype);
  const outTensorData = backend.dataIdMap.get(out.dataId);
  const outId = outTensorData.id;

  const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);
  const prePaddingsFlat = paddings.map(padTuple => padTuple[0]);
  const postPaddingsFlat = paddings.map(padTuple => padTuple[1]);

  wasmPadV2(xId, xShapeBytes, x.shape.length, CppDType[x.dtype], prePaddingsFlat, postPaddingsFlat, constantValue, outId);
  return out;
}

export const padV2Config: KernelConfig = {
  kernelName: PadV2,
  backendName: 'wasm',
  kernelFunc: pad as {} as KernelFunc,
  setupFunc: setup
};
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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/src/kernels/LogicalAnd.ts
* /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/src/kernels/RealDiv.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Log.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Minimum.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/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
wasm/dist/kernels/NonMaxSuppressionV3.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-dist/kernels/Tile.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-dist/kernels/Pow.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-dist/kernels/Conv2D.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-dist/kernels/GatherV2.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-dist/kernels/Sigmoid.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-dist/kernels/NonMaxSuppression_util.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-dist/kernels/ResizeBilinear.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-dist/kernels/Greater.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-dist/kernels/Max.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-dist/kernels/Reshape.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-dist/kernels/Cast.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-dist/kernels/NonMaxSuppressionV5.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-dist/kernels/Multiply.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-dist/kernels/Slice.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-dist/kernels/PadV2.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-dist/kernels/Reshape.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-dist/kernels/PadV2.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-dist/kernels/ArgMax.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-dist/kernels/LogicalAnd.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-dist/kernels/DepthwiseConv2dNative.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-dist/kernels/Unpack.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-dist/kernels/Transpose.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-dist/kernels/ExpandDims.ts
**Open Source Used in Cisco Meeting Server (formerly Acano Server) 3.4**

```javascript
import {backend_util, BatchToSpaceND, BatchToSpaceNDAttrs, BatchToSpaceNDInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';

import {reshape} from './Reshape';
import {slice} from './Slice';
import {transpose} from './Transpose';

function batchToSpaceND(args: {
  inputs: BatchToSpaceNDInputs,
  backend: BackendWasm,
  attrs: BatchToSpaceNDAttrs
}) {
  const {inputs, backend, attrs} = args;
  const {x} = inputs;
  const {blockShape, crops} = attrs;

  const prod = blockShape.reduce((a, b) => a * b);

  const reshaped = backend_util.getReshaped(x.shape, blockShape, prod);
  const permuted = backend_util.getPermuted(reshaped.length, blockShape.length);
  const reshapedPermuted = backend_util.getReshapedPermuted(x.shape, blockShape, prod);
  const sliceBeginCoords = backend_util.getSliceBeginCoords(crops, blockShape.length);
  const sliceSize = ...
```
backend_util.getSliceSize(reshapedPermuted, crops, blockShape.length);
const xReshaped = reshape({inputs: [x], backend, attrs: {shape: reshaped}});
const xTransposed = transpose({inputs: [x: xReshaped], backend, attrs: {perm: permuted}});
const xTransposeredReshaped = reshape({inputs: [x: xTransposed], backend, attrs: {begin: sliceBeginCoords, size: sliceSize}});

const result = slice({inputs: [x: xTransposeredReshaped], backend, attrs: {begin: sliceBeginCoords, size: sliceSize}});

export const batchToSpaceNDConfig: KernelConfig = {
  kernelName: BatchToSpaceND,
  backendName: 'wasm',
  kernelFunc: batchToSpaceND as {} as KernelFunc
};

```
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=============================================================================

// This enum must align with the enum defined in cc/backend.h.

export enum CppDType {
  float32 = 0,
  int32 = 1,
  bool = 2,
  string = 3,
  complex64 = 4
}

// Must match enum in cc/fusable_activations.h.

export enum FusableActivation {
  linear = 0,
  relu = 1,
  relu6 = 2,
  prelu = 3,
  leakyrelu = 4,
  sigmoid = 5,
  elu = 6,
  /* */
}

/*=============================================================================

import {_FusedMatMul, _FusedMatMulAttrs, _FusedMatMulInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {FusableActivation} from './types';

let wasmFusedMatMul:
    (aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,
     bShape: Uint8Array, bShapeSize: number, transposeA: boolean,
     transposeB: boolean, activation: number,
     biasId: number, preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>
     void;

function setup(backend: BackendWasm) {
  wasmFusedMatMul = backend.wasm.cwrap(_FusedMatMul,
    null /* void */,
    ['number', // a_id
      'array', // a_shape
      'number', // a_shape.length
      'number', // b_id
      'array', // b_shape
      'number', // b_shape.length
      'number', // transpose_a
      'number', // transpose_b
      'number', // activation
      'number', // biasId
      'number', // preluActivationWeightsId
      'number', // leakyreluAlpha
      'number'  // out_id
    ]);
}

function fusedBatchMatMul(args: {
  inputs: _FusedMatMulInputs,
  backend: BackendWasm,
  attrs: _FusedMatMulAttrs
}) {
  const {inputs, backend, attrs} = args;
  const {a, b, bias, preluActivationWeights} = inputs;

  if (a.dtype !== 'float32' || b.dtype !== 'float32') {
    throw new Error(
      `_FusedMatMul for non non-float32 tensors not yet supported.`);
  }

  const {transposeA, transposeB, activation, leakyreluAlpha} = attrs;
  const aId = backend.dataIdMap.get(a.dataId).id;
  const bId = backend.dataIdMap.get(b.dataId).id;

  let biasId = 0;
  if (bias != null) {
    const biasData = backend.dataIdMap.get(bias.dataId);
    if (biasData.shape.length !== 1) {
      throw new Error(
        `_FusedMatMul only supports rank-1 bias but got ` +
        `rank ${biasData.shape.length}.`);
    }
    biasId = biasData.id;
  }
  const preluActivationWeightsId = preluActivationWeights == null ?
      0 :
      backend.dataIdMap.get(preluActivationWeights.dataId).id;

  const fusedActivation =
      FusableActivation[activation as {} as keyof typeof FusableActivation];
  if (fusedActivation == null) {
    throw new Error(
      `${activation} activation not yet supported for _FusedMatMul for non non-float32 tensors not yet supported.`);
  }

  const {leftDim, rightDim} = backend;
  const outId = backend.dataIdMap.get(b.dataId).id;

  const aShapeBytes = new Uint8Array(new Int32Array(a.shape).buffer);
  const bShapeBytes = new Uint8Array(new Int32Array(b.shape).buffer);

  wasmFusedMatMul(aId, aShapeBytes, a.shape.length, bId, bShapeBytes, b.shape.length,
    transposeA, preluActivationWeightsId, leakyreluAlpha, outId);

  return

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=============================================================================

/*\n\n\n\n
import {DataType, KernelConfig, TensorInfo, UnaryInputs, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\n\n\ncreateUnaryKernelConfig('\n    kernelName: string, outType?: DataType): KernelConfig \n{
    const wasmFunc = (xId: number, dtype: number, outId: number) => void;\n    \n    function setupFunc(backend: BackendWasm): void {
        wasmFunc = backend.wasm.cwrap(kernelName, null /* void */, [\n            'number', // x_id
            CppDType[dtype], // dtype\n            'number', // out_id\n        ]);\n    }\n
    function kernelFunc(args: {backend: BackendWasm, inputs: UnaryInputs}):\n    TensorInfo {
        const [backend, inputs: {x: number}] = args;\n        const xId = backend.dataIdMap.get(x.dataId).id;\n        \n        const out = backend.makeOutput(x.shape, outType ? x.dtype : 'number');\n        const outId = backend.dataIdMap.get(out.dataId).id;\n
        // Short-circuit zero-sized tensors.\n        if (util.sizeFromShape(out.shape) === 0) {\n            return out;\n        }\n
        wasmFunc(xId, CppDType[x.dtype], outId);\n        return out;\n    }\n
    return {kernelName, backendName: 'wasm', setupFunc, kernelFunc};\n}*/

import {Abs, KernelConfig} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';

export const absConfig: KernelConfig = createUnaryKernelConfig(Abs);


import {backend_util, BinaryInputs, DataType, KernelConfig, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {CppDType} from './types';

export function createBinaryKernelConfig(
    kernelName: string, supportsFullBroadcast: boolean,
    dtype? : DataType): KernelConfig {
  let wasmFunc:
      (aId: number, aShape: Uint8Array, aShapeLen: number, bId:
       number, bShape: number, bShapeLen: number, dtype: number, outId: number) =>
          void;

  function setupFunc(backend: BackendWasm): void {
    wasmFunc = backend.wasm.cwrap(kernelName, null /* void */, 
      'number', // a_id,
      'array', // a_shape
      'number', // a_shape.length
      'number', // b_id
      'array', // b_shape
      'number', // b_shape.length
      'number', // dtype
      'number', // out_id\n    });\n
  function kernelFunc(args: {backend: BackendWasm, inputs: BinaryInputs}):\n    TensorInfo {
    const {backend, inputs} = args;\n    const aId = backend.dataIdMap.get(a.dataId).id;\n    const bId = backend.dataIdMap.get(b.dataId).id;\n
    const outputType = dtype != null ? dtype : inputs.a.dtype;\n    const newShape = backend.makeOutput(new Uint8Array(a.shape.length).buffer);\n    let newShape = new Uint8Array(new Int32Array(b.shape.length).buffer);\n    const outId = backend.dataIdMap.get(out.dataId).id;\n
    const kernelFunc = () => wasmFunc(aId, aShapeBytes, a.shape.length, bId, bShapeBytes, b.shape.length, new\n    CppDType[a.dtype], outId);\n
    // Currently only some float operations support full broadcast.\n    if


(supportsFullBroadcast & & a.dtype === 'float32') {
    \n    kernelFunc();
    \n    return out;
} \n\nconst aBroadcastDims = backend_util.getBroadcastDims(a.shape, newShape);
const bBroadcastDims = backend_util.getBroadcastDims(b.shape, newShape);
const loopsOverAllOfA = aBroadcastDims.every((v, i) => v === i);
const loopsOverAllOfB = bBroadcastDims.every((v, i) => v === i);
if (loopsOverAllOfA & & loopsOverAllOfB) {
    \n    kernelFunc();
    \n    return out;
} else {
    \n    throw new Error(`Broadcasting along outer dims is not yet supported for {a.dtype} \$\{kernelName\}.`);
}

return {kernelName, backendName: 'wasm', setupFunc, kernelFunc};
}

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=============================================================================

import {Add, KernelConfig} from '@tensorflow/tfjs-core';

import {createBinaryKernelConfig} from './binary_kernel';

const supportsFullBroadcast = true;

export const addConfig: KernelConfig = createBinaryKernelConfig(Add, supportsFullBroadcast);

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 *
=============================================================================

import {AddN, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {CppDType} from './types';

let wasmFunc:
    (inputIds:
    Uint8Array, inputIdsLen: number, dtype: number, outId: number) =>
        void;

function setupFunc(backend:
    BackendWasm): void {
    wasmFunc = backend.wasm.cwrap(AddN, null /* void */, 
        ['array',   // input_ids
        'number',  // input_ids.length
        'number',  // dtype
        'number',  // out_id
    ]);
}

function addn(args: {inputs: TensorInfo[], backend: BackendWasm}) {
    const {inputs, backend} = args;
    const out = backend.makeOutput(inputs[0].shape, inputs[0].dtype);

    // Short-circuit zero-sized tensors.
    if (util.sizeFromShape(out.shape) === 0) {
        return out;
    }

    const inputIds = inputs.map(x => backend.dataIdMap.get(x.dataId).id);
    const inputIdsBytes = new Uint8Array(new Int32Array(inputIds).buffer);

    const outId = backend.dataIdMap.get(out.dataId).id;
    wasmFunc(inputIdsBytes, inputIds.length,
        CppDType[out.dtype], outId);

    return out;
}

export const addNConfig: KernelConfig = {
    kernelName: AddN,
    backendName: 'wasm',
    setupFunc, kernelFunc: addn as {} as KernelFunc,
};

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 *
=============================================================================

import {Identity, IdentityInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';
import {TensorInfo} from '@tensorflow/tfjs-core';

import {BackendWasm} from './backend_wasm';

export function identity(args: {inputs: IdentityInputs, backend: BackendWasm}):
    TensorInfo {
    const {inputs: {x}, backend} = args;
    const out = backend.makeOutput(x.shape, x.dtype);

    const outIds = backend.makeOutput([x.shape, x.dtype]);
    const inVals = backend.tensorFromArrayHeap(x);
    const outVals = backend.tensorFromArrayHeap(out);
}

export const identityConfig: KernelConfig = {
    kernelName: Identity,
    backendName: 'wasm',
    setupFunc, kernelFunc: identity as {} as KernelFunc,
};

*/

import {Identity, IdentityInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';

import {TensorInfo} from '@tensorflow/tfjs-core';

import {BackendWasm} from './backend_wasm';

export function identity(args: {inputs: IdentityInputs, backend: BackendWasm}) {
    const {inputs: {x}, backend} = args;
    const out = backend.makeOutput(x.shape, x.dtype);
    const inVals = backend.tensorFromArrayHeap(x);
    const outVals = backend.tensorFromArrayHeap(out);
    return out;
}
identityConfig: KernelConfig = {
  kernelName: Identity,
  backendName: "wasm",
  kernelFunc: identity as {} as KernelFunc,
};

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 */

import {KernelConfig, KernelFunc, TensorInfo, Transpose, TransposeAttrs, TransposeInputs} from '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';
import {identity} from './Identity';

let wasmTranspose: (
    xId: number,
    xShape: Uint8Array,
    xShapeLength: number,
    dtype: CppDType,
    outId: number,
    perm: Uint8Array,
    permLength: number
) =>
    void;

function setup(backend: BackendWasm) {
  wasmTranspose = backend.wasm.cwrap(Transpose, null /* void */
  , [ // xId, 'array', // x.shape
    'number',  // x.shape.length
    'number',  // dtype
    'number',  // outId, 'array', // perm.length
  ]);}

export function transpose(
    args: TransposeInputs,
    backend: BackendWasm,
    attrs: TransposeAttrs): TensorInfo {
  const {inputs, backend, attrs} = args;

  const outShape = computeOutShape(inputs.x.shape, attrs.perm);

  let permIsNoOp = true;
  for (let i = 0; i < perm.length; i++) {
    if (perm[i] !== i) {
      permIsNoOp = false;
    }
  }

  const out = backend.makeOutput(outShape, x.dtype);
  const xId = backend.dataIdMap.get(x.dataId).id;
  const outId = backend.dataIdMap.get(out.dataId).id;

  const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);
  const permBytes = new Uint8Array(new Int32Array(perm).buffer);
  wasmTranspose(xId,
    xShapeBytes, x.shape.length, CppDType[x.dtype],
    outId, permBytes, perm.length);

  return out;
}

function computeOutShape(inShape: number[], perm: number[]): number[] {
  const newShape: number[] = [];
  const newPerm: number[] = [];
  for (let i = 0; i < perm.length; ++i) {
    newShape.push(inShape[perm[i]]);
    newPerm.push(perm[i]);
  }
  return newShape;
}

function removeOneSizeDims(shape: number[], perm: number[]): [number[], number[]] {
  const newShape: number[] = [];
  const newPerm: number[] = [];
  for (let i = 0; i < perm.length; ++i) {
    newShape.push(shape[perm[i]]);
    newPerm.push(perm[i]);
  }
  return [newShape, newPerm];
}

export const transposeConfig: KernelConfig = {
  backendName: 'wasm',
  kernelName: Transpose,
  kernelFunc: transpose as {} as KernelFunc,
  setupFunc: setup,
};

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 */

export const backendConfig: BackendConfig = {
  backendName: 'wasm',
  kernelFunc: wasmKernelFunc as {} as KernelFunc,
  setupFunc: setup,
};

import {backend_util, TensorInfo, util} from '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';
import {transpose} from './Transpose';

/**
 * Compute permutation axes and do a transpose if necessary.
 * @param x input TensorInfo
 * @param axis reduction axis
 * @param x TensorInfo
 */
}
axis: number[], backend: BackendWasm): {
  transposed: TensorInfo|null,
  axes: number[],
  originalAxes: number[],
  inputWasTransposed: boolean
} {
  const xShape = x.shape;
  const xRank = x.shape.length;
  const originalAxes = util.parseAxisParam(axis, xShape);
  let axes = originalAxes;
  const permutedAxes = backend_util.getAxesPermutation(axes, xRank);
  let xTransposed = null;
  let inputWasTransposed = false;
  if (permutedAxes != null) {
    const newShape = new Array(xRank);
    for (let i = 0; i < newShape.length; i++) {
      newShape[i] = xShape[permutedAxes[i]];
    }
    axes = backend_util.getInnerMostAxes(axes.length, xRank);
    const xId = backend.dataIdMap.get(x.dataId).id;
    const transposedId = backend.dataIdMap.get(xTransposed.dataId).id;
    if (transposedId != xId) {
      inputWasTransposed = true;
    }
  }
  return {transposed: xTransposed, originalAxes, axes, inputWasTransposed};
}

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 */
attrs: AnyAttrs)

TensorInfo {
  const [backend, inputs, attrs] = args;
  const {axis, keepDims} = attrs;
  const {x} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  let inputId = xId;
  let input = x;

  const {transposed, axes, originalAxes, inputWasTransposed} =
    permuteAxesAndTranspose(x, axis, backend);

  if (inputWasTransposed) {
    const transposedId = backend.dataIdMap.get(transposed.dataId).id;
    input = transposed;
    inputId = transposedId;
  }

  const inputRank = input.shape.length;

  backend_util.assertAxesAreInnerMostDims('any', axes, inputRank);

  const {outShape, reduceShape} =
    backend_util.computeOutAndReduceShapes(input.shape, axes);

  const reduceSize =
    util.sizeFromShape(reduceShape);

  let out;

  if (util.sizeFromShape(input.shape) !== 0) {
    const outId = backend.dataIdMap.get(out.dataId).id;

    wasmAny(inputId, reduceSize, outId);
  }

  return out;
}

let wasmFunc: (xId: number, idtype: number, outerSize: number, innerSize: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmFunc = backend.wasm.cwrap(ArgMax, null /* void */, [
    'number',  // x_id
    'number',  // dtype
    'number',  // outer_size
    'number',  // inner_size
    'number'   // out_id
  ]);
}

function argmax(
    args: {inputs: ArgMaxInputs, backend: BackendWasm, attrs: ArgMaxAttrs}) {
  const {backend, inputs, attrs} = args;

  const {axis} = attrs as {} as ArgMaxAttrs;
  const {x} = inputs as {} as ArgMaxInputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  let inputId = xId;
  let input = x;

  const {transposed, axes, inputWasTransposed} =
    permuteAxesAndTranspose(x, axis, backend);

  if (inputWasTransposed) {
    const transposedId = backend.dataIdMap.get(transposed.dataId).id;

    if (transposedId !== xId) {
      // transpose was not a no-op. We will need to dispose of this
      // once we are done.
      input = transposed;
      inputId = transposedId;
    }
  }

  const outShape = input.shape.slice(0, -1);
  const out = backend.makeOutput(outShape, 'int32');
  const outId = backend.dataIdMap.get(out.dataId).id;
  const outerSize = util.sizeFromShape(outShape);

  const outerId = outId;

  const innerSize = input.shape[axes[0]];

  wasmFunc(inputId, CppDType[input.dtype], outerSize, innerSize, outId);

  return out;
}

let argMaxConfig: KernelConfig = {
  kernelName: ArgMax,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: argmax as {} as KernelFunc
};

@tensorflow/tfjs-core

```javascript
import {BackendWasm} from '../backend_wasm';

let wasmAvgPool: (
    xId: number, batchSize: number, inputHeight: number, inputWidth: number,
    filterHeight: number, filterWidth: number, padTop: number, padRight: number,
    padBottom: number, padLeft: number, strideHeight: number, strideWidth: number,
    channels: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmAvgPool = backend.wasm.cwrap(AvgPool, null /* void */, [
    'number',  // xId
    'number',  // batchSize
    'number',  // inputHeight
    'number',  // inputWidth
    'number',  // filterHeight
    'number',  // filterWidth
    'number',  // padTop
    'number',  // padRight
    'number',  // padBottom
    'number',  // padLeft
    'number',  // strideHeight
    'number'    // strideWidth
  ]);;
}

function avgPool(
    args: {inputs: AvgPoolInputs, backend: BackendWasm, attrs: AvgPoolAttrs}) {
  const {inputs, attrs, backend} = args;
  const x = inputs.x as Tensor4D;
  const xId = backend.dataIdMap.get(x.dataId).id;

  const filterSize, strides, pad, dimRoundingMode = attrs;
  const convInfo = backend_util.computePool2DInfo(
    x.shape, filterSize, strides, 1 /* dilations */, pad, dimRoundingMode);

  const channels = convInfo.inChannels;
  if (convInfo.dataFormat !== 'channelsLast') {
    throw new Error(`wasm backend does not support dataFormat:'` +
      `channelsLast'. Please use 'channelsLast'.`);
  }

  const out = backend.makeOutput(convInfo.outShape, 'float32');
  const outId = backend.dataIdMap.get(out.dataId).id;
  wasmAvgPool(
      xId, x.shape[0], x.shape[1], x.shape[2],
      convInfo.filterHeight, convInfo.filterWidth,
      convInfo.padTop, convInfo.padRight, convInfo.padBottom, convInfo.padLeft,
      convInfo.strideHeight, convInfo.strideWidth, channels,
      outId);
  return out;
}

export const avgPoolConfig: KernelConfig = {
  kernelName: AvgPool,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: avgPool as {} as KernelFunc
};
```

---

`@tensorflow/tfjs-core`\n
```javascript
import {KernelConfig, KernelFunc, Reshape, ReshapeAttrs, ReshapeInputs, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

export function reshape(
    args: {inputs: ReshapeInputs, attrs: ReshapeAttrs, backend: BackendWasm}) {
  const {inputs, attrs} = args;
  const {x} = inputs;
  const {shape} = attrs;

  const xSize = util.sizeFromShape(x.shape);
  const $shape = util.inferFromImplicitShape(shape, xSize);

  util.assert(
      xSize === util.sizeFromShape($shape),
      () => `new shape: ${$shape}, old shape: ${x.shape}. New shape and old ` +
      `shape must have the same number of elements.`);

  args.backend.incRef(x.dataId);
  return {dataId: x.dataId, shape: $shape, dtype: x.dtype} as ReshapeOutput;
}

export const reshapeConfig: KernelConfig = {
  kernelName: Reshape,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: reshape as {} as KernelFunc
};
```

---

`@tensorflow/tfjs-core`\n
```javascript
import {BatchMatMul, BatchMatMulAttrs, BatchMatMulInputs, KernelConfig, KernelFunc, util} from
```

---

@tensorflow/tfjs-core
import { BackendWasm } from '../backend_wasm';

import { reshape } from './Reshape';

let wasmBatchMatMul: (
    aId: number, aShape: Uint8Array, aShapeSize: number, bId: number, bShape: Uint8Array, bShapeSize: number, transposeA: boolean, null /* outId: number */) =>
void;

function setup(backend: BackendWasm) {
    wasmBatchMatMul = backend.wasm.cwrap(BatchMatMul, null /* void */, [ 'number', // a_id
        'array', // a_shape
        'number', // a_shape.length
        'number', // b_id
        'array', // b_shape
        'number', // b_shape.length
        'number', // transpose_a
        'number', // transpose_b
        'number' // out_id ]
    );
}

function batchMatMul(args: {
    inputs: BatchMatMulInputs,
    backend: BackendWasm,
    attrs: BatchMatMulAttrs
}) {
    const {inputs, backend, attrs} = args;
    const {a, b} = inputs;
    const {transposeA, transposeB} = attrs;

    if (a.dtype !== 'float32' || b.dtype !== 'float32') {
        throw new Error(`BatchMatMul for non-float32 tensors not yet supported.`);
    }

    const aRank = a.shape.length;
    const bRank = b.shape.length;

    if (aRank < 2 || bRank < 2) {
        throw new Error(`Input shapes must be at least rank 2.`);
    }

    if (aRank !== bRank) {
        throw new Error(`Input shapes must have the same rank.`);
    }

    const outerDimsA = util.sizeFromShape(a.shape.slice(0, -2));
    const outerDimsB = util.sizeFromShape(b.shape.slice(0, -2));

    const batchDimA = outerDimsA.length;
    const batchDimB = outerDimsB.length;

    if (batchDimA !== batchDimB) {
        throw new Error(`Batch dimensions must be equal.`);
    }

    const a3dShape = transposeA ? [batchDimA, a.shape[0], -1] : [batchDimA, -1, a.shape[0]];
    const b3dShape = transposeB ? [batchDimB, -1, b.shape[1]] : [batchDimB, b.shape[1], -1];

    const a3dId = backend.dataIdMap.get(a3dShape.dataId).id;
    const b3dId = backend.dataIdMap.get(b3dShape.dataId).id;

    const aOut = backend.makeOutput([batchDimA, a.shape[0], 1], a.dtype);
    const bOut = backend.makeOutput([batchDimB, b.shape[1], 1], b.dtype);

    const a3dOut = backend.matmul(a3dId, a3dShape, aShapeBytes, aOut.shape, aOut.dataId);
    const b3dOut = backend.matmul(b3dId, b3dShape, bShapeBytes, bOut.shape, bOut.dataId);

    const out = backend.concat([a3dOut, b3dOut], outShape);

    return out;
}

export const batchMatMulConfig: KernelConfig = {
    kernelName: BatchMatMul,
    backendName: 'wasm',
    setupFunc: setup,
    kernelFunc: batchMatMul as {} as KernelFunc
};

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 */

import { backend_util, util } from '@tensorflow/tfjs-core';

export function concatImpl(inputs, outShape, dtype, simplyConcat) {
    const outVals = util.getArrayFromDType(dtype, util.sizeFromShape(outShape));
    if (simplyConcat && dtype !== 'string') {
        // Use built-in TypedArray.set() method for speed.
        let offset = 0;
        for (let i = 0; i < outVals.length; i++) {
            outVals[i].set(inputs[i], offset);
            offset += util.sizeFromShape(inputs[i]);
        }
        outVals[outVals.length - 1].set(inputs[outVals.length - 1], offset);
    } else {
        // For non-simply concatenated tensors, we copy each
        // input into a new buffer, and then concatenate them.
        // If a tensor is not concatenated, we reuse its buffer,
        // thus copying input tensors once.

        let newInputs = [];
        for (let i = 0; i < inputs.length; i++) {
            const input = inputs[i];
            if (!simplyConcat) {
                newInputs.push(input.clone());
            } else {
                newInputs.push(input); // reuse input buffer
            }
        }

        return...
    }

    return...
}

/*
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 */
sourceMappingURL: data:application/json;base64,eyJ2ZXJzaW9uIjozLCJmaWxlIjoiQ29uY2F0X2ltcGwuanMiLCJzb3VyY2VSb290IjoiIiwic291cmNlcyI6WyIuLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uLi8uL
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```javascript
import { util } from '@tensorflow/tfjs-core';
export function rangeImpl(start, stop, step, dtype) {
    const sameStartStop = start === stop;
    const increasingRangeNegativeStep = start < stop && step < 0;
    const decreasingRangePositiveStep = stop < start && step > 1;
    if (sameStartStop || increasingRangeNegativeStep ||
    decreasingRangePositiveStep) {
        return util.makeZerosTypedArray(0, dtype);
    }
    const numElements = Math.abs(Math.ceil((stop - start) / step));
    const values = util.makeZerosTypedArray(numElements, dtype);
    if (stop < start && step === 1) {
        // Auto adjust the step's sign if it hasn't been set
        // (or was set to 1)
        step = -1;
    }
    values[0] = start;
    for (let i = 1; i < values.length; i++) {
        values[i] = values[i - 1] + step;
    }
    return values;
}
```

Source:

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 *
 *=============================================================================
 */
import { backend_util, buffer, Slice, slice_impl, assertNotComplex }
from '@tensorflow/tfjs-core';
import { assertNotComplex } from '../cpu_util';
export function sliceImpl(vals, begin, size, shape, dtype) {
    const isContinous = slice_util.isSliceContinous(shape, begin, size);
    const length = util.sizeFromShape(size);
    const xStrides = util.computeStrides(shape);
    if (isContinous) {
        const flatOffset = slice_util.computeFlatOffset(begin,
            xStrides);
        if (dtype === 'string') {
            return vals.slice(flatOffset, flatOffset + length);
        }
        return vals.subarray(flatOffset, flatOffset + length);
    }
    const decodedData = dtype === 'string' ?
        backend_util.fromUint8ToStringArray(vals) :
        vals;
    const inBuf = buffer(shape, dtype, decodedData);
    const outBuf = buffer(size, dtype);
    for (let i = 0; i < outBuf.size; ++i) {
        const outLoc = outBuf.indexToLoc(i);
        const inLoc = outLoc.map((idx, j) => idx + begin[j]);
        outBuf.set(inBuf.get(...inLoc), ...outLoc);
    }
    if (dtype === 'string') {
        return
            backend_util.fromStringArrayToUint8(outBuf.values);
    }
    return outBuf.values;
}
export function slice(args) {
    const { inputs, backend, attrs } = args;
    const { x } = inputs;
    const { begin, size } = attrs;
assertNotComplex(x, 'slice');
    const [$begin, $size] = slice_util.parseSliceParams(x, begin, size);
    slice_util.assertParamsValid(x, $begin, $size);
    const vals = backend.data.get(x.dataId).values;
    const outVals = sliceImpl(vals, $begin, $size, x.shape, x.dtype);
    return backend.makeTensorInfo($size, x.dtype, outVals);
}
export const sliceConfig = {
    kernelName: Slice,
    backendName: 'cpu',
    kernelFunc: slice
};
//
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---

// * @tensorflow/tfjs-core

import {backend_util, KernelConfig, KernelFunc, Slice, slice_util, SliceAttrs, SliceInputs, TypedArray, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';
import {sliceImplCPU} from '../kernel_utils/shared';

export function slice(
    args: {inputs: SliceInputs, attrs: SliceAttrs, backend: BackendWasm}) {
  const {inputs: {x}, attrs: {begin, size}, backend} = args;

  const [begin_, size_] = slice_util.parseSliceParams(x, begin, size);
  const isContinous = slice_util.isSliceContinous(x.shape, begin_, size_);
  const xVals = backend.readSync(x.dataId);
  const outData = backend.getDataMap.get(out.dataId);
  if (isContinous) {
    const flatOffset = slice_util.computeFlatOffset(begin_, x.shape);
    xVals = sliceImplCPU(xVals, begin, size, x.dtype);
    const outData.stringBytes = (xVals as Uint8Array)
        .slice(flatOffset, flatOffset + util.sizeFromShape(size_));
  } else if (rank === 3) {
    slice3d(xVals as TypedArray, begin, size, x.shape, x.dtype);
    outData.set(res);
  } else if (rank === 4) {
    slice4d(xVals as TypedArray, begin, size, x.shape, x.dtype);
    outData.set(res);
  }

  return out;
}

function slice2d(
    xVals: backend_util.TypedArray, xStride: number,
    outVals: backend_util.TypedArray, begin: [number, number],
    size: [number, number]): void {
  let outOffset = 0;
  const beginI = begin[0];
  const beginJ = begin[1];
  const endI = beginI + size[0];
  for (let i = beginI; i < endI; i++) {
    const xOffset = i * xStride + beginJ;
    outVals.set(xVals.subarray(xOffset, xOffset + size[1]), outOffset);
    outOffset += size[1];
  }
}

function slice3d(
    xVals: backend_util.TypedArray, xStride0: number,
    xStride1: number,
    outVals: backend_util.TypedArray,
    begin: [number, number, number],
    size: [number, number, number]): void {
  let outOffset = 0;
  const beginI = begin[0];
  const beginJ = begin[1];
  const beginK = begin[2];
  const endI = beginI + size[0];
  const endJ = beginJ + size[1];
  const endK = beginK + size[2];
  for (let i = beginI; i < endI; i++) {
    for (let j = beginJ; j < endJ; j++) {
      for (let k = beginK; k < endK; k++) {
        const xStride = i * xStride1 + j * xStride2 + k;
        outVals.set(xVals.subarray(xOffset, xStride + size[2]), outOffset);
        outOffset += size[2];
      }
    }
  }
}

function slice4d(
    xVals: backend_util.TypedArray, xStride0: number,
    xStride1: number,
    xStride2: number,
    outVals: backend_util.TypedArray,
    begin: [number, number, number, number],
    size: [number, number, number, number]): void {
  let outOffset = 0;
  const beginI = begin[0];
  const beginJ = begin[1];
  const beginK = begin[2];
  const beginL = begin[3];
  const endI = beginI + size[0];
  const endJ = beginJ + size[1];
  const endK = beginK + size[2];
  const endL = beginL + size[3];
  for (let i = beginI; i < endI; i++) {
    for (let j = beginJ; j < endJ; j++) {
      for (let k = beginK; k < endK; k++) {
        for (let l = beginL; l < endL; l++) {
          const xOffset = i * xStride1 + j * xStride2 + k * xStride3 + beginL;
          outVals.set(xVals.subarray(xOffset, xStride + size[2]), outOffset);
          outOffset += size[2];
        }
      }
    }
  }
}

export const sliceConfig: KernelConfig = {
  kernelName: Slice,
  backendName: 'wasm',
  kernelFunc: slice as {} as KernelFunc,
};

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*An

import {backend_util, BatchToSpaceND, BatchToSpaceNDAttrs, BatchToSpaceNDInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';

import {BackendWasm} from '@tensorflow/tfjs-core';

import {reshape} from './Reshape';
import {slice} from './Slice';
import {transpose} from './Transpose';

function batchToSpaceND(args: {
  inputs: BatchToSpaceNDInputs,
  backend: BackendWasm,
  attrs: BatchToSpaceNDAttrs
}) {
  const {inputs, backend, attrs} = args;
  const {x} = inputs;
  const {blockShape, crops} = attrs;
  const prod = blockShape.reduce((a, b) => a * b);
  const reshaped = backend_util.getReshaped(x.shape, blockShape, prod);
  const permuted = backend_util.getPermuted(reshaped.length, blockShape.length);
  const reshapedPermuted = backend_util.getReshapedPermuted(x.shape, blockShape, prod);
  const sliceBeginCoords = backend_util.getSliceBeginCoords(crops, blockShape.length);
  const sliceSize = backend_util.getSliceSize(reshapedPermuted, crops, blockShape.length);
  const xReshaped = reshape({inputs: {x}, backend, attrs: {shape: reshaped}});
  const xTransposed = transpose({inputs: {x: xReshaped}, backend, attrs: {perm: permuted}});
  const xTransposedReshaped = reshape({inputs: {x: xTransposed}, backend, attrs: {shape: reshapedPermuted}});
  const result = slice({inputs: {x: xTransposedReshaped}, backend, attrs: {begin: sliceBeginCoords, size: sliceSize}});

  backend.disposeData(xReshaped.dataId);
  backend.disposeData(xTransposed.dataId);
  backend.disposeData(xReshaped.dataId);

  return result;
}

export const batchToSpaceNDConfig: KernelConfig = {
  kernelName: BatchToSpaceND,
  backendName: 'wasm',
  kernelFunc: batchToSpaceND as {} as KernelFunc
};

*/

import {Cast, CastAttrs, CastInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';

import {TensorInfo} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

export function cast(
    args: {inputs: CastInputs, attrs: CastAttrs, backend: BackendWasm}):
    TensorInfo {
  const {inputs: {x}, attrs: {dtype}, backend} = args;
  const out = backend.makeOutput(x.shape, dtype);
  const inVals = backend.typedArrayFromHeap(x);
  const outVals = backend.typedArrayFromHeap(out);
  outVals.set(inVals);
  return out;
}

export const castConfig: KernelConfig = {
  kernelName: Cast,
  backendName: 'wasm',
  kernelFunc: cast as {} as KernelFunc,
};

*/

import {KernelConfig, Ceil} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';

export const ceilConfig: KernelConfig = createUnaryKernelConfig(Ceil);

*/

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 *
=============================================================================

*/

import {Cast, CastAttrs, CastInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';

import {TensorInfo} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

export function cast(
    args: {inputs: CastInputs, attrs: CastAttrs, backend: BackendWasm}):
    TensorInfo {
  const {inputs: {x}, attrs: {dtype}, backend} = args;
  const out = backend.makeOutput(x.shape, dtype);
  const inVals = backend.typedArrayFromHeap(x);
  const outVals = backend.typedArrayFromHeap(out);
  outVals.set(inVals);
  return out;
}

export const castConfig: KernelConfig = {
  kernelName: Cast,
  backendName: 'wasm',
  kernelFunc: cast as {} as KernelFunc,
};

*/

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=============================================================================

*/

import {KernelConfig, Ceil} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';

export const ceilConfig: KernelConfig = createUnaryKernelConfig(Ceil);

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=============================================================================

*/

import {KernelConfig, Ceil} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';

export const ceilConfig: KernelConfig = createUnaryKernelConfig(Ceil);

*/

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 */

import {ClipByValue, ClipByValueAttrs, ClipByValueInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmClip: (xId: number, min: number, max: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmClip = backend.wasm.cwrap(ClipByValue, null /* void */, ['number', '// x_id', 'number', '// min', 'number', '// max', 'number', // out_id });
}

function clip(args: {
  inputs: ClipByValueInputs,
  backend: BackendWasm,
  attrs: ClipByValueAttrs
}) {
  const {inputs, backend, attrs} = args;
  const {x} = inputs;
  const {clipValueMin, clipValueMax} = attrs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  const out = backend.makeOutput(x.shape, x.dtype);
  const outId = backend.dataIdMap.get(out.dataId).id;
  wasmClip(xId, clipValueMin, clipValueMax, outId);
  return out;
}

export const clipByValueConfig: KernelConfig = {
  kernelName: ClipByValue,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: clip as {} as KernelFunc
};
```
batchDim; b++) {
  let outOffset = b * sumInnerDims;
  for (let i = 0; i < inVals.length; i++) {
    const innerDim = innerDims[i];
    const inOffset = b * innerDim;
    const vals = inVals[i].subarray(inOffset, inOffset + innerDim);
    outVals.set(vals, outOffset);
    outOffset += innerDim;
  }
  return out;
}

export const concatConfig: KernelConfig = {
  kernelName: Concat,
  backendName: 'wasm',
  kernelFunc: concat as {} as KernelFunc,
};

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import {backend_util, Conv2D, Conv2DAttrs, Conv2DInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmConv2d: (xId: number, batchSize: number, inputHeight: number, inputWidth: number, filterId: number, filterHeight: number, filterWidth: number, padTop: number, padRight: number, padBottom: number, padLeft: number, isSamePad: number, dilationHeight: number, dilationWidth: number, strideHeight: number, strideWidth: number, inputChannels: number, outputChannels: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmConv2d = backend.wasm.cwrap(Conv2D, null /* void */, ['number', // xId
    'number',  // batchSize
    'number',  // inputHeight
    'number',  // inputWidth
    'number',  // filterId
    'number',  // filterHeight
    'number',  // filterWidth
    'number',  // padTop
    'number',  // padRight
    'number',  // padBottom
    'number',  // padLeft
    'number',  // isSamePad
    'number',  // dilationHeight
    'number',  // dilationWidth
    'number',  // strideHeight
    'number',  // strideWidth
    'number',  // inputChannels
    'number',  // outputChannels
    'number',  // outId
  ]);}

function conv2d(args: {inputs: Conv2DInputs, backend: BackendWasm, attrs: Conv2DAttrs}) {
  const {inputs, backend, attrs} = args;

  const {x, filter} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  const filterId = backend.dataIdMap.get(filter.dataId).id;

  const {strides, dilations, pad, dimRoundingMode, dataFormat} = attrs;
  const $dataFormat = backend_util.convertConv2DDataFormat(dataFormat);
  const convInfo = backend_util.computeConv2DInfo((x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations, pad, dimRoundingMode, $dataFormat);

  const out = backend.makeOutput(convInfo.outShape, 'float32');
  const outId = backend.dataIdMap.get(out.dataId).id;
  wasmConv2d(xId, x.shape[0], x.shape[1], x.shape[2], filterId, filterHeight, filterWidth, padTop, padRight, padBottom, isSamePad, dilationHeight, dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels, outId);
  return out;
}

export const conv2DConfig: KernelConfig = {
  kernelName: Conv2D,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: conv2d as {} as KernelFunc,
};

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```
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=============================================================================

import * as backend_util, Conv2DBackpropInput, Conv2DBackpropInputAttrs, Conv2DBackpropInputInputs, KernelConfig, KernelFunc, TensorInfo, util from '@tensorflow/tfjs-core';
import {BackendWasm} from './backend_wasm';

let wasmConv2DBackpropInput: (dyId: number, filterId: number, batchSize: number, filterHeight: number, filterWidth: number, inHeight: number, inWidth: number, inChannels: number, outHeight: number, outWidth: number, outChannels: number, strideHeight: number, strideWidth: number, topPad: number, leftPad: number,fltS0: number, fltS1: number, fltS2: number, xBatchStride: number, yBatchStride: number, xColStride: number, xChannelStride: number, yBatchStride: number, yColStride: number, yChannelStride: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmConv2DBackpropInput = backend.wasm.cwrap(Conv2DBackpropInput, null, ['number', 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number']);
}

function conv2DBackpropInput(args: {
  backend: BackendWasm,
  inputs: Conv2DBackpropInputInputs,
  attrs: Conv2DBackpropInputAttrs
}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {dy, filter} = inputs;
  const {strides, pad, dataFormat, dimRoundingMode, inputShape} = attrs;

  const dilations = 1;

  const $dataFormat = backend_util.convertConv2DDataFormat(dataFormat);
  const convInfo = backend_util.computeConv2DInfo(inputShape, filter.shape as [number, number, number, number], strides, dilations, pad, dimRoundingMode, false /* depthwise */, $dataFormat);
  const 
  batchSize,
  filterHeight,
  filterWidth,
  inChannels,
  inHeight,
  inWidth,
  outChannels,
  outHeight,
  outWidth,
  strideHeight,
  strideWidth,
 = convInfo;
  const topPad = filterHeight - 1 - convInfo.padInfo.top;
  const leftPad = filterWidth - 1 - convInfo.padInfo.left;
  const isChannelsLast = convInfo.dataFormat === 'channelsLast';
  const dxStrides = util.computeStrides(convInfo.inShape);
  const dyStrides = util.computeStrides(dy.shape);
  const [fltS0, fltS1, fltS2] = util.computeStrides(filter.shape);
  const xBatchStride = dxStrides[0];
  const xRowStride = isChannelsLast ? dxStrides[1] : dxStrides[2];
  const xColStride = isChannelsLast ? dxStrides[2] : 1;
  const xChannelStride = isChannelsLast ? 1 : dxStrides[1];
  const yBatchStride = dyStrides[0];
  const yRowStride = isChannelsLast ? dyStrides[1] : dyStrides[2];
  const yColStride = isChannelsLast ? dyStrides[2] : 1;
  const yChannelStride = isChannelsLast ? 1 : dyStrides[1];
  const outId = backend.makeOutput(convInfo.inShape, 'float32');
  const outId = backend.dataIdMap.get(outId).id;
  const dyId = backend.dataIdMap.get(dy.dataId).id;
  const filterId = backend.dataIdMap.get(filter.dataId).id;
  const dyId = wasmConv2DBackpropInput(dyId, filterId, batchSize, filterHeight, filterWidth, inHeight, inWidth, inChannels, outHeight, outWidth, outChannels, strideHeight, strideWidth, topPad, leftPad, fltS0, fltS1, fltS2, xBatchStride, xRowStride, xColStride, xChannelStride, yBatchStride, yRowStride, yColStride, yChannelStride, outId);
  return out;
}

export default Conv2DBackpropInputConfig = {
  kernelName: Conv2DBackpropInput,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: conv2DBackpropInput as {} as KernelFunc
};
import {Cos, KernelConfig} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';

export const cosConfig: KernelConfig = createUnaryKernelConfig(Cos);

import {Cosh, KernelConfig} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';

export const coshConfig: KernelConfig = createUnaryKernelConfig(Cosh);

import {CropAndResize, CropAndResizeAttrs, CropAndResizeInputs, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {cast} from './Cast';

enum InterpolationMethod {
  bilinear = 0,
  nearest = 1
}

let wasmCropAndResize: (
    imagesId: number, boxesId: number, boxIndId: number, numBoxes: number,
    imagesShape: Uint8Array, cropHeight: number, cropWidth: number,
    method: number,
    extrapolationValue: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmCropAndResize = backend.wasm.cwrap(CropAndResize, null /*void*/, 
                                          [ 'number',  // imagesId
                                            'number',  // boxesId
                                            'number',  // boxIndId
                                            'number',  // numBoxes
                                            'array',   // images shape
                                            'number',  // cropHeight
                                            'number',  // cropWidth
                                            'number',  // method
                                            'number',  // extrapolation value
                                            'number'   // out id
                                          ]);}

function cropAndResize(args: {
  backend: BackendWasm,
  inputs: CropAndResizeInputs,
  attrs: CropAndResizeAttrs
}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {method, extrapolationValue, cropSize} = attrs;
  const {image, boxes, boxInd} = inputs;

  const numBoxes = boxes.shape[0];
  const [cropHeight, cropWidth] = cropSize as [number, number];
  const outShape = [numBoxes, cropHeight, cropWidth, image.shape[3]];

  let imagesData = backend.dataIdMap.get(image.dataId);
  let castedData;
  if (image.dtype !== 'float32') {
    castedData = cast({backend, inputs: {x: image}, attrs: {dtype: 'float32'}});
    imagesData = backend.dataIdMap.get(castedData.dataId);
  }

  const imagesId = imagesData.id;
  const boxesId = backend.dataIdMap.get(boxes.dataId).id;
  const boxIndId = backend.dataIdMap.get(boxInd.dataId).id;

  const out = backend.makeOutput(outShape, 'float32');
  const outId = backend.dataIdMap.get(out.dataId).id;

  const imagesShapeBytes = new Uint8Array(new Int32Array(image.shape).buffer);
  wasmCropAndResize(imagesId, boxesId, boxIndId, numBoxes, imagesShapeBytes, 0, 0, 0, 0, 0, 0, outId);

  if (castedData != null) {
    backend.disposeData(castedData.dataId);
  }

  return out;
}

export const cropAndResizeConfig: KernelConfig = {
  kernelName: CropAndResize,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: cropAndResize as {} as KernelFunc
};
import {backend_util, KernelConfig, KernelFunc, Cumnsum, CumnsumAttrs, CumnsumInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {CppDType} from './types';

import {transpose} from './Transpose';

let wasmCumsum: (xId: number, exclusive: number, reverse: number, finalDim: number, outId: number, dtype: CppDType) => void;

function setup(backend: BackendWasm) {
  wasmCumsum = backend.wasm.cwrap(Cumnsum, null /* void */, 
    ['number', // x_id
     'number', // exclusive
     'number', // reverse
     'number', // final_dim
     'number', // out_id
     'number' // dtype
    ]);}

export function cumsum(
  args: {inputs: CumnsumInputs, backend: BackendWasm, attrs: CumnsumAttrs}):
TensorInfo {
  const {inputs, backend, attrs} = args;
  const {x} = inputs;
  const {axis, exclusive, reverse} = attrs;
  const xRank = x.shape.length;

  util.assert(x.dtype === 'float32' || x.dtype === 'int32', () => `cumsum does not support ${x.dtype} tensors in the WASM backend`);
  // permute required axis to inner most axis
  const permutation = backend_util.getAxesPermutation([axis], xRank);
  let permutedX = x;

  if (permutation !== null) {
    permutedX = transpose({inputs: {x}, attrs: {perm: permutation}, backend});
  }

  const permutedAxis = backend_util.getInnerMostAxes(1, xRank)[0];

  backend_util.assertAxesAreInnerMostDims('cumsum', [permutedAxis], xRank);

  const permutedOut = backend.makeOutput(permutedX.shape, permutedX.dtype);
  const finalDim = permutedX.shape[permutedAxis];

  const permutedXId = backend.dataIdMap.get(permutedX.dataId).id;
  const permutedOutId = backend.dataIdMap.get(permutedOut.dataId).id;

  wasmCumsum(permutedXId, exclusive ? 1 : 0, reverse ? 1 : 0, finalDim, permutedOutId, CppDType[x.dtype]);

  // transpose data back if permuted
  let out = permutedOut;
  if (permutation !== null) {
    const undoPermutation = backend_util.getUndoAxesPermutation(permutation);
    out = transpose(
      {inputs: {x: permutedOut}, attrs: {perm: undoPermutation}, backend});
    backend.disposeData(permutedX.dataId);
    backend.disposeData(permutedOut.dataId);
  }
  return out;
}

export const cumsumConfig: KernelConfig = {
  kernelName: Cumnsum,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: cumsum as {} as KernelFunc
};
out = backend.makeOutput(outputShape, 'float32');
const xData = backend.dataIdMap.get(x.dataId);
const xId = xData.id;
const xStridesBytes = new Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);
const outputShapeBytes = new Uint8Array(new Int32Array(outputShape).buffer);
const outId = backend.dataIdMap.get(out.dataId);
const out = backend.makeOutput(outputShape, 'float32');

const xData = backend.dataIdMap.get(x.dataId);
const xId = xData.id;
const xStridesBytes = new Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);
const outputShapeBytes = new Uint8Array(new Int32Array(outputShape).buffer);
const outId = backend.dataIdMap.get(out.dataId);
const out = backend.makeOutput(outputShape, 'float32');

const outputShapeBytes = new Uint8Array(new Int32Array(outputShape).buffer);
const outStridesBytes = new Uint8Array(new Int32Array(util.computeStrides(outputShape).buffer));
const outId = backend.dataIdMap.get(out.dataId);

const channelsLast = dataFormat === 'NHWC' ? 1 : 0;
wasmdToSpace(out, outId, blockSize, channelsLast,
xStridesBytes, x.shape.length - 1, outputShapeBytes, outStridesBytes, outputShape.length, outId);
export const depthToSpaceConfig: KernelConfig = {
  kernelName: 'DepthToSpace',
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: depthToSpace as {} as KernelFunc
};

export const depthToSpaceConfig: KernelConfig = {
  kernelName: 'DepthToSpace',
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: depthToSpace as {} as KernelFunc
};

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 *=============================================================================
 */

import {backend_util, DepthwiseConv2dNative, DepthwiseConv2dNativeAttrs, DepthwiseConv2dNativeInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmDepthwiseConv2d: (xId: number, batchSize: number,
  inputHeight: number, inputWidth: number,
  filterId: number, filterHeight: number, filterWidth: number,
  padTop: number,
  padRight: number, padBottom: number, padLeft: number,
  isSamePad: number,
  dilationHeight: number, dilationWidth: number,
  strideHeight: number, strideWidth: number,
  inputChannels: number,
  outputChannels: number,
  outId: number) => void;

function setup(backend: BackendWasm) {
  wasmDepthwiseConv2d =
      backend.wasm.cwrap(DepthwiseConv2dNative, null /* void */, 
        'number',  // xId
        'number',  // batchSize
        'number',  // inputHeight
        'number',  // inputWidth
        'number',  // filterId
        'number',  // filterHeight
        'number',  // filterWidth
        'number',  // padTop
        'number',  // padRight
        'number',  // padBottom
        'number',  // padLeft
        'number',  // isSamePad
        'number',  // dilationHeight
        'number',  // dilationWidth
        'number',  // strideHeight
        'number',  // strideWidth
        'number',  // inputChannels
        'number',  // outputChannels
        'number',  // outId
      );
}

function depthwiseConv2d(args: {
  inputs: DepthwiseConv2dNativeInputs,
  backend: BackendWasm,
  attrs: DepthwiseConv2dNativeAttrs
}) {
  const {inputs, backend, attrs} = args;

  const {x, filter} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  const filterId = backend.dataIdMap.get(filter.dataId).id;

  const {strides, dilations, pad, dimRoundingMode} = attrs;

  const $dilations = dilations == null ? [1, 1] : dilations;

  const convInfo = backend_util.computeConv2DInfo(
      (x as Tensor4D).shape, (filter as Tensor4D).shape,
      strides, (dilations as number | [number, number]), pad, dimRoundingMode);

  const filterHeight = convInfo.filterHeight;
  const filterWidth = convInfo.filterWidth;
  const padTop = convInfo.padTop;
  const padRight = convInfo.padRight;
  const padBottom = convInfo.padBottom;
  const padLeft = convInfo.padLeft;
  const dilationHeight = convInfo.dilationHeight;
  const dilationWidth = convInfo.dilationWidth;
  const strideHeight = convInfo.strideHeight;
  const strideWidth = convInfo.strideWidth;
  const outputChannels = convInfo.outputChannels;

  if (convInfo.dataFormat === 'channelsLast') {
    throw new Error('wasm backend DepthwiseConv2dNative does not support dataFormat: ');
  }

  const outId = backend.dataIdMap.get(out.dataId).id;
  const out = backend.makeOutput(outputShape, 'float32');

  wasmDepthwiseConv2d(xId, x.shape[0], x.shape[1], x.shape[2], filterId, filterHeight,
    filterWidth, padTop, padRight, padBottom, padLeft, isSamePad,
    dilationHeight, dilationWidth, strideHeight, strideWidth,
    inputChannels, outputChannels, outId);
  return out;
}

export const depthwiseConv2dNativeConfig: KernelConfig = {
  kernelName: 'DepthwiseConv2dNative',
  backendName: 'wasm',
  setupFunc: setup,
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=============================================================================

```javascript
import {KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';
import {Fill, FillAttrs} from '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';

export function fill(args: {attrs: FillAttrs, backend: BackendWasm}) {
  const {attrs: {shape, value, dtype}, backend} = args;
  const outVals = backend.makeOutput(shape, dtype);
  outVals.fill(value as number);
  return outVals;
}

export const fillConfig = {
  kernelName: Fill,
  backendName: 'wasm',
  kernelFunc: fill as {} as KernelFunc,
};
```

```javascript
import {FlipLeftRight, FlipLeftRightInputs, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

function setup(backend: BackendWasm) {
  backend.wasm.cwrap(FlipLeftRight, null /* void */, [
    'number',  // xId
    'number',  // batch
    'number',  // imageHeight
    'number',  // imageWidth
    'number',  // numChannels
    'number',  // outId
  ]);}

export function flipLeftRight(args: {inputs: FlipLeftRightInputs, backend: BackendWasm}): TensorInfo {
  const {inputs, backend} = args;
  const {image} = inputs;

  const out = backend.makeOutput(image.shape, image.dtype);
  const xId = backend.dataIdMap.get(image.dataId).id;
  const outId = backend.dataIdMap.get(out.dataId).id;

  const [batch, imageHeight, imageWidth, numChannels] = image.shape;

  backend.wasm.cwrap(FlipLeftRight, null /* void */, [
    'number',  // xId
    'number',  // batch
    'number',  // imageHeight
    'number',  // imageWidth
    'number',  // numChannels
    'number',  // outId
  ]);}

export const flipLeftRightConfig = {
  kernelName: FlipLeftRight,
  backendName: 'wasm',
  kernelFunc: flipLeftRight as {} as KernelFunc,
  setupFunc: setup
};
```

```javascript
import {Floor, KernelConfig} from '@tensorflow/tfjs-core';

export const floorConfig = createUnaryKernelConfig(Floor);
```

```javascript
import {FloorDiv, KernelConfig} from '@tensorflow/tfjs-core';

export const floorDivConfig = createBinaryKernelConfig(FloorDiv);
```

---

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*/

import {FusedBatchNorm, FusedBatchNormAttrs, FusedBatchNormInputs, KernelConfig, KernelFunc,
TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

const supportsFullBroadcast = false;
export const floorDivConfig: KernelConfig =
createBinaryKernelConfig(FloorDiv, supportsFullBroadcast);

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*/

import {FusedBatchNorm, FusedBatchNormAttrs, FusedBatchNormInputs, KernelConfig, KernelFunc,
TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

const supportsFullBroadcast = false;
export const floorDivConfig: KernelConfig =
createBinaryKernelConfig(FloorDiv, supportsFullBroadcast);

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*/

import {FusedBatchNorm, FusedBatchNormAttrs, FusedBatchNormInputs, KernelConfig, KernelFunc,
TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

const supportsFullBroadcast = false;
export const floorDivConfig: KernelConfig =
createBinaryKernelConfig(FloorDiv, supportsFullBroadcast);

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import {FusedBatchNorm, FusedBatchNormAttrs, FusedBatchNormInputs, KernelConfig, KernelFunc,
TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

const supportsFullBroadcast = false;
export const floorDivConfig: KernelConfig =
createBinaryKernelConfig(FloorDiv, supportsFullBroadcast);
```javascript
fusedConv2d(args: {
  inputs: FusedConv2DInputs,
  backend: BackendWasm,
  attrs: FusedConv2DAattrs
}) {
  console.log('fusing Conv2D');
  const {inputs, attrs, backend} = args;
  const x = inputs['x'];
  const filter = inputs['filter'];
  const bias = inputs['bias'];
  const dataFormat = inputs['dataFormat'];
  const dimRoundingMode = inputs['dimRoundingMode'];
  const activation = inputs['activation'];
  const leakyreluAlpha = inputs['leakyreluAlpha'];

  const convInfo = backend_util.computeConv2DInfo(x as Tensor4D, shape, (filter as Tensor4D).shape, strides, dilations, pad, dimRoundingMode);

  const fusedActivation = attrs['fusedActivation'] as keyof typeof FusableActivation;

  if (fusedActivation === 'linear') {
    return tf.tidy(() => tf.fusedConv2d(x, filter, bias, dataFormat, dimRoundingMode, leakyreluAlpha));
  } else if (fusedActivation === 'prelu') {
    const preluWeights = tf.tidy(() => tf.prelu(x, filter, bias, dataFormat, dimRoundingMode, leakyreluAlpha));
    return tf.tidy(() => tf.add(x, preluWeights));
  } else if (fusedActivation === 'leakyrelu') {
    const leakyreluWeights = tf.tidy(() => tf.leakyRelu(x, filter, bias, dataFormat, dimRoundingMode, leakyreluAlpha));
    return tf.tidy(() => tf.add(x, leakyreluWeights));
  } else if (fusedActivation === 'elu') {
    const eluWeights = tf.tidy(() => tf.elu(x, filter, bias, dataFormat, dimRoundingMode, leakyreluAlpha));
    return tf.tidy(() => tf.add(x, eluWeights));
  } else if (fusedActivation === 'relu6') {
    const relu6Weights = tf.tidy(() => tf.relu6(x, filter, bias, dataFormat, dimRoundingMode, leakyreluAlpha));
    return tf.tidy(() => tf.add(x, relu6Weights));
  } else {
    console.error('Unsupported fused activation:', fusedActivation);
    return null;
  }
}
```

---

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 */
```
filterHeight
'number',  // filterWidth
'number',  // biasId
'number',  // padTop
'number',  // padRight
'number',  // padBottom
'number',  // padLeft
'number',  // isSamePad
'number',  // dilationHeight
'number',  // dilationWidth
'number',  // strideHeight
'number',  // strideWidth
'number',  // inputChannels
'number',  // outputChannels
'number',  // activation
'number',  // preluActivationWeightsId
'number',  // leakyreluAlpha
'number',  // outId
});

function fusedDepthwiseConv2d(args: {
  inputs: FusedDepthwiseConv2DInputs,
  backend: BackendWasm,
  attrs: FusedDepthwiseConv2DAttrs
}) {
  const {inputs, backend, attrs} = args;
  const {x, filter, bias, preluActivationWeights} = inputs;
  const {strides, pad, dilations, dataFormat, dimRoundingMode, activation, leakyreluAlpha} = attrs;

  const convInfo = backend_util.computeConv2DInfo((x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations, pad, dimRoundingMode, true /* depthwise */, null /* fusedActivation */);

  const xId = backend.dataIdMap.get(x.dataId).id;
  const filterId = backend.dataIdMap.get(filter.dataId).id;
  const outputChannels = convInfo.outChannels;
  const biasId = 0;
  const filterHeight = convInfo.filterHeight;
  const filterWidth = convInfo.filterWidth;
  const padTop = convInfo.padInfo.top;
  const padRight = convInfo.padInfo.right;
  const padBottom = convInfo.padInfo.bottom;
  const padLeft = convInfo.padInfo.left;
  const dilationHeight = convInfo.dilationHeight;
  const dilationWidth = convInfo.dilationWidth;
  const strideHeight = convInfo.strideHeight;
  const strideWidth = convInfo.strideWidth;
  const inputChannels = convInfo.inChannels;
  const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;
  const batchSize = convInfo.batchSize;
  const inHeight = convInfo.inHeight;
  const inWidth = convInfo.inWidth;

  if (dataFormat !== 'NHWC') {
    throw new Error(`wasm backend FusedDepthwiseConv2D does not support dataFormat: '${dataFormat}'. Please use 'NHWC'.`);
  }

  const out = backend.makeOutput(convInfo.outShape, 'float32');
  const outId = backend.dataIdMap.get(out.dataId).id;
  const preluActivationWeightsId = preluActivationWeights == null ? 0 : backend.dataIdMap.get(preluActivationWeights.dataId).id;
  const numFusedActivation = convInfo.activated;
  if (numFusedActivation !== 0) {
    throw new Error(`FusedDepthwiseConv2D only supports rank-1 fused activation. Currently use as ${numFusedActivation} fusedActivation`);
  }

  wasmFusedDepthwiseConv2d(xId, batchSize, inHeight, inWidth, filterId, filterHeight, filterWidth, biasId, padTop, padRight, padBottom, padLeft, isSamePad, dilationHeight, dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels, fusedActivation, preluActivationWeightsId, leakyreluAlpha || 0, outId);

  return out;
}

export const fusedDepthwiseConv2DConfig: KernelConfig = {
  kernelName: FusedDepthwiseConv2D,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: fusedDepthwiseConv2d as {} as KernelFunc
};

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 */

import {TensorInfo, GatherNd, GatherNdInputs, KernelConfig, CppDType} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmGatherNd: (xId: number, dtype: CppDType, indicesId: number, numSlices: number, sliceRank: number, sliceSize: number, strides: Uint8Array, outId: number) => void;
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```javascript
function gatherNd(args: {backend: BackendWasm, inputs: GatherNdInputs}): TensorInfo {
  const {backend, inputs} = args;
  const {params, indices} = inputs;
  const [resultShape, numSlices, sliceSize, strides] = gather_util.prepareAndValidate(params, indices);
  const out = backend.makeOutput(resultShape, params.dtype);
  if (numSlices === 0) { return out; }
  const indicesShape = indices.shape;
  const sliceRank = indicesShape.length - 1;
  const xData = backend.dataIdMap.get(params.dataId);
  const xId = xData.id;
  const x = backend.readSync(xId) as Tensor;
  const xStrides = util.computeStrides(x.shape);
  const xStridesBytes = new Uint8Array(new Int32Array(xStrides).buffer);
  const outId = backend.dataIdMap.get(out.dataId).id;
  const wasmGatherNd = backend.wasm.cwrap('GatherNd', null /*void*/, [
    'number',  // xId
    'number',  // numSlices
    'number',  // sliceSize
    'array',  // strides
    'number',  // sliceRank
    'number',  // sliceSize
    'number'   // outId
  ]);

  const xOutput = wasmGatherNd(xId, CppDType[params.dtype], indices.dataId, numSlices, sliceRank, sliceSize, xStridesBytes, outId);
  const out = backend.readSync(outId) as Tensor;
  const outData = backend.dataIdMap.get(out.dataId);
  const outId = outData.id;
  const outStrides = util.computeStrides(out.shape);
  const outStridesBytes = new Uint8Array(new Int32Array(outStrides).buffer);
  const outData = backend.makeOutput(out.shape, out.dt); // reshape out.shape
  const outId = backend.dataIdMap.get(out.dataId).id;
  const exportedOut = backend.write(outId);
  const xData = backend.read(xId);
  const xOutput = backend.write(xId);
  const outData = backend.write(outId);
}
```
permuteAxesAndTranspose(x, axis, backend);

const transposedId = backend.datalMap.get(transposed.dataId).id;
input = transposed;
inputId = transposedId;

const inputRank = input.shape.length;
backend_util.assertAxesAreInnerMostDims('max', axes, inputRank);
const [outShape, reduceShape] =
backend_util.computeOutAndReduceShapes(input.shape, axes);
const reduceSize = util.sizeFromShape(reduceShape);

if (util.sizeFromShape(input.shape) !== 0) {
    const outId = backend.datalMap.get(out.dataId).id;
    wasmMax(inputId, CppDType[x.dtype], reduceSize, outId);
}

if (inputWasTransposed) {
    // dispose of the transposed tensor.
    backend.disposeData(transposed.dataId);
}

if (keepDims) {
    // reshape
    const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);
    out.shape = newShape;
}

return out;
}

export const maxConfig: KernelConfig = {
    kernelName: Max,
    backendName: 'wasm',
    setupFunc: setup,
    kernelFunc: max as {} as KernelFunc
};

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 */
import {KernelConfig, Maximum} from '@tensorflow/tfjs-core';

import {createBinaryKernelConfig} from './binary_kernel';
const supportsFullBroadcast = false;
export const maximumConfig: KernelConfig = createBinaryKernelConfig(Maximum, supportsFullBroadcast);

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 */

import {backend_util, KernelConfig, KernelFunc, MaxPool, MaxPoolAttrs, MaxPoolInputs, Tensor4D, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmMaxPool: (
    xId: number, batchSize: number, inputHeight: number, inputWidth: number,
    filterHeight: number, filterWidth: number, padTop: number, padRight: number,
    padBottom: number, padLeft: number, dilationHeight: number,
    dilationWidth: number, strideHeight: number, strideWidth: number,
    inputChannels: number, outputChannels: number, outId: number) => void;

function setup(backend: BackendWasm) {
    wasmMaxPool = backend.wasm.cwrap(MaxPool, null /* void */, [
        'number',  // xId
        'number',  // batchSize
        'number',  // inputHeight
        'number',  // inputWidth
        'number',  // filterHeight
        'number',  // filterWidth
        'number',  // padTop
        'number',  // padRight
        'number',  // padBottom
        'number',  // padLeft
        'number',  // dilationHeight
        'number',  // dilationWidth
        'number',  // strideHeight
        'number',  // strideWidth
        'number',  // inputChannels
        'number',  // outputChannels
        'number',  // outId
    ]);}

function maxPool(
    args:
{
    inputs: MaxPoolInputs,
    backend: BackendWasm,
    attrs: MaxPoolAttrs
}) {
    const {inputs, backend, attrs} = args;
    const x = inputs.x as Tensor4D;
    const xId = backend.datalMap.get(x.dataId).id;

    // TF API supports int32 input. CPU and WebGL backend also support int32
    // input. WASM backend doesn't support it because it uses xnnpack which only
    // supports float32. To avoid the following assertion only for the WASM
    // backend instead of at core op level
    // level
    // TODO: add support for int32 input util_assert(x.dtype !== 'float32')
    // => Error in MaxPool: only float32 input is supported. Got $x.dtype
    return wasmMaxPool(xId, x.shape, filterSize, strides, pad, dimRoundingMode) as inputInfo
}
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const filterHeight = convInfo.filterHeight;
const filterWidth = convInfo.filterWidth;
const padTop = convInfo.padInfo.top;
const padRight = convInfo.padInfo.right;
const padBottom = convInfo.padInfo.bottom;
const padLeft = convInfo.padInfo.left;

const dilationHeight = convInfo.dilationHeight;
const dilationWidth = convInfo.dilationWidth;
const strideHeight = convInfo.strideHeight;
const strideWidth = convInfo.strideWidth;
const inputChannels = convInfo.inChannels;
const outputChannels = convInfo.outChannels;

if (convInfo.dataFormat !== 'channelsLast') {
  throw new Error('wasm backend does not support dataFormat: ' + convInfo.dataFormat). Please use 'channelsLast'.
}

const out = backend.makeOutput(convInfo.outShape, 'float32');
const outId = backend.dataIdMap.get(out.dataId).id;

wasmMaxPool(
  xId, x.shape[0], x.shape[1], x.shape[2],
  filterHeight, filterWidth,
  padTop, padRight, padBottom, padLeft, dilationHeight, dilationWidth,
  strideHeight, strideWidth, inputChannels, outputChannels, outId);

return out;
}

export const maxPoolConfig:
  KernelConfig = {
    kernelName: MaxPool,
    backendName: 'wasm',
    setupFunc: setup,
    kernelFunc: maxPool
  } as {} as KernelFunc

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 */

import {backend_util, KernelConfig, KernelFunc, Mean, MeanAttrs, MeanInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';
import {cast} from './Cast';

import {permuteAxesAndTranspose} from './kernel_utils';

let wasmMean: (xId: number, reduceSize: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmMean = backend.wasm.cwrap(Mean, null /*void*/, 
    ['number, number, number']);
}

export function mean(
    args:
      {backend: BackendWasm, inputs: MeanInputs, attrs: MeanAttrs}):
      TensorInfo {
  const {backend, inputs, attrs} = args;
  const {axis, keepDims} = attrs;
  const {x} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  let inputId = xId;
  let input = x;

  const {transposed, axes, originalAxes, inputWasTransposed} =
    permuteAxesAndTranspose(x, axis, backend);

  const reductionAxes = axes;

  if (inputWasTransposed) {
    const transposedId = backend.dataIdMap.get(transposed.dataId).id;
    if (transposedId !== xId) {
      // transpose was not a no-op. We will need to dispose of this
      // once we are done.
      input = transposed;
      inputId = transposedId;
      reductionAxes = backend_util.getInnerMostAxes(inputAxes.length, input.shape.length);
    }
  }

  backend_util.assertAxesAreInnerMostDims('mean', reductionAxes, input.shape.length);
  const [outShape, reduceShape] =
    backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);

  const reduceSize = util.sizeFromShape(reduceShape);

  let castedInput = input;
  if (input.dtype !== 'float32') {
    castedInput =
      cast({backend, inputs: {x: input}, attrs: {dtype: 'float32'}});
    inputId = backend.dataIdMap.get(castedInput.dataId).id;
  }

  const out = backend.makeOutput(outShape, 'float32');
  const outId = backend.dataIdMap.get(out.dataId).id;

  const out =
    backend.disposeData(transposed.dataId);

  if (inputWasTransposed) {
    // dispose of the transposed tensor.
    backend.disposeData(castedInput.dataId);
  }

  const outId = backend.makeOutput(outShape, 'float32');

  if (util.sizeFromShape(input.size) !== 0) {
    const outId = backend.dataIdMap.get(out.dataId).id;

    wasmMean(inputId, reduceSize, outId);
  }

  if (inputWasTransposed) {
    // reshape
    const newShape =
      backend_util.expandShapeToKeepDim(out.shape, originalAxes);
    out.shape = newShape;
  }

  return out;
}

export const meanConfig:
  KernelConfig = {
    kernelName: Mean,
    backendName: 'wasm',
    setupFunc: setup,
    kernelFunc: mean
  } as {} as KernelFunc

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=============================================================================

*/

import {backend_util, KernelConfig, KernelFunc, Min, MinAttrs, MinInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {permuteAxesAndTranspose} from './kernel_utils';
import {CppDType} from './types';

let wasmMin: (xId: number, dtype: number, reduceSize: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmMin = backend.wasm.cwrap(Min, null /*void*/, [
    'number',  // x_id
    'number',  // dtype
    'number',  // reduce_size
    'number'   // out_id
  ]);
}

function min(args: {backend: BackendWasm, inputs: MinInputs, attrs: MinAttrs}): TensorInfo {
  const {backend, inputs, attrs} = args;

  const {axis, keepDims} = attrs;
  const {x} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  let inputId = xId;
  let input = x;

  const {transposed, axes, originalAxes, inputWasTransposed} =
  permuteAxesAndTranspose(x, axis, backend);

  if (inputWasTransposed) {
    const transposedId = backend.dataIdMap.get(transposed.dataId).id;
    if (transposedId !== xId) {
      // transpose was not a no-op. We
      // will need to dispose of this
      // once we are done.
      input = transposed;
      inputId = transposedId;
    }
  }

  const inputRank = input.shape.length;

  backend_util.assertAxesAreInnerMostDims('min', axes, inputRank);
  const [outShape, reduceShape] =
      backend_util.computeOutAndReduceShapes(input.shape, axes);
  const reduceSize = util.sizeFromShape(reduceShape);

  const out = backend.makeOutput(outShape, input.dtype);
  if (util.sizeFromShape(input.shape) !== 0) {
    const outId = backend.dataIdMap.get(out.dataId).id;
    wasmMin(inputId, CppDType[x.dtype], reduceSize, outId);
  }

  if (inputWasTransposed) {
    // dispose of the transposed tensor.
    backend.disposeData(transposed.dataId);
  }

  if (keepDims) {
    // reshape
    const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);
    out.shape = newShape;
  }

  return out;
}

export const minConfig: KernelConfig = {
  kernelName: Min,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: min as {} as KernelFunc
};

import {KernelConfig, Minimum} from '@tensorflow/tfjs-core';

import {createBinaryKernelConfig} from './binary_kernel';
const supportsFullBroadcast = false;
export const minimumConfig: KernelConfig =
createBinaryKernelConfig(Minimum, supportsFullBroadcast);

import {KernelConfig, KernelFunc, MirrorPad, MirrorPadAttrs, MirrorPadInputs} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {CppDType} from './types';

// Must match enum in MirrorPad.cc
enum MirrorPaddingMode {
  reflect = 0,
  symmetric = 1
}

let wasmMirrorPad: (
  xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype: number,
  prePaddingsBytes: Uint8Array, postPaddingsBytes: Uint8Array, mode: number,
  outId: number) => void;

function
setup(backend: BackendWasm) {
  wasmMirrorPad = backend.wasm.cwrap(MirrorPad, null /* void */, [
    'number', // xId
    'array', // x.shape
    'number', // x.shape.length
    'number', // x.dtype
    'array', // pre-paddings
    'array', // post-paddings
    'number', // mode
    'number', // outId
  ]);}

function mirrorPad(args: {
  inputs: MirrorPadInputs,
  backend: BackendWasm,
  attrs: MirrorPadAttrs
}) {
  const {inputs: {x}, backend, attrs: {paddings, mode}} = args;
  const outShape = paddings.map((p, i) => p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);
  const xId = backend.dataIdMap.get(x.dataId).id;
  const out = backend.makeOutput(outShape, x.dtype);
  const outId = backend.dataIdMap.get(out.dataId).id;
  const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);
  const prePaddingsFlat = paddings.map(padTuple => padTuple[0]);
  const postPaddingsFlat = paddings.map(padTuple => padTuple[1]);
  const prePaddingsBytes = new Uint8Array(new Int32Array(prePaddingsFlat).buffer);
  const postPaddingsBytes = new Uint8Array(new Int32Array(postPaddingsFlat).buffer);
  wasmMirrorPad(xId, xShapeBytes, x.shape.length, CppDType[x.dtype], prePaddingsBytes, postPaddingsBytes, MirrorPaddingMode[mode], outId);
  return out;
}

export const mirrorPadConfig: KernelConfig = {
  kernelName: MirrorPad,
  backendName: 'wasm',
  kernelFunc: mirrorPad as {} as KernelFunc,
  setupFunc: setup
};

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 */

import {KernelConfig, Multiply} from '@tensorflow/tfjs-core';

export const multiplyConfig: KernelConfig = createBinaryKernelConfig(Multiply, supportsFullBroadcast);

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 */

import {BackendWasm} from '../backend_wasm';

interface Result {
  pSelectedIndices: number;
  selectedSize: number;
  pSelectedScores: number;
  pValidOutputs: number;
}

export function parseResultStruct(backend: BackendWasm, resOffset: number): Result {
  const result = new Int32Array(backend.wasm.HEAPU8.buffer, resOffset, 4);
  const pSelectedIndices = result[0];
  const selectedSize = result[1];
  const pSelectedScores = result[2];
  const pValidOutputs = result[3]; // Since the result was allocated on the heap, we have to delete it.
}
backend.wasm._free(resOffset);
return {pSelectedIndices, selectedSize, pSelectedScores,
pValidOutputs};

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***********************************************************/

*@

import {KernelConfig, KernelFunc, NonMaxSuppressionV3, NonMaxSuppressionV3Attrs,
NonMaxSuppressionV3Inputs, TensorInfo} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {parseResultStruct} from './NonMaxSuppression_util';

let wasmFunc: (boxesId: number, scoresId: number, maxOutputSize: number, iouThreshold: number, scoreThreshold: number) => number;

function setup(backend: BackendWasm): void {
  wasmFunc = backend.wasm.cwrap(NonMaxSuppressionV3, 'number', ['number', 'number', 'number', 'number', 'number'],
      [boxesId: number, scoresId: number, maxOutputSize: number, iouThreshold: number, scoreThreshold: number]);
}

function kernelFunc(args: {
  backend: BackendWasm,
  inputs: NonMaxSuppressionV3Inputs,
  attrs: NonMaxSuppressionV3Attrs
}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {iouThreshold, maxOutputSize, scoreThreshold} = attrs;
  const {boxes, scores} = inputs;

  const boxesId = backend.dataIdMap.get(boxes.dataId).id;
  const scoresId = backend.dataIdMap.get(scores.dataId).id;

  const resOffset = wasmFunc(boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold);

  const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} = parseResultStruct(backend, resOffset);

  // Since we are not using scores for V3, we have to delete it from the heap.
  backend.wasm._free(pSelectedScores);
  backend.wasm._free(pValidOutputs);

  const selectedIndicesTensor = backend.makeOutput([selectedSize], 'int32', pSelectedIndices);

  return selectedIndicesTensor;
}

export const nonMaxSuppressionV3Config: KernelConfig = {
  kernelName: NonMaxSuppressionV3,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: kernelFunc as {} as KernelFunc,
};

 Россія
const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} =
parseResultStruct(backend, resOffset); // Since we are not using scores for V4, we have to delete it from the
heap.
backend.wasm._free(pSelectedScores);
const selectedIndicesTensor =
backend.makeOutput([selectedSize], 'int32', pSelectedIndices);
const validOutputsTensor =
backend.makeOutput([selectedSize], 'int32', pValidOutputs);
return [selectedIndicesTensor, validOutputsTensor];

export const nonMaxSuppressionV4Config: KernelConfig = {
  kernelName: NonMaxSuppressionV4,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: nonMaxSuppressionV4 as {} as KernelFunc,
} as KernelConfig;

const selectedIndicesTensor =
backend.makeOutput([selectedSize], 'int32', pSelectedIndices);
const validOutputsTensor =
backend.makeOutput([selectedSize], 'int32', pValidOutputs);
return [selectedIndicesTensor, validOutputsTensor];

export const nonMaxSuppressionV5Config: KernelConfig = {
  kernelName: NonMaxSuppressionV5,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: nonMaxSuppressionV5 as {} as KernelFunc,
} as KernelConfig;

const notEqualConfig: KernelConfig =
createBinaryKernelConfig(NotEqual, supportsFullBroadcast, 'bool');

const supportsFullBroadcast = false;
export const notEqualConfig: KernelConfig =
createBinaryKernelConfig(NotEqual, supportsFullBroadcast, 'bool');
import {backend_util, KernelConfig, KernelFunc, Prod, ProdAttrs, ProdInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {permuteAxesAndTranspose} from '../kernel-utils';

import {CppDType} from './types';

let wasmProd: (xId: number, reduceSize: number, dtype: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmProd = backend.wasm.cwrap(Prod, null /*void*/, [
    'number',
    'number',
    'number',
    'number'
  ]);}

function prod(args: {
  backend: BackendWasm,
  inputs: ProdInputs,
  attrs: ProdAttrs
}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {axis, keepDims} = attrs;
  const {x} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  let inputId = xId;
  let input = x;

  const {transposed, axes, originalAxes, inputWasTransposed} =
      permuteAxesAndTranspose(x, axis, backend);

  let reductionAxes = axes;
  if (inputWasTransposed) {
    const transposedId =
        backend.dataIdMap.get(transposed.dataId).id;
    if (transposedId !== xId) {
      // transpose was not a no-op. We
      // will need to dispose of this
      // once we are done.
      input = transposed;
      inputId = transposedId;
      let let inputId = xId;
    }
  }

  backend_util.assertAxesAreInnerMostDims(
      'prod', reductionAxes, input.shape.length);
  const [outShape, reduceShape] =
      backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);
  const reduceSize = util.sizeFromShape(reduceShape);
  const outId = backend.dataIdMap.get(outId).id;

  wasmProd(inputId, reduceSize, CppDType[out.dtype], outId);

  if (reduceShape) {
    const reduceAxes = backend_util.getInnerMostAxes(reduceAxes, input.shape.length);
    const backendUtilAxesAreInnerMostDims =
        backend_util.isAxesInnerMostDims('prod', reduceAxes, input.shape.length);
    const [outShape, reduceShape] =
        backend_util.computeOutputAndReduceShapes(input.shape, reduceAxes);
    const reduceShape =
        reduceShape.map(d => backend_util.expandShapeToKeepDim(outShape, originalAxes));
    const prodConf = config => {
      return out;
    };
  }

return out;}

export const prodConfig: KernelConfig = {
  kernelName: Prod,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: prod as {} as KernelFunc
};
import {KernelConfig, KernelFunc, Range, RangeAttrs, TensorInfo} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';
import {rangeImplCPU} from '../kernel_utils/shared';

export const range =
    (args: {backend: BackendWasm, attrs: RangeAttrs}): TensorInfo => {
      const {backend, attrs} = args;
      const {start, stop, step, dtype} = attrs;
      const values = rangeImplCPU(start, stop, step, dtype);
      const out = backend.makeOutput([values.length], dtype);
      const outVals = backend.typedArrayFromHeap(out);
      outVals.set(values);
      return out;
    };

export const rangeConfig: KernelConfig = {
  kernelName: Range,
  backendName: 'wasm',
  kernelFunc: range as {} as KernelFunc
};

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 */

import {KernelConfig, RealDiv} from '@tensorflow/tfjs-core';

import {createBinaryKernelConfig} from './binary_kernel';

const supportsFullBroadcast = true;
export const realDivConfig: KernelConfig =
    createBinaryKernelConfig(RealDiv, supportsFullBroadcast);

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 */

import {KernelConfig, Relu} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';
export const reluConfig: KernelConfig = createUnaryKernelConfig(Relu);

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 */

import {KernelConfig, KernelFunc, ResizeBilinear, ResizeBilinearAttrs, ResizeBilinearInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {cast} from './Cast';

let wasmResizeBilinear: (xId: number, batch: number, oldHeight: number, oldWidth: number, numChannels: number, newHeight: number, newWidth: number, alignCorners: number, halfPixelCenters: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmResizeBilinear =
```javascript
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', // alignBorders\n  'number', // halfPixelCenters\n  'number' // outId\n]);

function resizeBilinear(args: {
  backend: BackendWasm,
  inputs: ResizeBilinearInputs,
  attr: ResizeBilinearAttr
}): TensorInfo {
  const {backend, inputs, attr} = args;
  const images = inputs.images;
  const outShape = [batch, newHeight, newWidth, numChannels];
  const newShape = images.shape;

  const outId = backend.dataIdMap.get(out.dataId);\n  let xData = backend.dataIdMap.get(images.dataId);\n  let castedData = null;\n
  if (xData.dtype !== 'float32') {\n    castedData = cast({backend, inputs: {x: images}, attr: {dtype: 'float32'}});\n    xData = castedData.dataId;
  }

  const xId = xData.dataId.id;
  const out = backend.makeOutput(newShape, 'float32');\n  const outId = backend.dataIdMap.get(out.dataId);\n
  wasmResizeBilinear(xId, batch, oldHeight, oldWidth, numChannels, newHeight, newWidth,\n                    alignBorders ? 1 : 0, halfPixelCenters ? 1 : 0, outId);

  if (castedData != null) {\n    backend.disposeData(castedData.dataId);
  }

  return out;
}

export const resizeBilinearConfig: KernelConfig = {
  kernelName: ResizeBilinear,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: resizeBilinear as {} as KernelFunc
};

function reverse(args: {
  inputs: ReverseInputs,
  backend: BackendWasm,
  attr: ReverseAttr
}): TensorInfo {
  const {inputs, backend, attr} = args;
  const x = inputs.x;
  const dims = attr.dims;

  if (x.shape.length === 0) {\n    return identity({inputs: {x}, backend});
  }

  const out = backend.makeOutput(x.shape, x.dtype);
  const xId = backend.dataIdMap.get(out.dataId);\n  const outId = backend.dataIdMap.get(out.dataId);\n
  const axesBytes = new Uint8Array(new Int32Array(x.shape).buffer);
  const newShape = backend.dataIdMap.get(x.dataId).id;
  const out = backend.makeOutput(newShape, 'float32');\n
  wasmReverse(xId, axesBytes, axes.shape.length, out.dataId.id);

  const reshaped = reshape({inputs: {x: out}, attr: {dtype: 'float32'}});

  backend.disposeData(out.dataId);\n  return reshaped;
}

export const reverseConfig: KernelConfig = {
  kernelName: Reverse,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: reverse as {} as KernelFunc
};
```

The code snippet above includes functions for resizing images bilinearly and reversing their directions. The `ResizeBilinear` function accepts parameters such as the backend, inputs, and attributes, and returns a `TensorInfo`. Similarly, the `reverse` function also takes inputs and a backend, along with attributes, and returns a reshaped tensor.
import {TensorInfo} from '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';

import {BackendWasm} from '../backend_wasm';

let wasmRotate = backend.wasm.cwrap(RotateWithOffset, null /* void */);  

function setup(backend: BackendWasm) {
  wasmRotate = backend.wasm.cwrap(RotateWithOffset, null /* void */, 
      [ 'number', // xId
        'number',  // batch
        'number', // imageHeight
        'number', // imageWidth
        'number', // numChannels
        'number', // radians
        'number', // centerX
        'number', // centerY
        'array', // fillBytes
        'number', // fillLength
        'number', // outId
      ]);  
}

export function rotateWithOffset(args: {
  inputs: RotateWithOffsetInputs,
  backend: BackendWasm,
  attrs: RotateWithOffsetAttrs
}): TensorInfo {
  const {inputs, backend, attrs} = args;
  const {image} = inputs;
  const {radians, fillValue, center} = attrs;

  const out = backend.makeOutput(image.shape, image.dtype);
  const imageId = backend.dataIdMap.get(image.dataId).id;
  const outId = backend.dataIdMap.get(out.dataId).id;

  const [batch, imageHeight, imageWidth, numChannels] = image.shape;

  const [centerX, centerY] = center;

  const fillIsBlack = fillValue === 0;
  const fullOpacityValue = 255;

  const fillValues = typeof fillValue === 'number' ?
      [fillValue, fillValue, fillValue, fillIsBlack ? 0 : fullOpacityValue] :
      [...fillValue, fullOpacityValue];

  const fillBytes = new Uint8Array(new Int32Array(fillValues).buffer);

  wasmRotate(imageId, batch, imageHeight, imageWidth, numChannels, radians, centerX, centerY, fillBytes, fillValues.length, outId);
  return out;
}

export const rotateWithOffsetConfig: KernelConfig = {
  kernelName: RotateWithOffset,
  backendName: 'wasm',
  kernelFunc: rotateWithOffset as {} as KernelFunc,
  setupFunc: setup
};

import {KernelConfig, Round} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';

export const roundConfig: KernelConfig = createUnaryKernelConfig(Round);

import {KernelConfig, Rsqrt} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';

export const rsqrtConfig: KernelConfig = createUnaryKernelConfig(Rsqrt);

import {KernelConfig, KernelFunc, scatter_util, ScatterNd, ScatterNdAttrs, ScatterNdInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {CppDType} from './types';

let wasmScatterNd = backend.wasm.cwrap(ScatterNd, null /* void */);

function setup(backend: BackendWasm) {
  wasmScatterNd = backend.wasm.cwrap(ScatterNd, null /* void */, 
      [ 'number',  // xId
        'number',  // batch
        'number',  // imageHeight
        'number',  // imageWidth
        'number',  // numChannels
        'number',  // radians
        'number', // centerX
        'number', // centerY
        'array', // fillBytes
        'number', // fillLength
        'number', // outId
      ]);  
}

export function scatterNd(args: {
  inputs: ScatterNdInputs,
  backend: BackendWasm,
  attrs: ScatterNdAttrs
}): TensorInfo {
  const {inputs, backend, attrs} = args;
  const {indices, updates} = inputs;

  const out = backend.makeOutput(indices.shape, indices.dtype);
  const indicesId = backend.dataIdMap.get(indices.dataId).id;
  const updatesId = backend.dataIdMap.get(updates.dataId).id;

  const [batch, imageHeight, imageWidth, numChannels] = indices.shape;

  const [centerX, centerY] = attrs.center;

  const fillIsBlack = attrs.fillValue === 0;
  const fullOpacityValue = 255;

  const fillValues = typeof attrs.fillValue === 'number' ?
      [attrs.fillValue, attrs.fillValue, attrs.fillValue, fillIsBlack ? 0 : fullOpacityValue] :
      [...attrs.fillValue, fullOpacityValue];

  const fillBytes = new Uint8Array(new Int32Array(fillValues).buffer);

  wasmScatterNd(indicesId, updatesId, backend.wasm.wasmCtype(backend.wasm.wasmCtype(backend.wasm.cwrap(SparseTensor, null /* void */, [ 'number', // xId
          'number',  // batch
          'number',  // imageHeight
          'number',  // imageWidth
          'number',  // numChannels
          'number', // radians
          'number', // centerX
          'number', // centerY
          'array', // fillBytes
          'number', // fillLength
          'number', // outId
        ]));
  return out;
}

export const scatterNdConfig: KernelConfig = {
  kernelName: ScatterNd,
  backendName: 'wasm',
  kernelFunc: scatterNd as {} as KernelFunc,
  setupFunc: setup
};
number, numUpdates: number, sliceSize: number, strides: Uint8Array, outputSize: number, outId: number) => void;\n
function setup(backend: BackendWasm): void {
  wasmScatterNd = backend.wasm.cwrap(ScatterNd, null /*void*/, [
    'number', // indicesId 'number', // updatesId 'number', // dtype 'number', // sliceRank 'number', // numUpdates 'number', // sliceSize 'array', // strides 'number', // outputSize 'number' // outputId 
  ]);\n}

function scatterNd(
    args:
        {backend: BackendWasm, inputs: ScatterNdInputs, attrs: ScatterNdAttrs}):
    TensorInfo {
  const {backend, inputs, attrs} = args;
  const {indices, updates} = inputs;
  const {shape} = attrs;

  const out = backend.makeOutput(shape, updates.dtype);
  if 

  const stridesBytes = new Uint8Array(new Int32Array(strides).buffer);

  const outId = backend.dataIdMap.get(out.dataId).id;

  wasmScatterNd(indicesId, updatesId, CppDType[updates.dtype], sliceRank, numUpdates, sliceSize, stridesBytes, outputSize, outId);

  return out;
}

export const scatterNdConfig: KernelConfig = {
  kernelName: ScatterNd,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: scatterNd as {} as KernelFunc
};

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 */

import {KernelConfig, KernelFunc, Select, SelectInputs, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmSelect: (conditionId: number, tId: number, eId: number, offset: number, outId: number) => void = null;

function setup(backend: BackendWasm) {
  wasmSelect = backend.wasm.cwrap('SelectV2', null, ['number', 'number', 'number', 'number', 'number']);
}

function select(args: {inputs: SelectInputs, backend: BackendWasm}) {
  const {inputs, backend} = args;
  const {condition, t, e} = inputs;

  const conditionId = backend.dataIdMap.get(condition.dataId).id;
  const tId = backend.dataIdMap.get(t.dataId).id;
  const eId = backend.dataIdMap.get(e.dataId).id;
  const out = backend.makeOutput(t.shape, t.dtype);
  const outId = backend.dataIdMap.get(out.dataId).id;

  const cRank = condition.shape.length;
  const tRank = t.shape.length;

  const offset = cRank === 0 || cRank > 1 || tRank === 1 ?
      1 :
    util.sizeFromShape(t.shape.slice(1));

  wasmSelect(conditionId, tId, eId, offset, outId);
  return out;
}

export const selectConfig: KernelConfig = {
  kernelName: Select,
  backendName: 'wasm',
  kernelFunc: select as {} as KernelFunc,
  setupFunc: setup
};

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 */

import {KernelConfig, KernelFunc, Sigmoid, SigmoidInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmFunc: (xId: number, outId: number) => void = null;

function setup(backend: BackendWasm): void {
  wasmFunc = backend.wasm.cwrap(Sigmoid, null /*void*/, ['number', 'number']);
}

function sigmoid(args: {backend: BackendWasm, inputs: SigmoidInputs}):
    TensorInfo {
  const {backend, inputs: {x}} = args;
  const xId = backend.dataIdMap.get(x.dataId).id;
  const out = backend.makeOutput(x.shape, x.dtype);
  const outId = backend.dataIdMap.get(out.dataId).id;

  wasmFunc(xId, outId);
  return out;
}

export const sigmoidConfig: KernelConfig = {
  kernelName: Sigmoid,
  backendName: 'wasm',
  kernelFunc: sigmoid as {} as KernelFunc,
  setupFunc: setup
};

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 */

import {KernelConfig, KernelFunc, Dot, DotInputs, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmDot: (xId: number, yId: number, outId: number) => void = null;

function setup(backend: BackendWasm): void {
  wasmDot = backend.wasm.cwrap(Dot, null /*void*/, ['number', 'number', 'number']);
}

function dot(args: {backend: BackendWasm, inputs: DotInputs}):
    TensorInfo {
  const {backend, inputs: {x, y}} = args;
  const xId = backend.dataIdMap.get(x.dataId).id;
  const yId = backend.dataIdMap.get(y.dataId).id;

  wasmDot(xId, yId, outId);
  return out;
}

export const dotConfig: KernelConfig = {
  kernelName: Dot,
  backendName: 'wasm',
  kernelFunc: dot as {} as KernelFunc,
  setupFunc: setup
};
```javascript
const outId = backend.dataIdMap.get(out.dataId).id;

// Short-circuit zero-sized tensors.
if (util.sizeFromShape(out.shape) === 0) {
  return out;
}

backend.makeOutput(x.shape, x.dtype);
const outId = backend.dataIdMap.get(out.dataId).id;

// Short-circuit zero-sized tensors.
if (util.sizeFromShape(out.shape) === 0) {
  return out;
}

wasmFunc(xId, outId);
return out;
}

export const sigmoidConfig: KernelConfig = {
  kernelName: 'Sigmoid',
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: sigmoid as {} as KernelFunc
};

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 *
 *=============================================================================
 */

import {KernelConfig, Sin} from '@tensorflow/tfjs-core';

export const sinConfig: KernelConfig = createUnaryKernelConfig(Sin);

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 *
 *=============================================================================
 */

import {KernelConfig, KernelFunc, Softmax, SoftmaxAttrs, SoftmaxInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmFunc: (xId: number, outId: number, channels: number, batch: number) => void;

function setup(backend: BackendWasm): void {
  wasmFunc = backend.wasm.cwrap(Softmax, null /* void */, [
    'number',  // xId
    'number',  // outId
    'number',  // channels
    'number'   // batch
  ]);
}

function softmax(
    args: {backend: BackendWasm,
             inputs: SoftmaxInputs, attrs: SoftmaxAttrs}):
    TensorInfo {
  const {backend, inputs: {logits}, attrs: {dim}} = args;
  const xId = backend.dataIdMap.get(logits.dataId).id;
  const out = backend.makeOutput(logits.shape, logits.dtype);
  const outId = backend.dataIdMap.get(out.dataId).id;

  const channels = logits.shape[dim];
  const batch = util.sizeFromShape(logits.shape) / channels;

  // Short-circuit zero-sized tensors.
  if (util.sizeFromShape(out.shape) === 0) {
    return out;
  }

  wasmFunc(xId, outId, channels, batch);
  return out;
}

export const softmaxConfig: KernelConfig = {
  kernelName: Softmax,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: softmax as {} as KernelFunc
};

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 *
 *=============================================================================
 */

import {backend_util, KernelConfig, KernelFunc, ReshapeAttrs, ReshapeInputs, SpaceToBatchND, SpaceToBatchNDInputs, TensorInfo, TransposeAttrs, TransposeInputs, util} from '@tensorflow/tfjs-core';

import {padV2Config} from './PadV2';
import {reshape} from './Reshape';
import {transpose} from './Transpose';

function spaceToBatchND(args: {
  inputs: SpaceToBatchNDInputs,
  backend: BackendWasm,
  attrs: SpaceToBatchNDAttrs
}) {
  const {inputs, backend, attrs} = args;
  const {x} = inputs;
  const {blockShape, paddings} = attrs;
  const batch = util.sizeFromShape(logits.shape) / channels;

  if (util.sizeFromShape(out.shape) === 0) {
    return out;
  }

  wasmFunc(xId, outId, channels, batch);
  return out;
}

export const spaceToBatchNDConfig: KernelConfig = {
  kernelName: SpaceToBatchND,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: softmax as {} as KernelFunc
};
```
padV2Config.kernelFunc({
  inputs: [x],
  backend,
  attrs: {paddings: completePaddings, constantValue: 0}
}) as TensorInfo;
const reshapedPaddedShape = backend_util.getReshaped(paddedX.shape, blockShape, prod, false);
const permutedReshapedPaddedPermutation = backend_util.getPermuted
(reshapedPaddedShape.shape, prod, false);
const flattenedShape =
backend_util.getReshapedPermutated(paddedX.shape, blockShape, prod, false);
const reshapeInputs: ReshapeInputs = {x: paddedX};
const reshapeAttrs: ReshapeAttrs = {shape: reshapedPaddedShape};
const paddedXReshaped =
reshape(inputs: reshapeInputs, backend, attrs: reshapeAttrs);
const transposeInputs = {x: paddedXReshaped};
const transposeAttrs: TransposeAttrs = {perm:
permutedReshapedPaddedPermutation};
const paddedXT =
transpose(inputs: transposeInputs, backend, attrs: transposeAttrs);
const resultReshapeInputs: ReshapeInputs = {x: paddedXT};
const resultReshapeAttrs: ReshapeAttrs = {shape: flattenedShape};
const result = reshape(inputs: resultReshapeInputs, backend, attrs: resultReshapeAttrs);
backend.disposeData(paddedX.dataId);
backend.disposeData(paddedXReshaped.dataId);
backend.disposeData(paddedXT.dataId);
return result;
}

export const spaceToBatchNDConfig: KernelConfig = {
  kernelName: SpaceToBatchND,
  backendName: 'wasm',
  kernelFunc: spaceToBatchND as {} as KernelFunc
};

import {KernelConfig, Sqrt} from '@tensorflow/tfjs-core';
import {createUnaryKernelConfig} from './unary_kernel';
export const sqrtConfig: KernelConfig = createUnaryKernelConfig(Sqrt);

import {KernelConfig, Sqrt} from '@tensorflow/tfjs-core';
import {createUnaryKernelConfig} from './unary_kernel';
export const sqrtConfig: KernelConfig = createUnaryKernelConfig(Sqrt);

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*
=============================================================================

=============================================================================
import {KernelConfig, Square} from '@tensorflow/tfjs-core';

export const squareConfig: KernelConfig = createUnaryKernelConfig(Square);

import {KernelConfig, SquaredDifference} from '@tensorflow/tfjs-core';

export const squaredDifferenceConfig: KernelConfig = createBinaryKernelConfig(SquaredDifference, supportsFullBroadcast);

function setup(backend: BackendWasm): void {
  wasmStep = backend.wasm.cwrap(Step, null /*void*/, [
    'number',  // x_id
    'number',  // alpha
    'number',  // dtype
    'number',  // out_id
  ]);}

export function stridedSlice(args: {
  backend: BackendWasm,
  inputs: StridedSliceInputs,
  attrs: StridedSliceAttrs
}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {x} = inputs;

  const {
    begin,
    end,
    strides,
    beginMask,
    endMask,
    ellipsisMask,
    newAxisMask,
    shrinkAxisMask
  } = attrs;

  wasmStridedSlice(xId: number, beginBytes: Uint8Array, endBytes: Uint8Array, stridesBytes: Uint8Array, outShapeBytes: Uint8Array, outShapeLength: number, outId: number) =>
      void;

function stridedSlice(args: {
  backend: BackendWasm,
  inputs: StridedSliceInputs,
  attrs: StridedSliceAttrs
}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {x} = inputs;

  const {
    begin,
    end,
    strides,
    beginMask,
    endMask,
    ellipsisMask,
    newAxisMask,
    shrinkAxisMask
  } = attrs;

  wasmStridedSlice(xId: number, beginBytes: Uint8Array, endBytes: Uint8Array, stridesBytes: Uint8Array, outShapeBytes: Uint8Array, outShapeLength: number, outId: number) =>
      void;

function stridedSlice(args: {
  backend: BackendWasm,
  inputs: StridedSliceInputs,
  attrs: StridedSliceAttrs
}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {x} = inputs;

  const {
    begin,
    end,
    strides,
    beginMask,
    endMask,
    ellipsisMask,
    newAxisMask,
    shrinkAxisMask
  } = attrs;

  wasmStridedSlice(xId: number, beginBytes: Uint8Array, endBytes: Uint8Array, stridesBytes: Uint8Array, outShapeBytes: Uint8Array, outShapeLength: number, outId: number) =>
      void;

function stridedSlice(args: {
  backend: BackendWasm,
  inputs: StridedSliceInputs,
  attrs: StridedSliceAttrs
}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {x} = inputs;

  const {
    begin,
    end,
    strides,
    beginMask,
    endMask,
    ellipsisMask,
    newAxisMask,
    shrinkAxisMask
  } = attrs;

  wasmStridedSlice(xId: number, beginBytes: Uint8Array, endBytes: Uint8Array, stridesBytes: Uint8Array, outShapeBytes: Uint8Array, outShapeLength: number, outId: number) =>
      void;

  return out;
}

function setup(backend: BackendWasm): void {
  wasmStep = backend.wasm.cwrap(Step, null /*void*/, [
    'number',  // x_id
    'number',  // alpha
    'number',  // dtype
    'number',  // out_id
  ]);}

export function stridedSlice(args: {
  backend: BackendWasm,
  inputs: StridedSliceInputs,
  attrs: StridedSliceAttrs
}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {x} = inputs;

  const {
    begin,
    end,
    strides,
    beginMask,
    endMask,
    ellipsisMask,
    newAxisMask,
    shrinkAxisMask
  } = attrs;

  wasmStridedSlice(xId: number, beginBytes: Uint8Array, endBytes: Uint8Array, stridesBytes: Uint8Array, outShapeBytes: Uint8Array, outShapeLength: number, outId: number) =>
      void;

  return out;
}

const {backend, wasm: wasmStep} = import('@tensorflow/tfjs-wasm-core');

export const squareConfig: KernelConfig = createUnaryKernelConfig(Square);

import {KernelConfig, SquaredDifference} from '@tensorflow/tfjs-core';

export const squaredDifferenceConfig: KernelConfig = createBinaryKernelConfig(SquaredDifference, supportsFullBroadcast);

function setup(backend: BackendWasm): void {
  wasmStep = backend.wasm.cwrap(Step, null /*void*/, [
    'number',  // x_id
    'number',  // alpha
    'number',  // dtype
    'number',  // out_id
  ]);}

export function stridedSlice(args: {
  backend: BackendWasm,
  inputs: StridedSliceInputs,
  attrs: StridedSliceAttrs
}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {x} = inputs;

  const {
    begin,
    end,
    strides,
    beginMask,
    endMask,
    ellipsisMask,
    newAxisMask,
    shrinkAxisMask
  } = attrs;

  wasmStridedSlice(xId: number, beginBytes: Uint8Array, endBytes: Uint8Array, stridesBytes: Uint8Array, outShapeBytes: Uint8Array, outShapeLength: number, outId: number) =>
      void;

  return out;
}

function setup(backend: BackendWasm): void {
  wasmStep = backend.wasm.cwrap(Step, null /*void*/, [
    'number',  // x_id
    'number',  // alpha
    'number',  // dtype
    'number',  // out_id
  ]);}

export function stridedSlice(args: {
  backend: BackendWasm,
  inputs: StridedSliceInputs,
  attrs: StridedSliceAttrs
}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {x} = inputs;

  const {
    begin,
    end,
    strides,
    beginMask,
    endMask,
    ellipsisMask,
    newAxisMask,
    shrinkAxisMask
  } = attrs;

  wasmStridedSlice(xId: number, beginBytes: Uint8Array, endBytes: Uint8Array, stridesBytes: Uint8Array, outShapeBytes: Uint8Array, outShapeLength: number, outId: number) =>
      void;

  return out;
}

function setup(backend: BackendWasm): void {
  wasmStep = backend.wasm.cwrap(Step, null /*void*/, [
    'number',  // x_id
    'number',  // alpha
    'number',  // dtype
    'number',  // out_id
  ]);}

export function stridedSlice(args: {
  backend: BackendWasm,
  inputs: StridedSliceInputs,
  attrs: StridedSliceAttrs
}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {x} = inputs;

  const {
    begin,
    end,
    strides,
    beginMask,
    endMask,
    ellipsisMask,
    newAxisMask,
    shrinkAxisMask
  } = attrs;

  wasmStridedSlice(xId: number, beginBytes: Uint8Array, endBytes: Uint8Array, stridesBytes: Uint8Array, outShapeBytes: Uint8Array, outShapeLength: number, outId: number) =>
      void;

  return out;
}
sliceDim0,

let result;

if (isIdentity) {
  // Optimization #1, slice is a no-op plus reshape
  result = reshape({inputs: [x], backend, attrs: [shape: finalShape]});
} else if (sliceDim0 || isSimpleSlice) {
  // Optimization #2, slice is memory contiguous (only occurs in dim 0) util.assert(x.shape.length >= 1, () => "Input must have rank at least 1, got: ${x.shape.length}");
  const size = slice_util.computeOutShape($begin, $end, $strides);
  // To tolerate begin[0] > end[0] (a 0-output slice), we min(begin, end).
  const sliced = slice({inputs: [x], backend, attrs: [begin: $begin, size: $size]});
  result = reshape({inputs: [x: sliced], backend, attrs: [shape: finalShape]});
  backend.disposeData(sliced.dataId);
} else {
  const out = backend.makeOutput(finalShapeSparse, 'float32');
  const xId = backend.dataIdMap.get(x.dataId).id;
  const xStridesBytes = new Uint8Array(new Int32Array(x.shape).buffer);
  const beginBytes = new Uint8Array(new Int32Array($begin).buffer);
  const endBytes = new Uint8Array(new Int32Array($end).buffer);
  const stridesBytes = new Uint8Array(new Int32Array($strides).buffer);
  const outputShapeBytes = new Uint8Array(new Int32Array(finalShapeSparse).buffer);
  const outId = backend.dataIdMap.get(out.dataId).id;
  wasmStridedSlice(xId, xStridesBytes, x.shape.length, beginBytes, endBytes, stridesBytes, outputShapeBytes, outId);
  result = reshape({inputs: [x: out], backend, attrs: [shape: finalShape]});
  backend.disposeData(out.dataId);
}

return result;

export const stridedSliceConfig: KernelConfig = {
  kernelName: StridedSlice,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: stridedSlice as {} as KernelFunc
};

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 *
 *=============================================================================
 */

import {KernelConfig, Sub} from '@tensorflow/tfjs-core';
import {createBinaryKernelConfig} from './binary_kernel';
import {backend_util, KernelConfig, KernelFunc, Sum, SumAttrs, SumInputs, TensorInfo, util} from '@tensorflow/tfjs-core';
import {CppDType} from './types';

let wasmSum: (xId: number, reduceSize: number, dtype: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmSum = backend.wasm.cwrap(Sum, null /*void*/, [
    'number',  // input_id
    'number',  // reduce_size
    'number',  // dtype
    'number',  // out_id
  ]);}

function sum(args: {backend: BackendWasm, inputs: SumInputs, attrs: SumAttrs}):
    TensorInfo {
  const {backend, inputs, attrs} = args;
  const {axis, keepDims} = attrs;
  const {x} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  let inputId = xId;
  let input = x;
  const {transposed, axes, originalAxes, inWasTransposed} =
    permuteAxesAndTranspose(x, axis, backend);
  let reductionAxes = axes;
  if (inWasTransposed) {
    const transposedId = backend.dataIdMap.get(transposed.dataId).id;
    if (transposedId !== xId) {
      // transpose was necessary, so transposedId will
      // be the new inputId
      inputId = transposedId;
      input = transposed;
    }
  }
  const outputId = backend.dataIdMap.get(out.dataId).id;
  const outputAxes = axes;
  const outputKeepDims = keepDims;
  const outputAxesIds = new Int32Array(outputAxes.length);
  const outputKeepDimsIds = new Int32Array(outputKeepDims.length);
  for (let i = 0; i < outputAxes.length; i++) {
    outputAxesIds[i] = backend.dataIdMap.get(outputAxes[i]).id;
    outputKeepDimsIds[i] = outputKeepDims[i] ? 0 : -1;
  }
  const outputAxesSize = backend.getAxesSize(outputAxes.length);
  const outputKeepDimsSize = backend.getAxesSize(outputKeepDims.length);
  const sumAxesSize = backend.getAxesSize(axis.length);
  const sumAxesIds = new Int32Array(sumAxesSize);
  const sumAxesSizeId = backend.dataIdMap.get(sumAxesSize).id;
  const inputAxesSizeId = backend.dataIdMap.get(inputAxesSize).id;
  const outputAxesSizeId = backend.dataIdMap.get(outputAxesSize).id;
  const sumAxes = backend.makeAxes(sumAxesSizeId, CppDType.INT32);
  const inputAxes = backend.makeAxes(inputAxesSizeId, CppDType.INT32);
  const outputAxes = backend.makeAxes(outputAxesSizeId, CppDType.INT32);
  const axisIds = new Int32Array(axis.length);
  const inAxesSize = backend.getAxesSize(axis.length);
  const inAxesIds = new Int32Array(inAxesSize);
  const inputAxesIds = new Int32Array(inputAxes.length);
  const outputAxesIds = new Int32Array(outputAxes.length);
  const axisIdsData = new Uint8Array(new Int32Array(axisIds).buffer);
  const inputAxesIdsData = new Uint8Array(new Int32Array(inputAxesIds).buffer);
  const outputAxesIdsData = new Uint8Array(new Int32Array(outputAxesIds).buffer);
  const outputAxesSizeData = new Uint8Array(new Int32Array(outputAxesSize).buffer);
  const inputAxesSizeData = new Uint8Array(new Int32Array(inputAxesSize).buffer);
  const outputAxesSizeData = new Uint8Array(new Int32Array(outputAxesSize).buffer);
  const outputAxesSizeIdsData = new Uint8Array(new Int32Array(outputAxesSizeIds).buffer);
  const inputAxesSizeIdsData = new Uint8Array(new Int32Array(inputAxesSizeIds).buffer);
  const outputAxesSizeIdsData = new Uint8Array(new Int32Array(outputAxesSizeIds).buffer);
  const outputAxesSizeIdsIdsData = new Uint8Array(new Int32Array(outputAxesSizeIdsIds).buffer);

  // setup Axes and AxesSize
  backend.disposeData(xId);
  backend.disposeData(transposedId);
  // setup AxesIds
  for (let i = 0; i < axis.length; i++) {
    const axisId = backend.dataIdMap.get(outputAxes[i]).id;
    assert(backend.getAxesSize(outputAxes.length) !== -1, () => "Output Axes Size not set");
    assert(backend.getAxesSize(outputAxes.length) !== -1, () => "Output Axes Size not set");
    const axisIdData = new Uint8Array(new Int32Array(axisId).buffer);
    backend.disposeData(axisId);
    backend.disposeData(axisIdData);
    axisIdsData[i] = axisId;
    inputAxesIds[i] = inputAxesIdsData[i];
    outputAxesIds[i] = outputAxesIdsData[i];
    outputAxesSizeIds[i] = outputAxesSizeIdsData[i];
    outputAxesSizeIdsIds[i] = outputAxesSizeIdsIdsData[i];

    // Setup AxesSize and AxesSizeId
    backend.disposeData(axisIds[i]);
    const axisSizeIdId = backend.dataIdMap.get(axisSizeId).id;
    const axisSizeIdData = new Uint8Array(new Int32Array(axisSizeIdId).buffer);
    backend.disposeData(axisSizeId);
    backend.disposeData(axisSizeIdData);
    inputAxesSizeData = new Uint8Array(new Int32Array(axisSizeData).buffer);
    outputAxesSizeData = new Uint8Array(new Int32Array(axisSizeData).buffer);

    // Setup SumAxes
    const sumAxesId = backend.dataIdMap.get(sumAxesSizeId).id;
    const sumAxesIdData = new Uint8Array(new Int32Array(sumAxesId).buffer);
    backend.disposeData(sumAxesSizeId);
    backend.disposeData(sumAxes);
    backend.disposeData(sumAxesId);

    // Setup inputAxes
    const inputAxesId = backend.dataIdMap.get(inputAxesSizeId).id;
    const inputAxesIdsId = backend.dataIdMap.get(inputAxesSizeIdsId).id;
    const inputAxesIdsData = new Uint8Array(new Int32Array(inputAxesIdsId).buffer);
    backend.disposeData(inputAxesSizeId);
    backend.disposeData(inputAxesId);
    backend.disposeData(inputAxes);
    backend.disposeData(inputAxesIdsData);

    // Setup outputAxes
    const outputAxesId = backend.dataIdMap.get(outputAxesSizeId).id;
    const outputAxesIdsId = backend.dataIdMap.get(outputAxesSizeIdsId).id;
    const outputAxesIdsData = new Uint8Array(new Int32Array(outputAxesIdsId).buffer);
    backend.disposeData(outputAxesSizeId);
    backend.disposeData(outputAxesId);
    backend.disposeData(outputAxes);
    backend.disposeData(outputAxesIdsData);

    // Setup inputAxesSize
    const inputAxesSizeId = backend.dataIdMap.get(inputAxesSizeData).id;
    const inputAxesSizeIdsId = backend.dataIdMap.get(inputAxesSizeIdsIdsData).id;
    const inputAxesSizeIdsData = new Uint8Array(new Int32Array(inputAxesSizeIdsIdsData).buffer);
    backend.disposeData(inputAxesSizeData);
    backend.disposeData(inputAxesSizeId);
    backend.disposeData(inputAxes);
not a no-op. We will need to dispose of this\n  once we are done.\n\n  input = transposed:\n  inputId = transposedId:\n  reductionAxes = backend_util.getInnerMostAxes(input.shape.length,\n      reductionAxes.length):\n  newAxes = tensorFlowreduceAxesAreInnerMostDims(sum, reductionAxes,\n      input.shape.length):\n  const [outShape, reduceShape] =\n  backend_util.computeOutAndReduceShapes(input.shape, reductionAxes):\n  const reduceSize =\n      util.sizeFromShape(reduceShape):\n  const out = backend.makeOutput(outShape, input.dtype):\n  if (util.sizeFromShape(input.shape) !== 0) {
    const outId = backend.dataIdMap.get(out.dataId).id:  \n    wasmSum(inputId, reduceSize, CppDType[out.dtype], outId):\n  }\n
  if (inputWasTransposed) {
    // dispose of the transposed tensor.\n    backend.disposeData(transposed.dataId):\n  }\n
  if (keepDims) {
    // reshape\n    const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes):\n    out.shape = newShape:\n  }\n\n  return out;\n\nexport const sumConfig: KernelConfig = {
  kernelName: Sum,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: sum as {} as KernelFunc\n};
backend.makeOutput(newShape, x.dtype);}

const outId = backend.dataIdMap.get(out.dataId).id;

wasmTile(
    xId, xShapeBytes, x.shape.length, newShapeBytes, newShape.length,
    CppDType[out.dtype], outId);

return out;

export const tileConfig: KernelConfig = {
    kernelName: Tile,
    backendName: 'wasm',
    setupFunc: setup,
    kernelFunc: tile as {} as KernelFunc
};

export const tileConfig: KernelConfig = {
    kernelName: Tile,
    backendName: 'wasm',
    setupFunc: setup,
    kernelFunc: tile as {} as KernelFunc
};

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 */

import {KernelConfig, KernelFunc, TensorInfo, TopK, TopKAttrs, TopKInputs} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';
import {CppDType} from './types';

let wasmTopK:
    (xId: number, xShapeBytes: Uint8Array, xShapeLength: number,
     xDtype: CppDType, k: number, sorted: boolean, outValuesId: number,
     outIndicesId: number) => void;

function setup(backend: BackendWasm) {
    wasmTopK = backend.wasm.cwrap(TopK, null /* void */, 
    [ 'number',  // xId
    'array',   // x.shape
    'number',  // x.shape.length
    'number',  // x.dtype
    'number',  // k
    'bool',    // sorted
    'number',  // outValuesId
    'number'   // outIndicesId
  ]);}

export const topk:
    (args: {inputs: TopKInputs, backend: BackendWasm,
     attrs: TopKAttrs}) =>
        TensorInfo[] | TensorInfo = ({inputs, backend, attrs}) => {
          const {x} = inputs;
          const {k, sorted} = attrs;

          const xId = backend.dataIdMap.get(x.dataId).id;
          const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);
          const outputShape = x.shape.slice();
          outputShape[outputShape.length - 1] = k;
          const outValues = backend.makeOutput(outputShape, x.dtype);
          const outValuesId = backend.dataIdMap.get(outValues.dataId).id;
          const outIndices = backend.makeOutput(outputShape, 'int32');
          const outIndicesId = backend.dataIdMap.get(outIndices.dataId).id;

          wasmTopK(xId, xShapeBytes, x.shape.length,
                 CppDType[x.dtype], k, sorted, outValuesId, outIndicesId);

          return [outValues, outIndices];
        }

export const topKConfig: KernelConfig = {
    kernelName: TopK,
    backendName: 'wasm',
    setupFunc: setup,
    kernelFunc: topk as {} as KernelFunc,
};

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 * limitations under the License.
 */

import {KernelConfig, KernelFunc, TensorInfo, Transform, TransformAttrs, TransformInputs, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmTransform: (
    imageId: number, transformsId: number, isBatchTransform: boolean,
    batch: number, outHeight: number, outWidth: number,
    numChannels: number, imageWidth: number, imageHeight: number,
    strides: Uint8Array, stridesLength: number, interpolationModelId: number, fillModelId: number,
    fillValue: number, outId: number) => void;

function setup(backend: BackendWasm): void {
    wasmTransform = backend.wasm.cwrap(Transform, null /* void */,
    [ 'number',  // imageId
    'number',  // transformsId
    'bool',    // isBatchTransform
    'number',  // batch
    'number',  // outHeight
    'number',  // outWidth
    'number',  // numChannels
    'number',  // imageWidth
    'number',  // imageHeight
    'array',   // strides
    'number',  // stridesLength
    'number',  // interpolationModelId
    'number',  // fillModelId
    'number',  // fillValue
    'number',  // outId
  ]);}

function transform(args: 
    {backend: BackendWasm, inputs: TransformInputs, attrs: TransformAttrs}) =>
        TensorInfo = (args) => {
          const {backend, inputs, attrs} = args;

          const {image, transforms} = inputs;

          const {interpolation, fillMode, fillValue, outputShape} = attrs;

          const imageId = inputs.imageId;
          const transformsId = inputs.transformsId;
          const isBatchTransform = inputs.isBatchTransform;

          const batch = inputs.batch;
          const outHeight = inputs.outHeight;
          const outWidth = inputs.outWidth;
          const numChannels = inputs.numChannels;
          const imageWidth = inputs.imageWidth;
          const imageHeight = inputs.imageHeight;
          const strides = inputs.strides;
          const interpolationModelId = inputs.interpolationModelId;
          const fillModelId = inputs.fillModelId;
          const fillValue = inputs.fillValue;
          const outId = inputs.outId;
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the License.

We explicitly import the modular kernels so they get registered in the global registry when we compile the
library. A modular build would replace all the contents of this file and import only the kernels that are
needed.

import {KernelConfig, registerKernel} from '@tensorflow/tfjs-core';

import {fusedMatMulConfig} from './kernels/_FusedMatMul';
import {absConfig} from './kernels/Abs';
import {addConfig} from './kernels/Add';
import {addNConfig} from './kernels/AddN';
import {argMaxConfig} from './kernels/ArgMax';
import {avgPoolConfig} from './kernels/AvgPool';
import {batchMatMulConfig} from './kernels/BatchMatMul';
import {batchToSpaceNDConfig} from './kernels/BatchToSpaceND';
import {castConfig} from './kernels/Cast';
import {ceilConfig} from './kernels/Ceil';
import {clipByValueConfig} from './kernels/ClipByValue';
import {concatConfig} from './kernels/Concat';
import {conv2DConfig} from './kernels/Conv2D';
import {conv2DBackpropInputConfig} from './kernels/Conv2DBackpropInput';
import {cosConfig} from './kernels/Cos';
import {coshConfig} from './kernels/Cosh';
import {cropAndResizeConfig} from './kernels/CropAndResize';
import {cumsumConfig} from './kernels/Cumsum';
import {depthToSpaceConfig} from './kernels/DepthToSpace';
import {depthwiseConv2DNativeConfig} from './kernels/DepthwiseConv2DNative';
import {eluConfig} from './kernels/Elu';
import {expConfig} from './kernels/Exp';
import {flipLeftRightConfig} from './kernels/FlipLeftRight';
import {floorConfig} from './kernels/Floor';
import {floorDivConfig} from './kernels/FloorDiv';
import {fusedBatchNormConfig} from './kernels/FusedBatchNorm';
import {fusedConv2DConfig} from './kernels/FusedConv2D';
import {fusedDepthwiseConv2DConfig} from './kernels/FusedDepthwiseConv2D';
import {gatherNdConfig} from './kernels/GatherNd';
import {gatherV2Config} from './kernels/GatherV2';
import {greaterConfig} from './kernels/Greater';
import {greaterEqualConfig} from './kernels/GreaterEqual';
import {identityConfig} from './kernels/Identity';
import {leakyReluConfig} from './kernels/LeakyRelu';
import {lessConfig} from './kernels/Less';
import {lessEqualConfig} from './kernels/LessEqual';
import {logConfig} from './kernels/Log';
import {logicalAndConfig} from './kernels/LogicalAnd';
import {maxConfig} from './kernels/Max';
import {maximumConfig} from './kernels/Maximum';
import {meanConfig} from './kernels/Mean';
import {minConfig} from './kernels/Min';
import {mirrorPadConfig} from './kernels/MirrorPad';
import {multiplyConfig} from './kernels/Multiply';
import {negConfig} from './kernels/Neg';
import {nonMaxSuppressionV3Config} from './kernels/NonMaxSuppressionV3';
import {nonMaxSuppressionV4Config} from './kernels/NonMaxSuppressionV4';
import {nonMaxSuppressionV5Config} from './kernels/NonMaxSuppressionV5';
import {notEqualConfig} from './kernels/NotEqual';
import {onesLikeConfig} from './kernels/OnesLike';
import {packConfig} from './kernels/Pack';
import {padV2Config} from './kernels/PadV2';
import {powConfig} from './kernels/Pow';
import {preluConfig} from './kernels/Prelu';
import {prodConfig} from './kernels/Prod';
import {rangeConfig} from './kernels/Range';
import {realDivConfig} from './kernels/RealDiv';
import {reluConfig} from './kernels/Relu';
import {relu6Config} from './kernels/Relu6';
import {reshapeConfig} from './kernels/Reshape';
import {resizeBilinearConfig} from './kernels/ResizeBilinear';
import {reverseConfig} from './kernels/Reverse';
import {rotateWithOffsetConfig} from './kernels/RotateWithOffset';
import {roundConfig} from './kernels/Round';
import {rsqrtConfig} from './kernels/Rsqrt';
import {scatterNdConfig} from './kernels/ScatterNd';
import {selectConfig} from './kernels/Select';
import {sigmoidConfig} from './kernels/Sigmoid';
import * as tf from '@tensorflow/tfjs-core';

const ENV = env();

/**
 * True if SIMD is supported.
 */
env.registerFlag('WASM_HAS_SIMD_SUPPORT', async () => {
  // WebAssembly.validate returns true if the input is
  // a valid WebAssembly program.
  return WebAssembly.validate(tf.buffer('let x = 1; print(x);')).module.toArray().slice().length > 0;
});

/**
 * True if threads are supported.
 */
env.registerFlag('WASM_HAS_MULTITHREAD_SUPPORT', async () => {
  // WebAssembly.validate returns true if the input is
  // a valid WebAssembly program.
  return WebAssembly.validate(tf.buffer('let x = 1; print(x);')).module.toArray().slice().length > 0;
});

const kernels = require('./kernels');

for (const kernelConfig of kernels.KernelConfig) {
  registerKernel(kernelConfig);
}
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++]=u0;}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++]=128|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"];if(INITIAL_MEMORY){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)throw Error("bad memory")}if(wasmMemory.buffer instanceof SharedArrayBuffer){err("requested a shared WebAssembly Memory but the browser only has WASM memory")}}

if(!ENVIRONMENT_IS_PTHREAD)__ATPRERUN__.push({func:function(){___wasm_call_ctors()}});var runtimeInitialized=false;var runtimeExited=false;if(!ENVIRONMENT_IS_PTHREAD){__ATINIT__.push({func:function(){}});var __ATEXIT__.push({func:function(){}});var __ATPOSTRUN__.push({func:function(){}});var __ATPRERUN__.push({func:function(){}});var preRun(){if(ENVIRONMENT_IS_PTHREAD)return;Module["preRun"]}}

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instantiateArrayBuffer(receiver) { return getBinaryPromise().then(function(binary) {
  WebAssembly.instantiate(binary, info) } ).then(receiver, function(reason) {
    err("failed to asynchronously prepare wasm: "+ reason); abort(reason) });
}

WebAssembly.instantiateStreaming = function() {
  var fallback = instantiateArrayBuffer;
  var exports = Module['instawasm'](info, function(result) {
    receiveInstantiatedSource(result, function(reason) {
      err("failed to asynchronously prepare 
      wasm: "+ reason); abort(reason)
    });
  })
  return exports;}

killThread = function(ptr) {
  if (ptr) { return; }
  ptr = ThreadData(ptr);
  if (ptr) { return; }
  ptr = ThreadData(ptr); return;
}

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";
}

ERRNO_CODES = [0x43, 0x44, 0x45, 0x46, 0x47, 0x48, 0x49, 0x4a, 0x4b, 0x4c, 0x4d, 0x4e, 0x4f, 0x50, 0x51, 0x52, 0x53, 0x54, 0x55, 0x56, 0x57, 0x58, 0x59, 0x5a, 0x5b, 0x5c, 0x5d, 0x5e, 0x5f, 0x60, 0x61, 0x62, 0x63, 0x64, 0x65, 0x66, 0x67, 0x68, 0x69, 0x6a, 0x6b, 0x6c, 0x6d, 0x6e, 0x6f, 0x70, 0x71, 0x72, 0x73, 0x74, 0x75, 0x76, 0x77, 0x78, 0x79, 0x7a, 0x7b, 0x7c, 0x7d, 0x7e];

function _emscripten_futex_wake(addr, count) {
  if (addr <= 0 || addr > GROWABLE_HEAP_I8().length || addr & 3 != 0 || count < 0) return;
}

mainThreadWaitAddress = Atomics.load(GROWABLE_HEAP_I32(), __emscripten_main_thread_futex >> 2);
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";

worker(pthread&&pthreads.workers);if(!worker){return worker.postMessage({"cmd":"processThreadQueue"})}return 1}function _abort(){abort()}function _emscripten_asm_const_int(code,sigPtr,argument){var args=readAsmConstArgs(sigPtr,argument);return ASM_CONSTS[code].apply(null,arguments)}function _emscripten_conditional_set_current_thread_status(expectedStatus,newStatus){}function _emscripten_futex_wait(addr,val,timeout){if(addr<=0||addr>GROWABLE_HEAP_U16().length||addr&3!=0)return-28;if(!ENVIRONMENT_IS_WEB){var ret=Atomics.wait(GROWABLE_HEAP_U16(),addr>>2,val,timeout);if(ret==="timed-out"||ret==="not-equal")return-6;if(ret==="ok")return 0;throw"Atomics.wait returned an unexpected value \""+ret}else{if(Atomics.load(GROWABLE_HEAP_U16(),addr>>2)!=val){return-6}var tNow=performance.now();var tEnd=tNow+timeout;var lastAddr=Atoms.exchange(GROWABLE_HEAP_U16(),__emscripten_main_thread_futex>>2,addr);while(1){tNow=performance.now();if(tNow>tEnd){lastAddr=Atoms.exchange(GROWABLE_HEAP_U16(),__emscripten_main_thread_futex>>2,0);return-73}else{if(Atoms.load(GROWABLE_HEAP_U16(),addr>>2)!=val){return-6}lastAddr=Atoms.exchange(GROWABLE_HEAP_U16(),__emscripten_main_thread_futex>>2,0);lastAddr=Atoms.exchange(GROWABLE_HEAP_U16(),__emscripten_main_thread_futex>>2,0);if(lastAddr==0){break}}}}}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 isEmAsmConst=index<0;var func=!isEmAsmConst?proxiedFunctionTable[index]:ASM_CONSTS[-index-1];var ret=_emscripten_run_in_main_runtime_thread_js(index,serializedNumCallArgs,args,sync)}function _emscripten_get_heap_size(){return GROWABLE_HEAP_U8().length}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.eventHandlers[i].removeListener();}}}
getCanvas?UTF8ToString(targetCanvas):"\";_emsprpit_set_offscreenCanvas_size_on_target_thread_js(targetThread,targetCanva
s,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[1]==0&&prevViewport[2]==0&&prevViewport[3]==canvas.width&&prevViewport[4]==canvas.height}canvas.width=width;canvas.height=height;if(autoResizeViewport){canvas.GLctxObject.GLctx.viewport(0,0,canvas.width,canvas.height)}}else if(canvas.canvasSharedPtr){var targetThread=GROWABLE_HEAP_I32()[canvas.canvasSharedPtr+8>>2];_emsprpit_set_offscreenCanvas_size_on_target_thread(target,width,height)}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)};}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){ext["isVertexArrayOES"](vao)};return 1}function __webgl_enable_WEBGL_draw_buffers(ctx){return!!(ctx.multiDrawWebgl=ctx.getExtension("WEBGL_multi_draw"))}var
GL={counter:1,buffers:[],programs:[],framebuffers:[],renderbuffers:[],textures:[],uniforms:[],shaders:[],vaos:[],context:
soffscreenCanvases:[],timerQueriesEXT:[],programInfos:[],stringCache:[],unpackAlignment:4,recordError:function recordError(errorCode){if(GL.lastError)GL.lastError=errorCode},getNewId:function(table){var
re=GL.counter++;for(var i=table.length;i<=i+1){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]:-
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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=GROWABLE_HEAP_I32()[ptr];return UTF8ToString(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)!=0;num{return 0}function _pthread_cleanup_pop(execute){var routine=PThread.threadExitHandlers.pop();if(execute)routu
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 asmLibraryArgs={"e":assert_fail,"r":call_main,"x":emscripten_notify_thread_queue,"b":abort,"y":
emscripten_asm_const_int,"v":emscripten_conditional_set_current_thread_status,"d":emscripten_futex_wait,
"c":emscripten_futex_wake,"f":emscripten_get_now,"p":emscripten_mempcpy_big,"A":emscripten_num_logical_cores,"o":
emscripten_receive_on_main_thread_js,"q":emscripten_resize_heap,"v":emscripten_set_canvas_element_size,"i":
emscripten_set_current_thread_status,"w":emscripten_set_thread_name,"w":emscripten_webgl_create_context,"R":
fd_close,"m":fd_seek,"g":fd_write,"o":initPthreadsJS,"v":wasmMemory[Module["wasmMemory"]],"z":pthread_cleanup_pop,
"k":pthread_cleanup_push,"h":pthread_create,"m":pthread_join,"v":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"]=null, arguments)};
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+"\n\n\ne.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).Val
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
}
function stringToUTF8Array(str, heap, outIdx, maxBytesToWrite) {
    if (!(maxBytesToWrite > 0)) return 0;
    var startIdx = outIdx;
    var u = str.charCodeAt(0);
    if (u <= 0x7F) {
        heap[outIdx++] = u;
    } else if (u <= 0x7ff) {
        heap[outIdx++] = 0xC0 | (u >> 6);
        heap[outIdx++] = 0x80 | (u & 0x3f);
    } else if (u <= 0xffff) {
        heap[outIdx++] = 0xE0 | (u >> 12);
        heap[outIdx++] = 0x80 | (u >> 6 & 0x3f);
        heap[outIdx++] = 0x80 | (u & 0x3f);
    } else {
        heap[outIdx++] = 0xf0 | (u >> 18);
        heap[outIdx++] = 0x80 | (u >> 12 & 0x3f);
        heap[outIdx++] = 0x80 | (u >> 6 & 0x3f);
        heap[outIdx++] = 0x80 | (u & 0x3f);
    }
    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] != undefined) {
            a
        }
    }
}

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] != undefined) {
            a
        }
    }
}

function addRunDependency(id) {
    if (id in runDependencies++ > 0) {
        Module["monitorRunDependencies"] = Module["monitorRunDependencies"] || 0;
        Module["monitorRunDependencies"] = Module["monitorRunDependencies"] + 1;
    }
}

function removeRunDependency(id) {
    if (id in runDependencies-- > 0) {
        Module["monitorRunDependencies"] = Module["monitorRunDependencies"] - 1;
    }
}

var wasmBinaryFile = "tfjs-backend-wasm.wasm";

if (!isDataURI(wasmBinaryFile)) {
    wasmBinaryFile = locateFile(wasmBinaryFile);
    var getBinary = tryGetWebAssemblyBinaryFile;
    var wasmBinaryFile = new WebAssembly.Module(wasmBinaryFile);
}

var preloadedImages = { }
var preloadedAudios = { }

function abort(what) {
    abort(what)
}

function isDataURI(filename) {
    return hasPrefix(filename, dataURIPrefix); 
}

function isFileURI(filename) {
    return hasPrefix(filename, fileURIPrefix); 
}

function dataURIprefix(data, application/octet-stream;base64) {
    return dataURIprefix("data:application/octet-stream;base64," + data);
}

function dataURIprefix(filename) {
    return dataURIprefix("file://", filename); 
}

function getBinary(file) { tryGetWebAssemblyBinaryFile(file); 
}

function ini...
wasm failed"}) catch(err) {abort(err)}

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+"\n"} 
return response["arrayBuffer"]() 
.catch(function() 
{return
getBinary(wasmBinaryFile)})})

else if(readAsync)
{return new Promise(resolve, reject) 
{readAsync(wasmBinaryFile,function(response){resolve(new Uint8Array(response))}, reject) 
})

return Promise.resolve().then(function() 
{getBinary(wasmBinaryFile)})
})

function createWasm()
{var info={"a":asmLibraryArg};
function receiveInstance(instance,module)
{var exports=instance.exports;
Module["asm"] = exports;
wasmMemory = Module["asm"]["v"];
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 if(callback.argv===undefined)
{null:callback.argv}
}

var callback() {
{["function"]["c"]};

} function 
{emscripten_memcpy_big(dest,src,num) 
{HEAPU8.copyWithin(dest,src,src+num)
}

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);
if(overGrownHeapSize>=maxHeapSize)
{return false;
for(var
}
}

var newSize=Math.min(maxHeapSize,alignedUp(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.
getFunction()
{SYSCALLS.varargs++; 
ret=HEAP32[SYSCALLS.varargs-2];
return ret;
}

getStr:function(ptr)
{var ret=UTF8ToString(ptr);
return ret;
}

get64:function(low,high)
{return low 
}

function _fd_close(fd) 
{["function"]["c"]

} function 
{fd_seek(fd,offet_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,HEAP8[ptr+j])
}

num+=len;

return num >2]=num;
return 0
}
number[], dtype: DataType): DataId {
    const dataId = {id: this.dataIdNextNumber++};
    this.move(dataId, values, shape, dtype, 1); return dataId;
  }

  async time(f: () => void): Promise<BackendTimingInfo> {
    const start = util.now();
    f();
    const kernelMs = util.now() - start;
    return {kernelMs};
  }

  move(
      dataId: DataId, values: backend_util.BackendValues, shape: number[],
      dtype: DataType, refCount: number): void {
    const id = this.dataIdNextNumber++;
    if (dtype === 'string') {
      const stringBytes = values as Uint8Array[];
      this.dataIdMap.set(
          dataId,
          {id, stringBytes, shape, dtype, memoryOffset: null, refCount});
    } else {
      const size = util.sizeFromShape(shape);
      const numBytes = size * util.bytesPerElement(dtype);
      const memoryOffset = this.wasm._malloc(numBytes);
      this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype, refCount});
      this.wasm.tfjs.registerTensor(id, size,
      memoryOffset);
    }
  }

  readSync(dataId: DataId): backend_util.BackendValues {
    const {memoryOffset,
        shape, stringBytes} = this.dataIdMap.get(dataId);
    if (dtype === 'string') {
      return stringBytes;
    } else {
      const bytes = this.wasm.HEAPU8.slice(
          memoryOffset,
          memoryOffset + util.sizeFromShape(shape) * util.bytesPerElement(dtype));
      return typedArrayFromBuffer(bytes.buffer, dtype);
    }
  }

  disposeData(dataId: DataId, force = false): boolean {
    if (this.dataIdMap.has(dataId)) {
      const data = this.dataIdMap.get(dataId);
      data.refCount--;
      if (!force && data.refCount > 0) {
        return false;
      }
      this.wasm._free(data.memoryOffset);
      this.wasm.tfjs.disposeData(data.id);
      this.dataIdMap.delete(dataId);
    }
    return true;
  }

  typedArrayFromHeap({shape, dtype, dataId}:
      TensorInfo): backend_util.TypedArray {
    const buffer = this.wasm.HEAPU8.buffer;
    const {memoryOffset} = this.dataIdMap.get(dataId);
    const size = util.sizeFromShape(shape);
    switch (dtype) {
      case 'float32':
        return new Float32Array(buffer, memoryOffset, size);
      case 'int32':
        return new Int32Array(buffer, memoryOffset, size);
      case 'bool':
        return new Uint8Array(buffer, memoryOffset, size);
      default:
        throw new Error(`Unknown dtype ${dtype}`);
    }
  }

  getMemoryOffset(dataId: DataId): number {
    return this.dataIdMap.get(dataId).memoryOffset;
  }

  dispose() {
    this.wasm.tfjs.dispose();
    if ('PThread' in this.wasm) {
      this.wasm.PThread.terminateAllThreads();
    }
  }

  /**
   * Make a tensor info for the output of an op. If `memoryOffset` is not
   * present, this method allocates memory on the WASM heap.
   * @param {number} shape - The shape of the tensor.
   * @param {string} dtype - The data type of the tensor.
   * @param {number} memoryOffset - The memory offset of the tensor.
   * @returns {TensorInfo} A tensor info object.
   */
  makeOutput(shape: number[], dtype: DataType, memoryOffset?: number): TensorInfo {
    let dataId: {};
    if (memoryOffset == null) {
      dataId = this.write(null /* values */, shape, dtype);
      } else {
      const id = this.dataIdNextNumber++;
      dataId = {id};
      this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype,
          refCount: 1});
    } return {dataId, shape, dtype, refCount: 1};
  }

  createInstantiateWasmFunc(path: string) {
    // this will be replace by rollup plugin patchWechatWebAssembly in
    // miniprogram's output.
    WebAssembly.instantiateInto(path, imports).then(response => {
      if (response.ok) {
        const binary = response.arrayBuffer();
      } return imports.env.a(`failed to load wasm binary file at '${path}'`);
    });
  }
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```javascript
/**
 * Returns the path of the WASM binary.
 * @param simdSupported whether SIMD is supported
 * @param threadsSupported whether multithreading is supported
 * @param wasmModuleFolder the directory containing the WASM binaries.
 * @returns {string} The path to the WASM binary.
 */
function getPathToWasmBinary(
    simdSupported: boolean, threadsSupported: boolean, wasmModuleFolder: string) {
  if (wasmPath === null) {
    let path = wasmBinaryName = `tfjs-backend-wasm.wasm`;
    if (simdSupported && threadsSupported) {
      path = `tfjs-backend-wasm-threaded-simd.wasm`;
    } else if (simdSupported) {
      path = `tfjs-backend-wasm-simd.wasm`;
    }
    return wasmFileMap[path] || null;
  }

  let path: WasmBinaryName = 'tfjs-backend-wasm.wasm';
  if (simdSupported && threadsSupported) {
    path = 'tfjs-backend-wasm-threaded-simd.wasm';
  } else if (simdSupported) {
    path = 'tfjs-backend-wasm-simd.wasm';
  }
  return wasmFileMap[path] || null || null;
}

/**
 * Returns the path of the WASM binary.
 * @param
 */

/**
 * Initializes the wasm module and creates the js <-> wasm bridge.
 * @returns {Promise<BackendWasmModule>} The initialized wasm module.
 */
export async function init(): Promise<BackendWasmModule> {
  const [simdSupported, threadsSupported] = await Promise.all([env().getAsync('WASM_HAS_SIMD_SUPPORT'),
    env().getAsync('WASM_HAS_MULTITHREAD_SUPPORT')]);

  return new Promise((resolve, reject) => {
    const factoryConfig: WasmFactoryConfig = {};

    /**
     * This function overrides the Emscripten
     * module locateFile utility.
     * @param path The relative path to the file that needs to be loaded.
     * @param
     */
    factoryConfig.locateFile = (path, prefix) => {
      if (path.endsWith('.worker.js')) {
        const response = wasmWorkerContents;
        const blob = new Blob([response], {type: 'application/javascript'});
        return URL.createObjectURL(blob);
      }

      if (path.endsWith('.wasm')) {
        return getPathToWasmBinary(
            simdSupported as boolean, threadsSupported as boolean, wasmPathPrefix != null ? wasmPathPrefix : prefix);
      }
      return prefix + path;
    };

    // Use the instanceWasi override when system fetch is not available.
    // Reference:

    reject({message: rejectMsg});
```
'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-backendwasm.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
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```javascript
import './flags_wasm';

import {registerBackend} from '@tensorflow/tfjs-core';

import {BackendWasm, init} from './backend_wasm';

export {BackendWasm, getThreadsCount, setThreadsCount, setWasmPath, setWasmPaths} from './backend_wasm';
export {version as version_wasm} from './version';

const WASM_PRIORITY = 2;
registerBackend('wasm', async () => {
  const {wasm} = await init();
  return new BackendWasm(wasm);
}, WASM_PRIORITY);
```
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Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/miniprogram/index.js.map

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

```typescript
import {KernelConfig, KernelFunc, Pack, PackAttrs, PackInputs, TensorInfo, util} from '@tensorflow/tfjs-core';
import {concat} from './Concat';
```
```javascript
{expandDims} from './ExpandDims';

export function pack(
    args: {inputs: PackInputs, backend: BackendWasm, atttrs: PackAttrs}):
    TensorInfo {
  const {inputs, backend, atttrs} = args;
  const {axis} = atttrs;
  if (inputs.length === 1) {
    return expandDims(
        {inputs: {input: inputs[0]}, backend, atttrs: {dim: axis}});
  }
  const shape = inputs[0].shape;
  const dtype = inputs[0].dtype;

  inputs.forEach(t => {
    util.assertShapesMatch(
        shape, t.shape,
        'All tensors passed to stack must have matching shapes');
    util.assert(
        dtype === t.dtype,
        () => 'All tensors passed to stack must have matching dtypes');
  });

  const intermediateTensorInfos: TensorInfo[] = [
    const expandedT = expandDims({inputs: {input: t}, backend, atttrs: {dim: axis}});
    intermediateTensorInfos.push(expandedT);
    return expandedT;
  });

  const result = concat({inputs: expandedTensors, backend, atttrs: {axis}});

  intermediateTensorInfos.forEach(t => backend.disposeData(t.dataId));

  return result;
}

export const packConfig: KernelConfig = {
  kernelName: Pack,
  backendName: 'wasm',
  kernelFunc: pack as {} as KernelFunc
};
```

---

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```javascript
import {KernelConfig, Log} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';
export const logConfig: KernelConfig = createUnaryKernelConfig(Log);
```
Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm/dist/kernels/Pow.js.map

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---

*Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-dist/kernels/Pow.js.map

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```javascript
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 * distributed under the License is distributed on an "AS IS" BASIS,
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
 * See the License for the specific language governing permissions and
 * limitations under the License.
 *
 *=============================================================================
 */

import {KernelConfig, KernelFunc, TensorInfo, Transform, TransformAttrs, TransformInputs, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmTransform: (imageId: number, transformsId: number, isBatchTransform: boolean, batch: number, outHeight: number, outWidth: number, numChannels: number, imageWidth: number, imageHeight: number, strides: Uint8Array, stridesLength: number, interpolationModeId: number, fillModeId: number, fillValue: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmTransform = backend.wasm.cwrap(Transform, null /*void*/, [
    'number',  // imageId
    'number',  // transformsId
    'bool',    // isBatchTransform
    'number',  // batch
    'number',  // outHeight
    'number',  // outWidth
    'number',  // numChannels
    'number',  // imageWidth
    'number',  // imageHeight
    'array',   // strides
    'number',  // stridesLength
    'number',  // interpolationModeId
    'number',  // fillModeId
    'number',  // fillValue
    'number'   // outId
  ]);}

function transform(args: {backend: BackendWasm, inputs: TransformInputs, attrs:
```
TransformAttrs

const { backend, inputs, attrs } = args;
const { image, transforms } = inputs;
const { interpolation, fillMode, fillValue, outputShape } = attrs;
const [batch, imageHeight, imageWidth, numChannels] = image.shape;
const [outHeight, outWidth] = outputShape;
outputShape = null; outputShape = [imageHeight, imageWidth];
const outShape = [batch, outHeight, outWidth, numChannels] as [number, number, number, number];
const strides = new Uint8Array(new Int32Array(util.computeStrides(image.shape)).buffer);

const { interpolation, fillMode, fillValue, outputShape } = attrs;
const [batch, imageHeight, imageWidth, numChannels] = image.shape;
const [outHeight, outWidth] = outputShape;
const outShape = [batch, outHeight, outWidth, numChannels] as [number, number, number, number];
const strides = new Uint8Array(new Int32Array(util.computeStrides(image.shape)).buffer);

const { outputShape } = args;
const { image, transforms } = inputs;
const { interpolation, fillMode, fillValue, outputShape } = attrs;
const [batch, imageHeight, imageWidth, numChannels] = image.shape;
const [outHeight, outWidth] = outputShape;
outputShape = null; outputShape = [imageHeight, imageWidth];
const outShape = [batch, outHeight, outWidth, numChannels] as [number, number, number, number];
const strides = new Uint8Array(new Int32Array(util.computeStrides(image.shape)).buffer);

const { outputShape } = args;
const { image, transforms } = inputs;
const { interpolation, fillMode, fillValue, outputShape } = attrs;
const [batch, imageHeight, imageWidth, numChannels] = image.shape;
const [outHeight, outWidth] = outputShape;
outputShape = null; outputShape = [imageHeight, imageWidth];
const outShape = [batch, outHeight, outWidth, numChannels] as [number, number, number, number];
const strides = new Uint8Array(new Int32Array(util.computeStrides(image.shape)).buffer);

const { outputShape } = args;
const { image, transforms } = inputs;
const { interpolation, fillMode, fillValue, outputShape } = attrs;
const [batch, imageHeight, imageWidth, numChannels] = image.shape;
const [outHeight, outWidth] = outputShape;
outputShape = null; outputShape = [imageHeight, imageWidth];
const outShape = [batch, outHeight, outWidth, numChannels] as [number, number, number, number];
const strides = new Uint8Array(new Int32Array(util.computeStrides(image.shape)).buffer);

const { outputShape } = args;
const { image, transforms } = inputs;
const { interpolation, fillMode, fillValue, outputShape } = attrs;
const [batch, imageHeight, imageWidth, numChannels] = image.shape;
const [outHeight, outWidth] = outputShape;
outputShape = null; outputShape = [imageHeight, imageWidth];
const outShape = [batch, outHeight, outWidth, numChannels] as [number, number, number, number];
const strides = new Uint8Array(new Int32Array(util.computeStrides(image.shape)).buffer);
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 */

import {ClipByValue, ClipByValueAttrs, ClipByValueInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmClip: (xId: number, min: number, max: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmClip = backend.wasm.cwrap(ClipByValue, null /* void */, [
    'number', // x_id
    'number', // min
    'number', // max
    'number'   // out_id
  ]);}

function clip(args: {
  inputs: ClipByValueInputs,
  backend: BackendWasm,
  attrs: ClipByValueAttrs
}) {
  const {inputs, backend, attrs} = args;
  const {x} = inputs;
  const {clipValueMin, clipValueMax} = attrs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  const out = backend.makeOutput(x.shape, x.dtype);
  const outId = backend.dataIdMap.get(out.dataId).id;
  wasmClip(xId, clipValueMin, clipValueMax, outId);
  return out;
}

export const clipByValueConfig: KernelConfig = {
  kernelName: ClipByValue,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: clip as {} as KernelFunc
};

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/ClipByValue.js.map
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 * distributed under the License is distributed on an "AS IS" BASIS,
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
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 * limitations under the License.
 */
*/
/**
 * @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
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============================================================================
Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/starter/parcel/index.html
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["version":3,"file":"Sigmoid.js","sourceRoot":"","sources":null,"names":null,"mappings":null]
MAAM,CAAC,MAAM,aAAA,GAAiB;IACcC,UAAU,EAAE,SAAS;IACB,WAAW,EAAE,MAAM;IACnB,SAAS ,EAAE,KAAK,IACbB,UAUU,EAAE,OAAB2;CAcCc,CAAC,"sourcesContent":","**"*/@license
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=============================================================================

import {KernelConfig, KernelFunc, Sigmoid, SigmoidInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmFunc: (xId: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmFunc = backend.wasm.cwrap(Sigmoid, null, ['number', 'number']);
}

function sigmoid(args: {backend: BackendWasm, inputs: SigmoidInputs}): TensorInfo {
  const {backend, inputs: {x}} = args;
  const xId = backend.dataIdMap.get(x.dataId).id;
  const out = backend.makeOutput(x.shape, x.dtype);
  const outId = backend.dataIdMap.get(out.dataId).id;

  // Short-circuit zero-sized tensors.
  if (util.sizeFromShape(out.shape) === 0) {
    return out;
  }

  wasmFunc(xId, outId);
  return out;
}

export const sigmoidConfig: KernelConfig = {
  kernelName: 'Sigmoid',
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: sigmoid as {} as KernelFunc
};
```javascript
    const bytes = this.wasm.HEAPU8.slice(memoryOffset, memoryOffset + size);
    return typedArrayFromBuffer(bytes.buffer, dtype);

  /**
   * Dispose the memory if the dataId has 0 refCount. Return true if the memory
   * is released, false otherwise.
   * @param dataId
   * @param force Optional, remove the data regardless of refCount
   */
  disposeData(dataId: DataId, force = false): boolean {
    if (this.dataIdMap.has(dataId)) {
      const data = this.dataIdMap.get(dataId);
      data.refCount--;
      if (!force && data.refCount > 0) {
        return false;
      }

      this.wasm.freeData(dataId);
      this.wasmdisposeData(dataId);
      this.dataIdMap.delete(dataId);
      return true;
    }
    /* Return refCount of a `TensorData`. */
    refCount(dataId: DataId): number {
      if (this.dataIdMap.has(dataId)) {
        const tensorData = this.dataIdMap.get(dataId);
        return tensorData.refCount;
      }
      return 0;
    }

    incRef(dataId: DataId) {
      const data = this.dataIdMap.get(dataId);
      if (data != null) {
        data.refCount++;
      }
    }

    floatPrecision(): number {
      return 32;
    }

    getMemoryOffset(dataId: DataId): number {
      return this.dataIdMap.get(dataId).memoryOffset;
    }

    dispose() {
      this.wasm.dispose();
      this.wasm.PThread.terminateAllThreads();
      this.wasm = null;
    }

    /**
     * Make a tensor info for the output of an op. If `memoryOffset` is not
     * present, this method allocates memory on the WASM heap. If `memoryOffset`
     * is present, the memory was allocated elsewhere (in c++) and we just record
     * the pointer where that memory lives.
     */
    makeOutput(shape: number[], dtype: DataType, memoryOffset?: number): TensorInfo {
      let dataId: {};
      if (memoryOffset == null) {
        dataId = this.write(null /* values */, shape, dtype);
      } else {
        const id = this.dataIdNextNumber++;
        dataId = {id};
        this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype, refCount: 1});
        const size = util.sizeFromShape(shape);
        this.wasm.registerTensor(id, size, memoryOffset);
      }
      return {dataId, shape, dtype};
    }

    typedArrayFromHeap({shape, dtype, dataId}: TensorInfo): backend_util.TypedArray {
      const buffer = this.wasm.HEAPU8.buffer;
      const memoryOffset = this.dataIdMap.get(dataId);
      switch (dtype) {
        case 'float32':
          return new Float32Array(buffer, memoryOffset, size);
        case 'int32':
          return new Int32Array(buffer, memoryOffset, size);
        case 'bool':
          return new Uint8Array(buffer, memoryOffset, size);
        default:
          throw new Error(`Unknown dtype ${dtype}`);
      }
    }
}

function createInstantiateWasmFunc(path: string) {
  return (imports: any, callback: any) => {
    util.fetch(path, {credentials: 'same-origin'}).then((response) => {
      if (!response['ok']) {
        imports.env.a(`failed to load wasm binary file at '${path}'`);
      }
      response.arrayBuffer().then(binary => {
        WebAssembly.instantiate(binary, imports).then(output => {
          callback(output.instance, output.module);
        });
      });
    });
    return {};
  };

/**
 * Returns the path of the WASM binary.
 * @param simdSupported whether SIMD is supported
 * @param threadsSupported whether multithreading is supported
 * @param wasmModuleFolder the directory containing the WASM binaries.
 */
function getPathToWasmBinary(simdSupported: boolean, threadsSupported: boolean, wasmModuleFolder: string) {
  if (wasmPath != null) {
    // If wasmPath is defined, the user has supplied a full path to
    // the vanilla .wasm binary.
    return wasmPath;
  }

  let path = 'tfjs-backend-wasm.wasm';

  if (simdSupported && threadsSupported) {
    path = 'tfjs-backend-wasm-threaded-simd.wasm';
  } else if (simdSupported) {
    path = 'tfjs-backend-wasm-simd.wasm';
  } else if (threadsSupported) {
    path = 'tfjs-backend-wasm-threaded.wasm';
  } else {
    path = 'tfjs-backend-wasm.wasm';
  }

  if (wasmPath != null) {
    const wasmPath = path + '?' + path + '=wasm';
    return wasmPath;
  } else {
    // minprogram's output
    return tfjs._disableNextLineNoAny
      withRouter(imports: any, callback: any) => {
        util.fetch(path, {credentials: 'same-origin'}).then(response => {
          if (response['ok']) {
            response.arrayBuffer().then(binary => {
              WebAssembly.instantiateSync(binary, imports).then(output => {
                callback(output.instance, output.module);
              });
            });
          }
        });
      }
    return {};
  }

  return null;
```

---

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module locateFile.util.

* @param path The relative path to the file that needs to be loaded.
* @param prefix The path to the main JavaScript file's directory.
*/

/*
 * factoryConfig.locateFile = (path, prefix) => {
 *   if (path.endsWith('.worker.js')) {
 *     const blob = new ArrayBuffer(response), {type: 'application/javascript'});
 *   } else {
 *     return prefix + path;
 *   }
 * };
 *
 * Use the instantiateWasm override when system fetch is not available.
 * @doc {heading: 'Environment', namespace: 'wasm'}
 */

if (customFetch) {
  factoryConfig.instantiateWasm = createInstantiateWasmFunc(getPathToWasmBinary(
    wasmPathPrefix !== null ? wasmPathPrefix : prefix));
}

let initialized = false;

factoryConfig.onAbort = () => {
  if (initialized) {
    return;
  }
  if (initAborted) {
    return;
  }
  initAborted = true;
  const rejectMsg = 'Make sure the server can serve the `.wasm` file relative to the `bundled js` file. For more details see https://github.com/tensorflow/tfjs-backend-wasm\#using-bundlers';
  reject({message: rejectMsg});
}

wasm.then(modules, reason) => {
  initialized = true;
  initAborted = false;

  const voidReturnType: string = null;
  module.tfjs = {
    init: module.cwrap('init', null, []),
    initWithThreadsCount: module.cwrap('init_with_threads_count', null, ['number']),
    getThreadsCount: module.cwrap('get_threads_count', 'number', []),
    registerTensor: module.cwrap('register_tensor', null, ['number', 'number', 'number']),
    disposeData: module.cwrap('dispose_data', voidReturnType, ['number']),
    dispose: module.cwrap('dispose', voidReturnType, []),
  };

  resolve({wasm: module});
}

function typedArrayFromBuffer(buffer: ArrayBuffer, dtype: DataType): backend_util.TypedArray {
  switch (dtype) {
    case 'float32':
      return new Float32Array(buffer);
    case 'int32':
      return new Int32Array(buffer);
    case 'bool':
      return new Uint8Array(buffer);
    default:
      throw new Error(`Unknown dtype ${dtype}`);
  }
}

const wasmBinaryNames = ['tfjs-backend-wasm.wasm', 'tfjs-backend-wasm-simd.wasm', 'tfjs-backend-wasm-threaded-simd.wasm'] as const;
type WasmBinaryName = typeof wasmBinaryNames[number];

let wasmPath: string = null;
let wasmPathPrefix: string = null;
let wasmFileMap: {key in WasmBinaryName?: string} = {};
let initAborted = false;
let customFetch = false;

/**
 * @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\#using-bundlers
 */
export function setWasmPath(path: string, usePlatformFetch = false): void {
  deprecationWarn('setWasmPath has been deprecated in favor of setWasmPaths and' +
    ' will be removed in a future release.');
  if (initAborted) {
    throw new Error(`The WASM backend was already initialized. Make sure you call ` +
      `setWasmPath()` before you call `tf.setBackend()` or `tf.ready()`.
  }
  wasmPath = path;
  customFetch = usePlatformFetch;

  return;
}

if (initAborted) {
  throw new Error(`The WASM backend was already initialized. Make sure you call ` +
      `setWasmPath()` before you call `tf.setBackend()` or `tf.ready()`.
  };


```typescript
* 'tfjs-backend-wasm.wasm': 'renamed.wasm',
* 'tfjs-backend-wasm-simd.wasm': 'renamed-simd.wasm',
* 'tfjs-backend-wasm-threaded-simd.wasm': 'renamed-threaded-simd.wasm',
};

* @param prefixOrFileMap This can be either a string or object:
  * the wasm file, default to false.
  * doc {heading:
    'Environment', namespace: 'wasm'}

export function setWasmPaths(
    prefixOrFileMap: string|{
        [key in WasmBinaryName]: string
    },
    usePlatformFetch = false): void {
  if (initAborted) {
    throw new Error('The WASM backend was already initialized. Make sure you call ' +
        '`setWasmPaths()` before you call `tf.setBackend()`.');
  }

  if (typeof prefixOrFileMap === 'string') {
    wasmPathPrefix = prefixOrFileMap;
  } else {
    wasmFileMap = prefixOrFileMap;
    const missingPaths =
        Object.keys(wasmFileMap).filter(name => wasmFileMap[name] == null);
    if (missingPaths.length > 0) {
      throw new Error(`There were no entries found for the following binaries: ${missingPaths.join(',')}.
        Please either call setWasmPaths with a string indicating the directory where all the binaries can be found.`);
    }
  }

  customFetch = usePlatformFetch;
}

/**
 * Used in unit tests. */
export function resetWasmPath(): void {
  wasmPath = null;
  wasmPathPrefix = null;
  wasmFileMap = {};
  customFetch = false;
  initAborted = false;
  actualThreadsCount = -1;
}

/**
 * Sets the number of threads that will be used by XNNPACK to create a threadpool.
 * This must be called before calling `tf.setBackend('wasm')`. It is set after the backend is initialized.
 * (default to the number of logical CPU cores). *
 * *
 * @param numThreads number
 * *
 * @return actualThreadsCount
*/
export function setThreadsCount(numThreads: number) {
  threadsCount = numThreads;
}

/**
 * Gets the actual threads count that is used by XNNPACK.
 * It is set after the backend is initialized.
 * *
 * @return actualThreadsCount
*/
export function getThreadsCount(): number {
  if (actualThreadsCount === -1) {
    throw new Error(`WASM backend not initialized.`);
  }
  return actualThreadsCount;
}
```

---

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 */
import {KernelConfig, Rsqrt} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';
export const rsqrtConfig: KernelConfig = createUnaryKernelConfig(Rsqrt);
```
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```javascript
{"version":3,"file":"Less.js","sourceRoot":"","sources":[]}"
```

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```javascript
{"version":3,"file":"LeakyRelu.js","sourceRoot":"","sources":[]}"
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```javascript
{"version":3,"file":"AcanoServer.js","sourceRoot":"","sources":[]}"
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```javascript
{"version":3,"file":"AcanoServer.js","sourceRoot":"","sources":[]}"
```

No license file was found, but licenses were detected in source scan.
null /* void */,[\n'number',  // x_id\n'number',  // dtype\n'number',  // leakyrelu_alpha\n'number',  // out_id\n]);\n'unexport function leakyRelu(\n  args:\n    [inputs: LeakyReluInputs, attr: LeakyReluAttr, backend: BackendWasm]);\n'TensorInfo \n  const [inputs: {x}, attr: {alpha}, backend] = args;\n  const xId = backend.dataIdMap.get(x.dataId).id;\n  // According to TF API, LeakyRelu returns float32 when input is either\n  float32  \n  // or int32;\n  const outId = backend.makeOutput(x.shape, 'float32');\n  if (util.sizeFromShape(x.shape) !== 0) \n    wasmFunc(xId, CppDType[x.dtype], alpha,\n      outId);\n  }\n  return out;\n});\n
export function leakyRelu(
    args:
        {inputs: LeakyReluInputs, attrs: LeakyReluAttrs,\n         backend: BackendWasm}):
    TensorInfo {
  const {inputs: {x}, attrs: {alpha}, backend} = args;

  const xId =\n    backend.dataIdMap.get(x.dataId).id;\n  // According to TF API, LeakyRelu returns float32 when input is either\n  float32
  // or int32.
  const out = backend.makeOutput(x.shape, 'float32');

  if (util.sizeFromShape(x.shape) !== 0) {
    const outId = backend.dataIdMap.get(out.dataId).id;
    wasmFunc(xId, CppDType[x.dtype], alpha,\n      outId);\n  }

  return out;
}

export const leakyReluConfig: KernelConfig = {
  kernelName: LeakyRelu,
  backendName: 'wasm',
  setupFunc,
  kernelFunc: leakyRelu as {} as KernelFunc,
};


import {BatchMatMul, BatchMatMulAttrs, BatchMatMulInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {reshape} from './Reshape';

let wasmBatchMatMul: (aId: number, aShape: Uint8Array, aShapeSize: number, bId: number, bShape: Uint8Array, bShapeSize: number, transposeA: boolean, transposeB: boolean, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmBatchMatMul = backend.wasm.cwrap(BatchMatMul, null /* void */, [
    'number',  // a_id
    'array',   // a_shape
    'number',  // a_shape.length
    'number',  // b_id
    'array',   // b_shape
    'number',  // b_shape.length
    'number',  // transpose_a
    'number',  // transpose_b
    'number'   // out_id
  ]);}

function batchMatMul(args: {
  inputs: BatchMatMulInputs,
  backend: BackendWasm,
  attrs: BatchMatMulAttrs
}) {
  const {inputs, backend, attrs} = args;
  const {a, b} = inputs;
  const {transposeA, transposeB} = attrs;

  if (a.dtype !== 'float32' || b.dtype !== 'float32') {
    throw new Error(`BatchMatMul for non-float32 tensors not yet supported.`);
  }

  const aRank = a.shape.length;
  const bRank = b.shape.length;

  const innerShapeA = transposeA ? a.shape[aRank - 2] : a.shape[aRank - 1];
  const innerShapeB = transposeB ? b.shape[bRank - 2] : b.shape[bRank - 1];

  const outerShapeA = transposeA ? a.shape[aRank - 1] : a.shape[aRank - 2];
  const outerShapeB = transposeB ? b.shape[bRank - 1] : b.shape[bRank - 2];

  const batchDimA = util.sizeFromShape(a.shape.slice(0, -2));
  const batchDimB = util.sizeFromShape(b.shape.slice(0, -2));

  const batchDimsCompatible = batchDimA === batchDimB || batchDimA === 1 || batchDimB === 1;

  util.assert(aRank >= 2 && bRank >= 2 && batchDimsCompatible, () => `Error in matMul: the input batch dimensions must either be the same or at least one input batch dimension must be 1. Got input`);
const outShapeOuterDims = 
batchDimA > batchDimB ? a.shape.slice(0, -2) : b.shape.slice(0, -2);
const outShape = 
outShapeOuterDims.concat([outerShapeA, outerShapeB]);
util.assert(outShapeOuterDims.length === outShape.length);

const outShape = 
outShapeOuterDims.concat([outerShapeA, outerShapeB]);
// The rest of the implementation is designed to operate on rank-3 tensors
const a3d = reshape({inputs: {x: a}, backend, attrs: 
{shape: a3d.shape}}); const b3d = reshape({inputs: {x: b}, backend, attrs: {shape: b3d.shape}});

const a3dId = backend.getDataId(a3d.dataId, id);
const b3dId = backend.getDataId(b3d.dataId, id);
const leftDim = transposeA ? a3d.shape[2] : a3d.shape[1];
const out = backend.makeOutput([batchDim, leftDim, rightDim], a3d.dtype);
const outId = backend.getDataId(out.dataId, id);

wasmBatchMatMul(a3dId, aShapeBytes, a3d.shape.length, b3dId, 
bShapeBytes, b3d.shape.length, transposeA, transposeB, outId);
backend.disposeData(a3d.dataId);
backend.disposeData(b3d.dataId);
out.shape = outShape;
return out;

export const batchMatMulConfig:
KernelConfig = {
  kernelName: BatchMatMul,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: 
batchMatMul as {} as KernelFunc
};
../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/kernels/Concat.ts", 
../src/kernels/DequantizeLinear.ts", 
../src/kernels/Conv2D.ts", 
../src/kernels/Conv2DLatent.ts", 
../src/kernels/CrosswiseReduceMax.ts", 
../src/kernels/CrosswiseReduceMean.ts", 
../src/kernels/CTensorAsDType.ts", 
../src/kernels/CTensorAsDTypeStrings.ts", 
../src/kernels/DataFormatConversion.ts", 
../src/kernels/DequantizeLinear.ts", 
../src/kernels/Conv2D.ts", 
../src/kernels/Conv2DLatent.ts", 
../src/kernels/CrosswiseReduceMax.ts", 
../src/kernels/CrosswiseReduceMean.ts", 
../src/kernels/CTensorAsDType.ts", 
../src/kernels/CTensorAsDTypeStrings.ts", 
../src/kernels/DataFormatConversion.ts", 
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../src/kernels/Conv2D.ts", 
../src/kernels/Conv2DLatent.ts", 
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../src/kernels/CrosswiseReduceMean.ts", 
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../src/kernels/CTensorAsDTypeStrings.ts", 
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../src/kernels/DequantizeLinear.ts", 
../src/kernels/Conv2D.ts", 
../src/kernels/Conv2DLatent.ts", 
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../src/kernels/DataFormatConversion.ts", 
../src/kernels/DequantizeLinear.ts", 
../src/kernels/Conv2D.ts", 
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../src/kernels/CTensorAsDTypeStrings.ts", 
../src/kernels/DataFormatConversion.ts", 
../src/kernels/DequantizeLinear.ts", 
../src/kernels/Conv2D.ts", 
../src/kernels/Conv2DLatent.ts", 
../src/kernels/CrosswiseReduceMax.ts", 
../src/kernels/CrosswiseReduceMean.ts", 
../src/kernels/CTensorAsDType.ts", 
../src/kernels/CTensorAsDTypeStrings.ts", 
../src/kernels/DataFormatConversion.ts", 
../src/kernels/DequantizeLinear.ts".

```
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 * distributed under the License is distributed on an "AS IS" BASIS,
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
 * See the License for the specific language governing permissions and
 * limitations under the License.
 *
 *=============================================================================
 */

// This enum must align with the enum defined in cc/backend.h.
export enum CppDType {
  float32 = 0,
  int32 = 1,
  bool = 2,
  string = 3,
  complex64 = 4
}

// Must match enum in cc/fusable_activations.h.
export enum FusableActivation {
  linear = 0,
  relu = 1,
  relu6 = 2,
  prelu = 3,
  leakyrelu = 4,
  sigmoid = 5,
  elu = 6
}

```

```
```
const batchDim = a.shape[0];
const out = backend.makeOutput([batchDim, leftDim, rightDim], a.dtype);
const outId = backend.dataIdMap.get(out.dataId).id;
const aShapeBytes = new Uint8Array(new Int32Array(a.shape).buffer);
const bShapeBytes = new Uint8Array(new Int32Array(b.shape).buffer);

wasmFusedMatMul(
  aId, aShapeBytes, a.shape.length, bId, bShapeBytes, b.shape.length,
  transposeA, transposeB, fusedActivation, biasId, preluActivationWeightsId,
  leakyreluAlpha || 0, outId);

return out;
}

export const fusedMatMulConfig: KernelConfig = {
  kernelName: _FusedMatMul,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: fusedBatchMatMul as {} as KernelFunc
};

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 * distributed under the License is distributed on an "AS IS" BASIS,
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
 * See the License for the specific language governing permissions and
 * limitations under the License.
 */

import {DataType, KernelConfig, TensorInfo, UnaryInputs, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {CppDType} from './types';

export function createUnaryKernelConfig(
    kernelName: string, outType?: DataType): KernelConfig {
  let wasmFunc: (xId: number, dtype: number, outId: number) => void;

  function setupFunc(backend: BackendWasm): void {
    wasmFunc = backend.wasm.cwrap(kernelName, null /* void */, [
      'number',  // x_id
      'number',  // dtype
      'number',  // out_id
    ],
    );
  }

  function kernelFunc(args: {backend: BackendWasm, inputs: UnaryInputs}):
    TensorInfo {
    const {backend, inputs: {x}} = args;
    const xId = backend.dataIdMap.get(x.dataId).id;
    const out = backend.makeOutput(x.shape, outType || x.dtype);
    const outId = backend.dataIdMap.get(out.dataId).id;

    if (util.sizeFromShape(out.shape) === 0) {
      return out;
    }

    wasmFunc(xId, CppDType[x.dtype], outId);
    return out;
  }

  return {kernelName, backendName: 'wasm',
    setupFunc, kernelFunc
  };
}

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 * See the License for the specific language governing permissions and
 * limitations under the License.
 */

import {backend_util, BinaryInputs, DataType, KernelConfig, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {CppDType} from './types';

export function createBinaryKernelConfig(
    kernelName: string, supportsFullBroadcast: boolean,
    dtype?: DataType): KernelConfig {
  let wasmFunc:
      (aId: number, aShape: Uint8Array, aShapeLen: number, bId:
       number, bShape: Uint8Array, bShapeLen: number, dtype: number, outId: number) =>
          void;

  function setupFunc(backend: BackendWasm): void {
    wasmFunc = backend.wasm.cwrap(kernelName, null /* void */, [
      'number',  // a_id
      'number',  // a_shape
      'number',  // a_shape_len
      'number',  // b_id
      'number',  // b_shape
      'number',  // b_shape_len
      'number',  // dtype
      'number',  // out_id
    ],
    );
  }

  function kernelFunc(args: {backend: BackendWasm, inputs: BinaryInputs}):
    TensorInfo {
    const {backend, inputs: {a, b}, outId} = args;
    const aId = backend.dataIdMap.get(a.dataId).id;
    const bId = backend.dataIdMap.get(b.dataId).id;
    const outId = backend.dataIdMap.get(outId.dataId).id;

    if (supportFullBroadcast || outId) {
      const aShapeBytes = new Uint8Array(new Int32Array(a.shape).buffer);
      const bShapeBytes = new Uint8Array(new Int32Array(b.shape).buffer);
      const out = backend.makeOutput(outId, supportsFullBroadcast ? b.shape.length : 1);
    }

    wasmFunc(aId, aShapeBytes, a.shape.length, bId, bShapeBytes, b.shape.length,
      supportsFullBroadcast ? b.shape.length : 1, outId);
    return out;
  }

  return {kernelName, backendName: 'wasm',
    setupFunc, kernelFunc
  };
}
```javascript
void */ [n 'number', // a_id, 'array', // a_shape[0] 'number', // a_shape.length 'number', // b_id 'array', // b_shape 'number', // b_shape.length 'number', // dtype[0] 'number' // out_id[0] ];

function kernelFunc(args: {backend: BackendWasm, inputs: BinaryInputs}): TensorInfo { const {backend, inputs} = args; const [a, b] = inputs; const ald = backend.dataIdMap.get(a.dataId).id; const bld = backend.dataIdMap.get(b.dataId).id; const outputType = dtype[0] || dtype : a.dtype; const newShape = backend_util.assertAndGetBroadcastShape(a.shape, b.shape); const out = backend.makeOutput(newShape, outputType); return
    // Currently only some float operations support full broadcast.
    if (supportsFullBroadcast && a.dtype === 'float32') {
      kernelFunc();
      return out;
    }

    const aShapeBytes = new Uint8Array(new Int32Array(a.shape).buffer);
    const bShapeBytes = new Uint8Array(new Int32Array(b.shape).buffer);
    const outId = backend.dataIdMap.get(out.dataId).id;

    const kernelFunc = () => wasmFunc(aId, aShapeBytes, a.shape.length, bld, bShapeBytes, b.shape.length, CppDType[a.dtype], outId);
    return
    // Short-circuit zero-sized tensors.
    if (util.sizeFromShape(newShape) === 0) { return out;
    } else { throw new Error('Broadcasting along outer dims is not yet supported for ' + kernelName + '.'); }

    return {kernelName, backendName: 'wasm', setupFunc, kernelFunc};
}

export const addConfig: KernelConfig = createBinaryKernelConfig(Add, supportsFullBroadcast);

export const addNConfig: KernelConfig = {
  kernelName: AddN,
  backendName: 'wasm',
  setupFunc, kernelFunc: addn as KernelFunc,
};
```

---

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 */

import {Identity, IdentityInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';
import {TensorInfo} from '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';

export function identity(args: {inputs: IdentityInputs, backend: BackendWasm}): TensorInfo {
  const {inputs: {x}, backend} = args;
  const out = backend.makeOutput(x.shape, x.dtype);
  const inVals = backend.typedArrayFromHeap(x);
  const outVals = backend.typedArrayFromHeap(out);
  outVals.set(inVals);
  return out;
}

export const identityConfig: KernelConfig = {
  kernelName: Identity,
  backendName: 'wasm',
  kernelFunc: identity as {} as KernelFunc,
};

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 */

import {KernelConfig, KernelFunc, TensorInfo, Transpose, TransposeAttrs, TransposeInputs} from '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';
import {identity} from './Identity';
import {CppDType} from './types';

let wasmTranspose: (xId: number, xShape: Uint8Array, xShapeLength: number, dtype: CppDType, outId: number, perm: Uint8Array, permLength: number) => void;

function setup(backend: BackendWasm) {
  wasmTranspose = backend.wasm.cwrap(Transpose, null /* void */, ['number', /* xId */, 'array', /* x.shape */, 'number', /* x.shape.length */, 'number', /* dtype */, 'number', /* outId */, 'array', /* perm */, 'number', /* perm.length */, 'void']) as void;
}

export function transpose(args: {inputs: TransposeInputs, backend: BackendWasm, attrs: TransposeAttrs}): TensorInfo {
  const {inputs, backend, attrs} = args;
  const xId = backend.dataIdMap.get(inputs.x.dataId).id;
  const outId = backend.dataIdMap.get(inputs.perm.dataId).id;
  const permBytes = new Uint8Array(new Int32Array(attrs.perm).buffer);
  const xShapeBytes = new Uint8Array(new Int32Array(inputs.x.shape).buffer);

  wasmTranspose(xId, xShapeBytes, x.shape.length, CppDType[x.dtype], outId, permBytes, out.length);
  return out;
}

function computeOutShape(inShape: number[], perm: number[]): number[] {
  const outShape = new Array(inShape.length);
  for (let i = 0; i < outShape.length; i++) {
    outShape[i] = inShape[perm[i]];
  }
  return outShape;
}

function removeOneSizeDims(shape: number[], perm: number[]): [number[], number[]] {
  const newShape: number[] = new Array(shape.length);
  for (let i = 0; i < shape.length; i++) {
    if (shape[i] !== 1) {
      newShape[i] = shape[perm[i]];
    }
  }
  return [newShape, perm];
}

export const transposeConfig: KernelConfig = {
  kernelName: Transpose,
  backendName: 'wasm',
  kernelFunc: transpose as {} as KernelFunc,
  setupFunc: setup,
};

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```typescript
import {backend_util, TensorInfo, util} from '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';
import {transpose} from './Transpose';

/**
 * Compute permutation axes and do a transpose
 * if necessary.
 * @param x input TensorInfo
 * @param axis reduction axes
 * @param backend wasm backend instance
 * @export
 * @native function permuteAxesAndTranspose
 * @param x TensorInfo, axis: number[], backend: BackendWasm: {
 * transposed: TensorInfo|null, axes: number[], originalAxes: number[],
 * inputWasTransposed: boolean
 * |
 * const xShape = x.shape;
 * const xRank = x.shape.length;
 * const originalAxes = util.parseAxisParam(axis, xShape);
 * let axes = originalAxes;
 * const permutedAxes = backend_util.getAxesPermutation(axes, xRank);
 * let xTransposed = null;
 * let inputWasTransposed = false;
 * if (permutedAxes != null) {
 *   const newShape: number[] = new Array(xRank);
 *   for (let i = 0; i < newShape.length; i++) {
 *     newShape[i] = xShape[permutedAxes[i]];
 *   }
 *   axes = backend_util.getInnerMostAxes(axes.length, xRank);
 *   xTransposed = transpose({inputs: {x}, attrs: {perm: permutedAxes}, backend});
 *   const xId = backend.dataIdMap.get(x.dataId).id;
 *   const transposedId = backend.dataIdMap.get(xTransposed.dataId).id;
 *   if (transposedId !== xId) {
 *     inputWasTransposed = true;
 *   }
 *   return {transposed: xTransposed, originalAxes, axes, inputWasTransposed};
 * }
 * return {transposed: null, originalAxes, axes, inputWasTransposed};
 */

export function permuteAxesAndTranspose(
    x: TensorInfo,
    axis: number|number[],
    backend: BackendWasm): {
  transposed: TensorInfo|null,
  axes: number[],
  originalAxes: number[],
  inputWasTransposed: boolean
} {
  const xShape = x.shape;
  const xRank = x.shape.length;

  const originalAxes = util.parseAxisParam(axis, xShape);
  let axes = originalAxes;
  const permutedAxes = backend_util.getAxesPermutation(axes, xRank);
  let xTransposed = null;
  let inputWasTransposed = false;
  if (permutedAxes != null) {
    const newShape: number[] = new Array(xRank);
    for (let i = 0; i < newShape.length; i++) {
      newShape[i] = xShape[permutedAxes[i]];
    }
    axes = backend_util.getInnerMostAxes(axes.length, xRank);
    xTransposed = transpose({inputs: {x}, attrs: {perm: permutedAxes}, backend});
    const xId = backend.dataIdMap.get(x.dataId).id;
    const transposedId = backend.dataIdMap.get(xTransposed.dataId).id;
    if (transposedId !== xId) {
      inputWasTransposed = true;
    }
    return {transposed: xTransposed, originalAxes, axes, inputWasTransposed};
  }
  return {transposed: null, originalAxes, axes, inputWasTransposed};
}
```

---

```typescript
import {All, AllAttrs, AllInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {permuteAxesAndTranspose} from './kernel_utils';

let wasmAll: (xId: number, reduceSize: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmAll = backend.wasm.cwrap(All, null /*void*/, ['number, number, number']);
}

function all(args: {backend: BackendWasm, inputs: AllInputs, attrs: AllAttrs}):
    TensorInfo {
  const {backend, inputs, attrs} = args;
  const {axis, keepDims} = attrs;
  const {x} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  let inputId = xId;
  let input = x;

  const {transposed, axes, originalAxes, inputWasTransposed} =
      permuteAxesAndTranspose(x, axis, backend);
  if (inputWasTransposed) {
    const transposedId = backend.dataIdMap.get(transposed.dataId).id;
    input =
        transposed;
    inputId = transposedId;
  }
  const inputRank = input.shape.length;

  backend_util.assertAxesAreInnerMostDims('all', axes, inputRank);
  const [outShape, reduceShape] =
      permuteAxesAndTranspose(x, axis, backend);
  if (inputWasTransposed) {
    const transposedId = backend.dataIdMap.get(transposed.dataId).id;
    input =
        transposed;
    inputId = transposedId;
  }
  const output = backend.makeOutput(outShape, x.dtype);
  if (output.id !== 0) {
    const outId = backend.dataIdMap.get(out.dataId).id;
    wasmAll(inputId, reduceSize, outId);
  }
  if (inputWasTransposed) {
    // dispose of the transposed tensor.
    backend.disposeData(transposed.dataId);
  }
  if (keepDims) {
    const newShape =
        backend_util.expandShapeToKeepDim(outShape, originalAxes);
    output.shape = newShape;
    return;
  }
  return;
}

export const allConfig: KernelConfig = {
  kernelName: All,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: all as {} as KernelFunc
};
```

---

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============================================================================

*/

import {Any, AnyAttrs, AnyInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {permuteAxesAndTranspose} from './kernel_utils';

let wasmAny: (xId: number, reduceSize: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmAny = backend.wasm.cwrap(Any, null /*void*/, ['number', 'number', 'number']);
}

function any(args: {backend: BackendWasm, inputs: AnyInputs, attrs: AnyAttrs}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {axis, keepDims} = attrs;
  const {x} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  let inputId = xId;
  let input = x;

  const {transposed, axes, originalAxes, inputWasTransposed} = permuteAxesAndTranspose(x, axis, backend);
  if (inputWasTransposed) {
    const transposedId = backend.dataIdMap.get(transposed.dataId).id;
    input = transposed;
    inputId = transposedId;
  }

  const inputRank = input.shape.length;
  backend_util.assertAxesAreInnerMostDims('any', axes, inputRank);
  const [outShape, reduceShape] = backend_util.computeOutAndReduceShapes(input.shape, axes);
  const reduceSize = util.sizeFromShape(reduceShape);

  const out = backend.makeOutput(outShape, x.dtype);
  if (util.sizeFromShape(input.shape) !== 0) {
    const outId = backend.dataIdMap.get(out.dataId).id;
    wasmAny(inputId, reduceSize, outId);
  }

  if (inputWasTransposed) {
    // dispose of the transposed tensor.
    backend.disposeData(transposed.dataId);
  }

  if (keepDims) {
    // reshape
    const newShape = backend_util.reshapeInputShapeToKeepDim(out.shape, originalAxes);
    const out = backend_util.expandShapeToKeepDim(out.shape, originalAxes);
    return out;
  }

  export const anyConfig: KernelConfig = {
    kernelName: Any,
    backendName: 'wasm',
    setupFunc: setup,
    kernelFunc: any as {} as KernelFunc
  };

/*============================================================================

import {ArgMax, ArgMaxAttrs, ArgMaxInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {permuteAxesAndTranspose} from './kernel_utils';
import {CppDType} from './types';

let wasmFunc: (xId: number, dtype: number, outerSize: number, innerSize: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmFunc = backend.wasm.cwrap(ArgMax, null /*void*/, ['number', 'number', 'number', 'number', 'number']);
}

function argmax(args: {inputs: ArgMaxInputs, backend: BackendWasm, attrs: ArgMaxAttrs}) {
  const {backend, inputs, attrs} = args;
  const {x} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  let inputId = xId;
  let input = x;

  const {transposed, axes, originalAxes, inputWasTransposed} = permuteAxesAndTranspose(x, axis, backend);
  if (inputWasTransposed) {
    const transposedId = backend.dataIdMap.get(transposed.dataId).id;
    input = transposed;
    inputId = transposedId;
  }

  const inputRank = input.shape.length;
  backend_util.assertAxesAreInnerMostDims('argmax', axes, inputRank);
  const [outShape, reduceShape] = backend_util.computeOutAndReduceShapes(input.shape, axes);
  const reduceSize = util.sizeFromShape(reduceShape);

  const outId = backend.dataIdMap.get(out.dataId).id;
  const output = backend.makeOutput(outShape, x.dtype);
  const outerSize = util.sizeFromShape(out.shape);

  const outputId = backend.dataIdMap.get(out.dataId).id;
  const reduceArgMax = backend.makeOutput(outShape, CppDType[output.dtype], outerSize, x.dtype);

  wasmFunc(inputId, outputId, reduceArgMax, xId);

  if (inputWasTransposed) {
    // dispose of the
transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n return out;\n }\n\nexport const\nargMaxConfig: KernelConfig = {\n  kernelName: ArgMax,\n  backendName: 'wasm',\n  kernelFunc: argmax as {}\n  as KernelFunc,\n  setupFunc: setup\n};\n\ntransposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\nreturn out;\n}\n\nexport const\nargMaxConfig: KernelConfig = {\n  kernelName: ArgMax,\n  backendName: 'wasm',\n  kernelFunc: argmax as {}\n  as KernelFunc,\n  setupFunc: setup\n};\n\ntransposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\nreturn out;\n}\n\nexport const\nargMaxConfig: KernelConfig = {\n  kernelName: ArgMax,\n  backendName: 'wasm',\n  kernelFunc: argmax as {}\n  as KernelFunc,\n  setupFunc: setup\n};\n\nreturn out;\n}\n\nexport const\nargMaxConfig: KernelConfig = {\n  kernelName: ArgMax,\n  backendName: 'wasm',\n  kernelFunc: argmax as {}\n  as KernelFunc,\n  setupFunc: setup\n};\n\nreturn out;\n}\n\nexport const\nargMaxConfig: KernelConfig = {\n  kernelName: ArgMax,\n  backendName: 'wasm',\n  kernelFunc: argmax as {}\n  as KernelFunc,\n  setupFunc: setup\n};\n\nreturn out;\n}\n\nexport const\nargMaxConfig: KernelConfig = {\n  kernelName: ArgMax,\n  backendName: 'wasm',\n  kernelFunc: argmax as {}\n  as KernelFunc,\n  setupFunc: setup\n};\n\nreturn out;\n}
elements.;)\n
  // Backend needs to track refCount for the dataId for reshape op\n  args.backend.incRef(x.dataId);\n
  // Backend needs to track refCount for the dataId for reshape op\n  args.backend.incRef(x.dataId);\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};\n\nexport const reshapeConfig: KernelConfig = {
  kernelName: Reshape,\n  backendName: 'wasm',\n  kernelFunc: reshape as {} as KernelFunc\n};\n\n/**\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software distributed under the License is distributed on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and limitations under the License.\n */

import {BatchMatMul, BatchMatMulAttrs, BatchMatMulInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {reshape} from './Reshape';\n
let wasmBatchMatMul: (\naId: number, aShape: Uint8Array, aShapeSize: number, bId: number,\nbShape: Uint8Array, bShapeSize: number, transposeA: boolean,\ntransposeB: boolean, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {
  wasmBatchMatMul = backend.wasm.cwrap(BatchMatMul, null /* void */, [\n    'number', // a_id
    'array',   // a_shape
    'number',  // a_shape.length 'number', // b_id
    'array',   // b_shape
    'number',  // b_shape.length 'number', // transpose_a
    'number',  // transpose_b
    'number'   // out_id
  ]);\n}\n\nfunction batchMatMul(args: {\n  inputs: BatchMatMulInputs,
  backend: BackendWasm,\n  attrs: BatchMatMulAttrs\n}) {
  const {inputs, backend, attrs} = args;
  const {a, b} = inputs;
  const {transposeA, transposeB} = attrs;

  if (a.dtype !== 'float32' || b.dtype !== 'float32') {
    throw new Error(`BatchMatMul for non-float32 tensors not yet supported.`);
  }

  const aRank = a.shape.length;
  const bRank = b.shape.length;

  const innerShapeA = transposeA ? a.shape[aRank - 2] : a.shape[aRank - 1];
  const innerShapeB = transposeB ? b.shape[bRank - 1] : b.shape[bRank - 2];

  util.assert(aRank >= 2 && bRank >= 2 && innerShapeA === innerShapeB, () => `Error in matMul: the dimensions of Tensors with shapes ${a.shape} and ${b.shape} must match.`);

  const a3dShape = transposeA ? [batchDimA, innerShapeA, outerShapeA] : [batchDimA, outerShapeA, innerShapeA];
  const b3dShape = transposeB ? [batchDimB, outerShapeB, innerShapeB] : [batchDimB, innerShapeB, outerShapeB];

  const a3dId = backend.dataIdMap.get(a3d.dataId).id;
  const b3dId = backend.dataIdMap.get(b3d.dataId).id;

  const leftDim = Math.max(batchDimA, batchDimB);
  const outShape = util.sizeFromShape([leftDim, a3d.shape[2], b3d.shape[1]]);
  const outShapeOuterDims = util.sizeFromShape([leftDim, a3d.shape[1], b3d.shape[2]]);
  const outShapeOuterDims = util.sizeFromShape([leftDim, a3d.shape[2], b3d.shape[1]]);
  const outShapeOuterDims = util.sizeFromShape([leftDim, a3d.shape[1], b3d.shape[2]]);

  const out = backend.makeOutput(outShapeOuterDims, a3d.dtype);
  const outId = backend.dataIdMap.get(out.dataId).id;

  const aShapeBytes = new Uint8Array(new Int32Array(a3d.shape).buffer);
  const bShapeBytes = new Uint8Array(new Int32Array(b3d.shape).buffer);

  wasmBatchMatMul(a3dId, aShapeBytes, a3d.shape.length, b3dId, bShapeBytes, b3d.shape.length, transposeA, transposeB, outId);

  backend.disposeData(a3d.dataId);
  backend.disposeData(b3d.dataId);

  out.shape = outShape;\n  out.return = outShape;\n  export const batchMatMulConfig: KernelConfig = {
    kernelName: BatchMatMul,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc:
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---

```javascript
import { util } from '@tensorflow/tfjs-core';

export function rangeImpl(start, stop, step, dtype) {
  const sameStartStop = start === stop;
  const increasingRangeNegativeStep = start < stop && step < 0;
  const decreasingRangePositiveStep = stop < start && step > 0;

  if (sameStartStop || increasingRangeNegativeStep ||
      decreasingRangePositiveStep) {
    return util.makeZerosTypedArray(0, dtype);
  }
  const numElements = Math.abs(Math.ceil((stop - start) / step));
  const values = util.makeZerosTypedArray(numElements, dtype);

  if (stop < start && step === 1) {
    // Auto adjust the step's sign if it hasn't been set
    // (or was set to 1)
    step = -1;
  }
  values[0] = start;
  for (let i = 1; i < values.length; i++) {
    values[i] = values[i - 1] + step;
  }
  return values;
}
```

---

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 *
 *=============================================================================

*/
import { backend_util, buffer, Slice, slice_util, util } from '@tensorflow/tfjs-core';
import { assertNotComplex
from './cpu_util';

export function sliceImpl(vals, begin, size, dtype) {
  const isContinuous = slice_util.isSliceContinuous(shape, begin, size);
  const length = util.sizeFromShape(size);
  const xStrides = util.computeStrides(shape);
  if (isContinuous) {
    const flatOffset = slice_util.computeFlatOffset(begin, xStrides);
    if (dtype === 'string') {
      return vals.slice(flatOffset, flatOffset + length);
    }
    return vals.subarray(flatOffset, flatOffset + length);
  }
  const decodedData = dtype === 'string' ?
    backend_util.fromUint8ToStringArray(vals) :
    vals;
  const inBuf = buffer(shape, dtype, decodedData);
  const outBuf = buffer(size, dtype);
  for (let i = 0; i < outBuf.size; ++i) {
    const outLoc = outBuf.indexToLoc(i);
    const inLoc = outLoc.map((idx, j) => idx + begin[j]);
    outBuf.set(inBuf.get(...inLoc), ...outLoc);
  }
  if (dtype === 'string') {
    return backend_util.fromStringArrayToUint8(outBuf.values);
  }
  return outBuf.values;
}

export function slice(args) {
  const { inputs, backend, attrs } = args;
  const { x } = inputs;
  const { begin, size } = attrs;
  assertNotComplex(x, 'slice');
  const [$begin, $size] = slice_util.parseSliceParams(x, begin, size);
  slice_util.assertParamsValid(x, $begin, $size);
  const vals = backend.data.get(x.dataId).values;
  const outVals = sliceImpl(vals, $begin, $size, x.shape, x.dtype);
  return backend.makeTensorInfo($size, x.dtype, outVals);
}

export const sliceConfig = {
  kernelName: Slice,
  backendName: 'cpu',
  kernelFunc: slice
};

sourceMappingURL=data:application/json;base64,eyJ2ZXJzaW9uIjozLCJmaWxlIjoiU2xpY2UuanMiLCJjc291cmNlcyI6Iiwib3B0aWRlZCI6IjIiLCJmaWxsZSI6ImZldGVySWRlbnQiLCJ2aWV3Q291cmNlIjoiIiwicGF0aCI6IjIiLCJmb2xsb3IiOnsibWQiOiJib290IiwiZ2l2ZSI6MzAsImZpY2UtY2xvY2F0aW9uIjpudWxsLCJicm9hZCI6MzAsImZvcmciOnsibWQiOiJmdW5jdGlvbiIsImF1YWxpdHk7IiwiZGlzcw1fX19fdHlwZT0wLCAiY29sb3IiOiJicm9hZCIsImluc3lutjVzZSI6IiJ9
import {backend_util, KernelConfig, KernelFunc, Slice, slice_util, SliceAttrs, SliceInputs, TypedArray, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';
import {sliceImplCPU} from '../kernel_utils/shared';

export function slice(
    args: {inputs: SliceInputs, attrs: SliceAttrs, backend: BackendWasm}) {
  const {inputs: {x}, attrs: {begin, size}, backend} = args;

  const [begin_, size_] = slice_util.parseSliceParams(x, begin, size);
  const isContinous = slice_util.isSliceContinous(x.shape, begin_, size_);
  const xVals = backend.readSync(x.dataId);
  const out = backend.makeOutput(size_, x.dtype);
  const xStrides = util.computeStrides(x.shape);
  const outData = backend.dataIdMap.get(out.dataId);

  if (isContinous) {
    const flatOffset = slice_util.computeFlatOffset(begin_, xStrides);

    if (x.dtype === 'string') {
      outData.stringBytes = (xVals as Uint8Array[]) .slice(flatOffset, flatOffset + util.sizeFromShape(size_));
    } else {
      const outVals = backend.typedArrayFromHeap(out);
      outVals.set((xVals as TypedArray).subarray(flatOffset, flatOffset + util.sizeFromShape(size_)));
    }

    return out;
  }

  if (x.dtype === 'string') {
    const res = sliceImplCPU(xVals, begin_, size_, x.shape, x.dtype);
    outData.stringBytes = res as Uint8Array[];
    return out;
  }

  const outVals = backend.typedArrayFromHeap(out);
  const rank = x.shape.length;
  if (rank === 2) {
    slice2d(xVals as TypedArray, xStrides[0], outVals, begin_ as [number, number], size_ as [number, number]);
  } else if (rank === 3) {
    slice3d(xVals as TypedArray, xStrides[0], xStrides[1], outVals, begin_ as [number, number, number], size_ as [number, number, number]);
  } else if (rank === 4) {
    slice4d(xVals as TypedArray, xStrides[0], xStrides[1], xStrides[2], outVals, begin_ as [number, number, number, number], size_ as [number, number, number, number]);
  } else {
    const res = sliceImplCPU(xVals, begin_, size_, x.shape, x.dtype) as TypedArray;
    outVals.set(res);
  }

  return out;
}

function slice2d(
    xVals: backend_util.TypedArray, xStride: number,
    outVals: backend_util.TypedArray, begin: [number, number], size: [number, number]): void {

  let outOffset = 0;
  const beginI = begin[0];
  const beginJ = begin[1];

  for (let i = beginI; i < endI; i++) {
    const xOffset = i * xStride + beginJ;
    outVals.set(xVals.subarray(xOffset, xOffset + size[1]), outOffset);
    outOffset += size[1];
  }

  return out;
}

function slice3d(
    xVals: backend_util.TypedArray, xStride: [number, number], begin: [number, number, number], size: [number, number, number]): void {

  let outOffset = 0;
  const beginI = begin[0];
  const beginJ = begin[1];
  const beginK = begin[2];

  for (let i = beginI; i < endI; i++) {
    for (let j = beginJ; j < endJ; j++) {
      const xStride1 = i * xStride[0] + j * xStride[1];
      outVals.set(xVals.subarray(xStride1, xStride1 + size[2]), outOffset);
      outOffset += size[2];
    }
  }

  return out;
}

function slice4d(
    xVals: backend_util.TypedArray, xStride: [number, number, number], begin: [number, number, number, number], size: [number, number, number, number]): void {

  let outOffset = 0;
  const beginI = begin[0];
  const beginJ = begin[1];
  const beginK = begin[2];
  const beginL = begin[3];

  for (let i = beginI; i < endI; i++) {
    for (let j = beginJ; j < endJ; j++) {
      for (let k = beginK; k < endK; k++) {
        const xStride1 = i * xStride[0] + j * xStride[1] + k * xStride[2];
        outVals.set(xVals.subarray(xStride1, xStride1 + size[3]), outOffset);
        outOffset += size[3];
      }
    }
  }

  return out;
}
const beginK = begin[2];
const endI = beginI + size[0];
const endJ = beginJ + size[1];
const endK = beginK + size[2];
const beginL = begin[3];
for (let i = beginI; i < endI; i++) {
  for (let j = beginJ; j < endJ; j++) {
    for (let k = beginK; k < endK; k++) {
      const offsets = i * xStride1 + j * xStride2 + k * xStride3 + beginL;
      outVals.set(xVals.subarray(xOffset, xOffset + size[3]), outOffset);
      outOffset += size[3];
    }
  }
}

export const sliceConfig: KernelConfig = {
  kernelName: 'Slice',
  backendName: 'wasm',
  kernelFunc: slice as {} as KernelFunc
};

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 */

import {BackendWasm} from '../backend_wasm';
import {reshape} from './Reshape';
import {slice} from './Slice';
import {transpose} from './Transpose';

function batchToSpaceND(args: {
  inputs: BatchToSpaceNDInputs,
  backend: BackendWasm,
  attrs: BatchToSpaceNDAttrs
}) {
  const {inputs, backend, attrs} = args;
  const {x} = inputs;
  const {blockShape, crops} = attrs;

  const prod = blockShape.reduce((a, b) => a * b);

  const reshaped = backend_util.getReshaped(x.shape, blockShape, prod);
  const permuted = backend_util.getPermuted(reshaped.length, blockShape.length);
  const reshapedPermuted = backend_util.getReshapedPermuted(x.shape, blockShape, prod);
  const sliceBeginCoords = backend_util.getSliceBeginCoords(crops, blockShape.length);
  const sliceSize = backend_util.getSliceSize(reshapedPermuted, crops, blockShape.length);

  const xReshaped = reshape({inputs: {x}, backend, attrs: {shape: reshaped}});
  const xTransposed = transpose({inputs: {x: xReshaped}, backend, attrs: {perm: permuted}});
  const xReshapedPermuted = reshape({inputs: {x: xTransposed}, backend, attrs: {shape: reshapedPermuted}});
  const result = slice({inputs: {x: xReshapedPermuted}, backend, attrs: {begin: sliceBeginCoords, size: sliceSize}});

  backend.disposeData(xReshaped.dataId);
  backend.disposeData(xTransposed.dataId);
  backend.disposeData(xReshaped.dataId);

  return result;
}

export const batchToSpaceNDConfig: KernelConfig = {
  kernelName: 'BatchToSpaceND',
  backendName: 'wasm',
  kernelFunc: batchToSpaceND as {} as KernelFunc
};

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 */

import {Cast, CastAttrs, CastInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';
import {TensorInfo} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

export function cast(
    args: {inputs: CastInputs, attrs: CastAttrs, backend: BackendWasm}):
    TensorInfo {
  const {inputs: {x}, attrs: {dtype}, backend} = args;
  const out = backend.makeOutput(x.shape, dtype);
  const inVals = backend.typedArrayFromHeap(x);
  const outVals = backend.typedArrayFromHeap(out);
  outVals.set(inVals);

  return out;
}

export const castConfig: KernelConfig = {
  kernelName: 'Cast',
  backendName: 'wasm',
  kernelFunc: cast as {} as KernelFunc
};

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=============================================================================

import {KernelConfig, Ceil} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';

export const ceilConfig: KernelConfig = createUnaryKernelConfig(Ceil);

/*=============================================================================

import {ClipByValue, ClipByValueAttrs, ClipByValueInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmClip: (xId: number, min: number, max: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmClip = backend.wasm.cwrap(ClipByValue, null /* void */, ['number', 'number', 'number', 'number']);
}

function clip(args: {
  inputs: ClipByValueInputs,
  backend: BackendWasm,
  attrs: ClipByValueAttrs
}) {
  const {inputs, backend, attrs} = args;
  const {x} = inputs;
  const {clipValueMin, clipValueMax} = attrs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  const out = backend.makeOutput(x.shape, x.dtype);
  const outId = backend.dataIdMap.get(out.dataId).id;
  wasmClip(xId, clipValueMin, clipValueMax, outId);
  return out;
}

export const clipByValueConfig: KernelConfig = {
  kernelName: ClipByValue,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: clip as {} as KernelFunc
};

/*=============================================================================

import {backend_util, Concat, ConcatAttrs, ConcatInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';
import {concatImplCPU} from '../kernel_utils/shared';
import {identity} from './Identity';
import {reshape} from './Reshape';

export function concat(args: {inputs: ConcatInputs, backend: BackendWasm, attrs: ConcatAttrs}) {
  const {inputs, backend} = args;
  const axis = util.parseAxisParam(args.attrs.axis, inputs[0].shape)[0];

  let outShape = backend_util.computeOutShape(inputs.map(t => t.shape), axis);

  // Keep only non-empty tensors (ignore tensors with 0 in their shape).
  const $inputs = inputs.filter(t => util.sizeFromShape(t.shape) > 0);
  if ($inputs.length === 1) {
    return identity({inputs: {x: $inputs[0]}, backend});
  }

  const out = backend.makeOutput(outShape, inputs[0].dtype);
  if (util.sizeFromShape(outShape) === 0) {
    return out;
  }

  const shapes = $inputs.map(t => t.shape);
  backend_util.assertParamsConsistent(shapes, axis);

  if ($inputs[0].dtype === 'string') {
    // Any concat of n-dimensional tensors across any axis can be reduced to a
    // concatenation of two-dimensional tensors across the axis 1 by first
    // partitioning the axes of the original tensors into those less than
    // axis to be concatenated and the rest. Then reshape the tensors
    // into a two-dimensional tensor by collapsing these two sets of axes and
    // concatenate the resulting matrices across the axis 1, finally reshaping
    // the result to have the proper shape. const inputs2D = $inputs.map(t => {
    // axis to be concatenated and the rest. Then reshape the tensors
    // into a two-dimensional tensor by collapsing these two sets of axes and
    // concatenate the resulting matrices across the axis 1, finally reshaping
    // the result to have the proper shape.
    const inputsValShapes = inputs2D.map(t => {
      const innerSize = util.sizeFromShape(t.shape, slice(axis));
      const shape = [-1, innerSize];
      return reshape({inputs: [t, backend, attrs: {shape}]});
    });
    const inputs = $inputs.map(t => {
      return {vals:...
backend.readSync(t.dataId), shape: t.shape};

    });

    // Concats 2d tensors along axis=1.
    outShape =
    backend_util.computeOutShape(inputs2D.map(t => t.shape), 1 /* axis */);
    const simplyConcat = inputs2D[0].shape[0] === 1;
    const outVals = concatImplCPU(
      inputsValShapes, outShape, inputs[0].dtype,
      simplyConcat) as string[];
    const finalOutShape =
    backend_util.computeOutShape(inputs.map(t => t.shape), axis);
    const outData = backend.dataIdMap.get(out.dataId);
    outData.stringBytes =
    backend_util.fromStringArrayToUint8(outVals);
    inputs2D.forEach(t => backendDisposeData(t.dataId));

    return out;
  }

  const batchDim = util.sizeFromShape($inputs[0].shape.slice(0, axis));
  let sumInnerDims = 0;
  const innerDims = $inputs.map(input => {
    const innerDim = util.sizeFromShape(input.shape.slice(axis));
    sumInnerDims += innerDim;
  });
  const inVals = $inputs.map(input =>
    backend.typedArrayFromHeap(input));
  const outVals = backend.typedArrayFromHeap(out);
  for (let b = 0; b < batchDim; b++) {
    let outOffset = b * sumInnerDims;
    for (let i = 0; i < inVals.length; i++) {
      const innerDim = innerDims[i];
      const inOffset = b * innerDim;
      const vals = inVals[i].subarray(inOffset, inOffset + innerDim);
      outVals.set(vals, outOffset);
      outOffset += innerDim;
    }
  }
  return out;
}

export const concatConfig: KernelConfig = {
  kernelName: Concat,
  backendName: 'wasm',
  kernelFunc: concat as {} as KernelFunc,
};
const out = backend.makeOutput(convInfo.outShape, 'float32');
const outId = backend.dataIdMap.get(out.dataId).id;
const wasmConv2d = backend.get('@tensorflow/tfjs-core').wasmConv2d;
const filterId = backend.dataIdMap.get(filter.dataId).id;
const filter = backend.getData(filterId);
const batchSize = filter.shape[0];
const topPad = filterHeight - 1 - convInfo.padInfo.top;
const leftPad = filterWidth - 1 - convInfo.padInfo.left;
const conv2DConfig = {kernels: [{name : 'W', id: outId},
  {name : 'X', id: xId, shape:[0], x.shape[0], x.shape[1], x.shape[2], filterId, filterHeight, filterWidth, padTop, padRight, padBottom, padLeft, isSamePad, dilationHeight, dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels, outId}];
return out;
}

export

const conv2DConfig: KernelConfig = {
  kernelName: Conv2D,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: conv2d as {} as KernelFunc,
};

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 */

import {backend_util, Conv2DBackpropInput, Conv2DBackpropInputAttrs, Conv2DBackpropInputInputs, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmConv2DBackpropInput: (
    dyId: number, filterId: number, batchSize: number,
    filterHeight: number,
    filterWidth: number, inHeight: number, inWidth: number, inChannels: number,
    outHeight: number, outWidth: number, outChannels: number, strideHeight: number, strideWidth: number,
    topPad: number, leftPad: number,
    inHeight: number, inWidth: number, inChannels: number,
    outHeight: number, outWidth: number, outChannels: number, strideHeight: number, strideWidth: number,
    topPad: number, leftPad: number,
    inHeight: number, inWidth: number, inChannels: number,
    outHeight: number, outWidth: number, outChannels: number, strideHeight: number, strideWidth: number,
    topPad: number, leftPad: number,
    inHeight: number, inWidth: number, inChannels: number,
    outHeight: number, outWidth: number, outChannels: number, strideHeight: number, strideWidth: number,
    topPad: number, leftPad: number,
    inHeight: number, inWidth: number, inChannels: number,
    outHeight: number, outWidth: number, outChannels: number, strideHeight: number, strideWidth: number,
    topPad: number, leftPad: number,
    inHeight: number, inWidth: number, inChannels: number,
    outHeight: number, outWidth: number, outChannels: number, strideHeight: number, strideWidth: number,
    topPad: number, leftPad: number,
    inHeight: number, inWidth: number, inChannels: number,
    outHeight: number, outWidth: number, outChannels: number, strideHeight: number, strideWidth: number,
    topPad: number, leftPad: number,
    inHeight: number, inWidth: number, inChannels: number,
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    topPad: number, leftPad: number,
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    outHeight: number, outWidth: number, outChannels: number, strideHeight: number, strideWidth: number,
    topPad: number, leftPad: number,
    inHeight: number, inWidth: number, inChannels: number,
    outHeight: number, outWidth: number, outChannels: number, strideHeight: number, strideWidth: number,
    topPad: number, leftPad: number,
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    outHeight: number, outWidth: number, outChannels: number, strideHeight: number, strideWidth: number,
    topPad: number, leftPad: number,
    inHeight: number, inWidth: number, inChannels: number,
    outHeight: number, outWidth: number, outChannels: number, strideHeight: number, strideWidth: number,
    topPad: number, leftPad: number,
    inHeight: number, inWidth: number, inChannels: number,
    outHeight: number, outWidth: number, outChannels: number, strideHeight: number, strideWidth: number,
    topPad: number, leftPad: number,
    inHeight: number, inWidth: number, inChannels: number,
    outHeight: number, outWidth: number, outChannels: number, strideHeight: number, strideWidth: number,
    topPad: number, leftPad: number,
xBatchStride, xRowStride, xColStride, xChannelStride, yBatchStride, yRowStride, yColStride,
yChannelStride, outId); return out;

export const conv2DBackpropInputConfig: KernelConfig = {
  kernelName: Conv2DBackpropInput,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: conv2DBackpropInput as {} as KernelFunc
};

export const conv2DBackpropInputConfig: KernelConfig = {
  kernelName: Conv2DBackpropInput,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: conv2DBackpropInput as {} as KernelFunc
};

export const conv2DBackpropInputConfig: KernelConfig = {
  kernelName: Conv2DBackpropInput,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: conv2DBackpropInput as {} as KernelFunc
};

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 */

import {Cos, KernelConfig} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';

export const cosConfig: KernelConfig = createUnaryKernelConfig(Cos);

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 */

import {Cosh, KernelConfig} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';

export const coshConfig: KernelConfig = createUnaryKernelConfig(Cosh);

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 */

import {CropAndResize, CropAndResizeAttrs, CropAndResizeInputs, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {cast} from './Cast';

// Must match enum in CropAndResize.cc
enum InterpolationMethod {
  bilinear = 0,
  nearest = 1
}

let wasmCropAndResize: (imagesId: number, boxesId: number, boxIndId: number, numBoxes: number,
  imagesShape: Uint8Array, cropHeight: number, cropWidth: number, method: number, extrapolationValue: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmCropAndResize = backend.wasm.cwrap(CropAndResize, null /*void*/, 
    'number',  // imagesId
    'number',  // boxesId
    'number',  // boxIndId
    'number',  // numBoxes
    'array',   // imagesShape
    'number',  // cropHeight
    'number',  // cropWidth
    'number',  // method
    'number',  // extrapolationValue
    'number'
  );
}

function cropAndResize(args: {
  backend: BackendWasm,
  inputs: CropAndResizeInputs,
  attrs: CropAndResizeAttrs
}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {method, extrapolationValue, cropSize} = attrs;
  const {image, boxes, boxInd} = inputs;

  const numBoxes = boxes.shape[0];
  const [cropHeight, cropWidth] = cropSize as [number, number];
  const outShape = [numBoxes, cropHeight, cropWidth, image.shape[3]];

  let imagesData = backend.dataIdMap.get(image.dataId);
  let castedData = cast({backend, inputs: {x: image}, attrs: {dtype: 'float32'}});
  const dataShape = castedData.shape[0];
  const outId = backend.dataIdMap.get(outShape, 'float32');
  const outId = backend.dataIdMap.get(outId, 'float32');

  let imagesData = backend.dataIdMap.get(image.dataId);
  let castedData = castedData.dataId;
  let const imagesId = imagesData.dataId;
  const const filesId = backend.dataIdMap.get(files.dataId).id;
  const const outId = backend.dataIdMap.get(outId, 'float32');
  const const outId = backend.dataIdMap.get(outId, 'float32');

  let imagesData = backend.dataIdMap.get(image.dataId);
  let castedData = castedData.dataId;
  let const imagesId = imagesData.dataId;
  const const filesId = backend.dataIdMap.get(files.dataId).id;
  const const outId = backend.dataIdMap.get(outId, 'float32');
  const const outId = backend.dataIdMap.get(outId, 'float32');

  let imagesData = backend.dataIdMap.get(image.dataId);
  let castedData = castedData.dataId;
  let const imagesId = imagesData.dataId;
  const const filesId = backend.dataIdMap.get(files.dataId).id;
  const const outId = backend.dataIdMap.get(outId, 'float32');
  const const outId = backend.dataIdMap.get(outId, 'float32');
imagesShapeBytes = new Uint8Array(new Int32Array(image.shape).buffer);

wasmCropAndResize(config: CropAndResizeConfig): TensorInfo {
  const {kernelName, componentName} = config;

  const cropAndResize = function cropAndResize(imageId, boxesId, boxIndId, numBoxes, imageShapeBytes, cropHeight, cropWidth, InterpolationMethod, scaleX, scaleY, extrapolationValue, outId) {
    if (castedData != null) {
      backend.disposeData(castedData.dataId);
    }
    return out;
  };

  wasmCropAndResize(config);

  return out;
}

export const cropAndResizeConfig: KernelConfig = {
  kernelName: CropAndResize,
  componentName: 'wasm',
  setupFunc: setup,
  kernelFunc: cropAndResize as {} as KernelFunc
};

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 */

import {backend_util, KernelConfig, KernelFunc, Cumsum, CumsumAttr, CumsumInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {CppDType} from './types';

import {Transpose} from './Transpose';

let wasmCumsum: (xId: number, exclusive: number, reverse: number, finalDim: number, outId: number, dtype: CppDType) => void;

function setup(backend: BackendWasm) {
  wasmCumsum = backend.wasm.cwrap(Cumsum, null /* void */, 
    'number', // x_id
    'number', // exclusive
    'number', // reverse
    'number', // final_dim
    'number', // out_id
    'number'  // dtype
  );
}

export function cumsum(args: {inputs: CumsumInputs, backend: BackendWasm, attrs: CumsumAttr}): TensorInfo {
  const {inputs, backend, attrs} = args;
  const {x} = inputs;
  const {axis, exclusive, reverse} = attrs;
  const xRank = x.shape.length;

  if (x.dtype === 'float32' || x.dtype === 'int32',
    () => `cumsum does not support ${x.dtype} tensors in the WASM backend`);
  // permute required axis
  const permutation = backend_util.getAxesPermutation([axis], xRank);
  let permutedX = x;

  if (permutation !== null) {
    permutedX = transpose({inputs: {x}, attrs: {perm: permutation}, backend});
  }

  const permutedAxis = backend_util.getInnerMostAxes(1, xRank)[0];
  backend_util.assertAxesAreInnerMostDims('cumsum', [permutedAxis], xRank);

  const permutedOut = backend.makeOutput(x.shape, CppDType(x.dtype));
  const permutedOutId = backend.dataIdMap.get(permutedOut.dataId);
  const permutedXId = backend.dataIdMap.get(x.dataId);

  wasmCumsum(permutedXId, exclusive ? 1 : 0, reverse ? 1 : 0,
    finalDim, permutedOutId, CppDType(x.dtype));

  // transpose data back if permuted
  let out = permutedOut;
  if (permutation !== null) {
    const undoPermutation = backend_util.getUndoAxesPermutation(permutation);
    out = transpose({inputs: {x: permutedOut}, attrs: {perm: undoPermutation}, backend});
  }

  return out;
}

export const cumsumConfig: KernelConfig = {
  kernelName: Cumsum,
  componentName: 'wasm',
  setupFunc: setup,
  kernelFunc: cumsum as {} as KernelFunc
};

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 */

import {DepthToSpace, DepthToSpaceAttr, DepthToSpaceInputs, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmDepthToSpace:
    (xId: number, blockSize: number, channelsLast: number, xStrides: Uint8Array, xStridesLength: number, outputShape: Uint8Array, outputStrides: Uint8Array) => void;

function setup(backend: BackendWasm) {
  wasmDepthToSpace = backend.wasm.cwrap(DepthToSpace, null /* void */, 
    'number', // x_id
    'number', // blockSize
    'number', // channelsLast
    'number', // xStrides
    'number', // xStridesLength
    'number', // outputShape
    'number', // outputStrides
    'number', // outputStridesLength
    'number'  // dtype
  );
}

export function depthToSpace(args: {inputs: DepthToSpaceInputs, backend: BackendWasm, attrs: DepthToSpaceAttr}): TensorInfo {
  const {inputs, backend, attrs} = args;
  const {x} = inputs;
  const {blockSize, channelsLast, xStrides, xStridesLength, outputShape, outputStrides} = attrs;

  if (x.dtype === 'float32' || x.dtype === 'int32',
    () => `depthToSpace does not support ${x.dtype} tensors in the WASM backend`);
  // permute required axis
  const permutation = backend_util.getAxesPermutation([axis], xRank);
  let permutedX = x;

  if (permutation !== null) {
    permutedX = transpose({inputs: {x}, attrs: {perm: permutation}, backend});
  }

  const permutedAxis = backend_util.getInnerMostAxes(1, xRank)[0];
  backend_util.assertAxesAreInnerMostDims('depthToSpace', [permutedAxis], xRank);

  const permutedOut = backend.makeOutput(permutedX.shape, CppDType(x.dtype));
  const permutedOutId = backend.dataIdMap.get(permutedOut.dataId);
  const permutedXId = backend.dataIdMap.get(x.dataId);

  wasmDepthToSpace(permutedXId, blockSize, channelsLast, xStrides, xStridesLength, outputShape, outputStrides);

  // transpose data back if permuted
  let out = permutedOut;
  if (permutation !== null) {
    const undoPermutation = backend_util.getUndoAxesPermutation(permutation);
    out = transpose({inputs: {x: permutedOut}, attrs: {perm: undoPermutation}, backend});
  }

  return out;
}

export const depthToSpaceConfig: KernelConfig = {
  kernelName: DepthToSpace,
  componentName: 'wasm',
  setupFunc: setup,
  kernelFunc: depthToSpace as {} as KernelFunc
};
setup(backend: BackendWasm): void | wasmDepthToSpace = backend.wasm.cwrap(DeepToSpace, null /*void*/, [ 'number', 'xId' number, 'blockSize' number, 'channelsLast' array, 'xStrides' number, 'array', 'outputShape' array, 'number', 'outputStride' number, 'outputSize' number, 'outId' ]); wasmDepthToSpace(xId, batchSize, x.shape[0], x.shape[1], x.shape[2], x.shape[3], xStrides, outputShape, outId);

export function depthToSpace(args: { backend: BackendWasm, inputs: DepthToSpaceInputs, attr: DepthToSpaceAttr });: TensorSizeInfo { const [backend, inputs, attr] = args; const { x } = inputs; const { blockSize, dataFormat } = attr; const batchSize = x.shape[0]; const inputHeight = (dataFormat === 'NHWC') ? x.shape[1] : x.shape[2]; const inputWidth = (dataFormat === 'NHWC') ? x.shape[3] : x.shape[1]; const outputHeight = inputHeight * blockSize; const outputWidth = inputWidth * blockSize; const outputDepth = inputDepth / (blockSize * blockSize); const outputShape = (dataFormat === 'NHWC') ? [batchSize, outputHeight, outputWidth, outputDepth] : [batchSize, outputDepth, outputHeight, outputWidth]; const out = backend.makeOutput(outputShape, 'float32'); const xData = backend.dataIdMap.get(x.dataId); const xId = xData.id; const xStridesBytes = new Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);

export function depthToSpace(args: { backend: BackendWasm, inputs: DepthToSpaceInputs, attr: DepthToSpaceAttr });: TensorSizeInfo { const { x } = inputs; const { batchSize, dataFormat } = attr; const batchSize = x.shape[0]; const inputHeight = (dataFormat === 'NHWC') ? x.shape[1] : x.shape[2]; const inputWidth = (dataFormat === 'NHWC') ? x.shape[3] : x.shape[1]; const outputHeight = inputHeight * blockSize; const outputWidth = inputWidth * blockSize; const outputDepth = inputDepth / (blockSize * blockSize); const outputShape = (dataFormat === 'NHWC') ? [batchSize, outputHeight, outputWidth, outputDepth] : [batchSize, outputDepth, outputHeight, outputWidth]; const out = backend.makeOutput(outputShape, 'float32'); const xData = backend.dataIdMap.get(x.dataId); const xId = xData.id; const xStridesBytes = new Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);

const outputSize = new Uint8Array(new Int32Array(outputShape).buffer);

export function depthToSpace(args: { backend: BackendWasm, inputs: DepthToSpaceInputs, attr: DepthToSpaceAttr });: TensorSizeInfo { const { x } = inputs; const { batchSize, dataFormat } = attr; const batchSize = x.shape[0]; const inputHeight = (dataFormat === 'NHWC') ? x.shape[1] : x.shape[2]; const inputWidth = (dataFormat === 'NHWC') ? x.shape[3] : x.shape[1]; const outputHeight = inputHeight * blockSize; const outputWidth = inputWidth * blockSize; const outputDepth = inputDepth / (blockSize * blockSize); const outputShape = (dataFormat === 'NHWC') ? [batchSize, outputHeight, outputWidth, outputDepth] : [batchSize, outputDepth, outputHeight, outputWidth]; const out = backend.makeOutput(outputShape, 'float32'); const xData = backend.dataIdMap.get(x.dataId); const xId = xData.id; const xStridesBytes = new Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);

export function depthToSpace(args: { backend: BackendWasm, inputs: DepthToSpaceInputs, attr: DepthToSpaceAttr });: TensorSizeInfo { const { x } = inputs; const { batchSize, dataFormat } = attr; const batchSize = x.shape[0]; const inputHeight = (dataFormat === 'NHWC') ? x.shape[1] : x.shape[2]; const inputWidth = (dataFormat === 'NHWC') ? x.shape[3] : x.shape[1]; const outputHeight = inputHeight * blockSize; const outputWidth = inputWidth * blockSize; const outputDepth = inputDepth / (blockSize * blockSize); const outputShape = (dataFormat === 'NHWC') ? [batchSize, outputHeight, outputWidth, outputDepth] : [batchSize, outputDepth, outputHeight, outputWidth]; const out = backend.makeOutput(outputShape, 'float32'); const xData = backend.dataIdMap.get(x.dataId); const xId = xData.id; const xStridesBytes = new Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);

export function depthToSpace(args: { backend: BackendWasm, inputs: DepthToSpaceInputs, attr: DepthToSpaceAttr });: TensorSizeInfo { const { x } = inputs; const { batchSize, dataFormat } = attr; const batchSize = x.shape[0]; const inputHeight = (dataFormat === 'NHWC') ? x.shape[1] : x.shape[2]; const inputWidth = (dataFormat === 'NHWC') ? x.shape[3] : x.shape[1]; const outputHeight = inputHeight * blockSize; const outputWidth = inputWidth * blockSize; const outputDepth = inputDepth / (blockSize * blockSize); const outputShape = (dataFormat === 'NHWC') ? [batchSize, outputHeight, outputWidth, outputDepth] : [batchSize, outputDepth, outputHeight, outputWidth]; const out = backend.makeOutput(outputShape, 'float32'); const xData = backend.dataIdMap.get(x.dataId); const xId = xData.id; const xStridesBytes = new Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);
const padLeft = convInfo.padInfo.left;
const dilationHeight = convInfo.dilationHeight;
const dilationWidth = convInfo.dilationWidth;
const strideHeight = convInfo.strideHeight;
const strideWidth = convInfo.strideWidth;
const inputChannels = convInfo.inChannels;
const outputChannels = convInfo.outChannels;
const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;

if (convInfo.dataFormat !== 'channelsLast') {
  throw new Error("wasm backend DepthwiseConv2dNative does not support dataFormat: " + $\{convInfo.dataFormat\}. Please use 'channelsLast'.");
}

const out = backend.makeOutput(convInfo.outShape, 'float32');
const outId = backend.dataIdMap.get(out.dataId).id;

wasmDepthwiseConv2d(xId, x.shape[0], x.shape[1], x.shape[2], filterId, filterHeight, filterWidth, padTop, padRight, padBottom, padLeft, isSamePad, dilationHeight, dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels, outId);

return out;

export const depthwiseConv2dNativeConfig: KernelConfig = {
  kernelName: DepthwiseConv2dNative,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: depthwiseConv2d as {} as KernelFunc
};

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 */

import {Elu, KernelConfig} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';

export const eluConfig: KernelConfig = createUnaryKernelConfig(Elu);

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 */

import {Equal, KernelConfig} from '@tensorflow/tfjs-core';

import {createBinaryKernelConfig} from './binary_kernel';

const supportsFullBroadcast = false;
export const equalConfig: KernelConfig = createBinaryKernelConfig(Equal, supportsFullBroadcast, 'bool');

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 */

import {Exp, KernelConfig} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';

export const expConfig: KernelConfig = createUnaryKernelConfig(Exp, 'float32');

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 */

import {ExpandDims, ExpandDimsAttrs, ExpandDimsInputs, KernelConfig, KernelFunc, util} from
import {BackendWasm, ExpandDims, TensorInfo} from '@tensorflow/tfjs-core';

export function expandDims(args: {
  inputs: ExpandDimsInputs,
  attrs: ExpandDimsAttrs,
  backend: BackendWasm
}) {
  const {inputs, attrs, backend} = args;
  const {input} = inputs;
  const {dim} = attrs;
  const inputRank = input.shape.length;
  const newShape = input.shape.slice();
  let $dim = dim;
  if ($dim < 0) {
    // Negative value is counted from the tail of rank.
    util.assert(-inputRank + 1 <= dim,
        () => `Axis must be in the interval [${- (inputRank + 1)}, ${inputRank}]`);
    $dim = inputRank + dim + 1;
  }
  newShape.splice($dim, 0, 1);
  return reshape({inputs: {x: input}, backend, attrs: {shape: newShape}});
}

export const expandDimsConfig: KernelConfig = {
  kernelName: ExpandDims,
  backendName: 'wasm',
  kernelFunc: expandDims as {} as KernelFunc,
};

import {KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';

export function fill(args: {attrs: FillAttrs, backend: BackendWasm}) {
  const {attrs: {shape, value, dtype}, backend} = args;
  const out = backend.makeOutput(shape, dtype);
  const outVals = backend.typedArrayFromHeap(out);
  outVals.fill(value as number);
  return out;
}

export const fillConfig: KernelConfig = {
  kernelName: Fill,
  backendName: 'wasm',
  kernelFunc: fill as {} as KernelFunc,
};

import {FlipLeftRight, FlipLeftRightInputs, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-core';

function setup(backend: BackendWasm) {
  wasmFlipLeftRight = backend.wasm.cwrap(FlipLeftRight, null /* void */, [
    'number',  // xId
    'number',  // batch
    'number',  // numChannels
    'number',  // output
  ]);}

export function flipLeftRight(args: {inputs: FlipLeftRightInputs, backend: BackendWasm}) {
  const {inputs, backend} = args;
  const {image} = inputs;
  const out = backend.makeOutput(image.shape, image.dtype);
  const imageId = backend.dataIdMap.get(image.dataId).id;
  const outputId = backend.dataIdMap.get(out.dataId).id;
  const [batch, imageHeight, numChannels] = image.shape;
  wasmFlipLeftRight(imageId, batch, numChannels, outputId, numChannels);
  return out;
}

export const flipLeftRightConfig: KernelConfig = {
  kernelName: FlipLeftRight,
  backendName: 'wasm',
  kernelFunc: flipLeftRight as {} as KernelFunc,
  setupFunc: setup
};
```javascript
import { Floor, KernelConfig } from '@tensorflow/tfjs-core';

import { createUnaryKernelConfig } from './unary_kernel';
export const floorConfig: KernelConfig = createUnaryKernelConfig(Floor);

import { FloorDiv, KernelConfig } from '@tensorflow/tfjs-core';

import { createBinaryKernelConfig } from './binary_kernel';

const supportsFullBroadcast = false;
export const floorDivConfig: KernelConfig =
    createBinaryKernelConfig(FloorDiv, supportsFullBroadcast);

import { FusedBatchNorm, FusedBatchNormAttrs, FusedBatchNormInputs, KernelConfig, KernelFunc, TensorInfo, util } from '@tensorflow/tfjs-core';

import { BackendWasm } from '../backend_wasm';

let wasmBatchNorm: (
    xId: number, meanId: number, varianceId: number, offsetId: number,
    scaleId: number, varianceEpsilon: number, outId: number) => void;

function setup(backend: BackendWasm): void {
    wasmBatchNorm = backend.wasm.cwrap(
        FusedBatchNorm, null /* void */, 
        ['number', 'number',
        'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number']);
    backend.functionSetup(backend, wasmBatchNorm): void {
        wasmBatchNorm = backend.wasm.cwrap(backend, FusedBatchNorm, null /* void */, 
        ['number', 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number']);
    }
}

function fusedBatchNorm(args: {
    backend:
    BackendWasm,
    inputs:
    FusedBatchNormInputs,
    attrs:
    FusedBatchNormAttrs
}: {
    // Short-circuit zero-sized tensors.
    if (util.sizeFromShape(x.shape) === 0) { return out; }
})
    const xId = backend.dataIdMap.get(x.dataId).id;
    const meanId = backend.dataIdMap.get(mean.dataId).id;
    const varianceId = backend.dataIdMap.get(variance.dataId).id;
    const offsetId = offset != null ? backend.dataIdMap.get(offset.dataId).id : 0;
    const scaleId = scale != null ? backend.dataIdMap.get(scale.dataId).id : 0;
    const out = backend.makeOutput(x.shape, x.dtype);
    wasmBatchNorm(xId, meanId, varianceId, offsetId, scaleId,
        varianceEpsilon, outId);
    return out;

export const fusedBatchNormConfig: KernelConfig = {
    kernelName: FusedBatchNorm,
    backendName: 'wasm',
    setupFunc: fusedBatchNorm as {} as KernelFunc
};

import { backend_util, FusedConv2D, FusedConv2DAttrs, FusedConv2DInputs, KernelConfig, KernelFunc, Tensor4D } from '@tensorflow/tfjs-core';

import { BackendWasm } from '../backend_wasm';

import { FusableActivation } from './types';

let wasmFusedConv2d:
    (xId: number, batchSize: number, inputHeight:
    number, inputWidth: number,
    filterId: number, filterHeight: number, filterWidth: number,
    biasId: number,
    kernelName: FusedConv2D,
    backendName: 'wasm',
    setupFunc: setup, kernelFunc: fusedBatchNorm as {} as KernelFunc
}: {
    // Short-circuit zero-sized tensors.
    if (util.sizeFromShape(x.shape) === 0) { return out; }
};
```
padTop: number, padRight: number, padBottom: number, padLeft: number, isSamePad: number, dilationHeight: number, dilationWidth: number, strideHeight: number, strideWidth: number, inputChannels: number, outputChannels: number, activation: number, preluActivationWeightsId: number, leakyreluAlpha: number, outId: number} => void;

function setup(backend: BackendWasm) {
  wasmFusedConv2d = backend.wasm.cwrap(FusedConv2D, null /* void */, ['number', ...]);

  function fusedConv2d(inputs: FusedConv2DInputs, backend: BackendWasm, attrs: FusedConv2DAttrs) {
    const {inputs, attrs, backend} = args;
    const {x, filter, bias, preluActivationWeights} = inputs;
    const {strides, pad, dilations, dataFormat, dimRoundingMode, activation, leakyreluAlpha} = attrs;
    const convInfo = backend_util.computeConv2DInfo(x as Tensor4D, filter as Tensor4D, strides, dilations, dataFormat, dimRoundingMode);

    const fusedActivation = FusableActivation[activation as {} as keyof typeof FusableActivation];
    if (fusedActivation == null) {
      throw new Error(`FusableActivation[activation as {} as keyof typeof FusableActivation] not supported for FusedConv2D`);
    }

    const xId = backend.dataIdMap.get(x.dataId).id;
    const filterId = backend.dataIdMap.get(filter.dataId).id;
    const outputChannels = convInfo.outChannels;
    const biasId = 0;
    if (bias != null) {
      const biasData = backend.dataIdMap.get(bias.dataId);
      if (biasData.shape.length !== 1) {
        throw new Error(`FusedConv2D only supports rank-1 bias but got rank ${biasData.shape.length}.`);
      }
      if (biasData.shape[0] !== outputChannels) {
        throw new Error(`FusedConv2D bias shape (${biasData.shape}) does not match the number of output channels`);
      }
      biasId = biasData.id;
    }

    const filterHeight = convInfo.filterHeight;
    const filterWidth = convInfo.filterWidth;
    const padTop = convInfo.padInfo.top;
    const padRight = convInfo.padInfo.right;
    const padBottom = convInfo.padInfo.bottom;
    const padLeft = convInfo.padInfo.left;
    const dilationHeight = convInfo.dilationHeight;
    const dilationWidth = convInfo.dilationWidth;
    const strideHeight = convInfo.strideHeight;
    const strideWidth = convInfo.strideWidth;
    const inputChannels = convInfo.inChannels;
    const isSamePad = convInfo.type === 'SAME' ? 1 : 0;
    const batchSize = convInfo.batchSize;
    const inHeight = convInfo.inHeight;
    const inWidth = convInfo.inWidth;

    if (dataFormat !== 'NHWC') {
      throw new Error(`wasm backend FusedConv2D does not support dataFormat:'${dataFormat}'. Please use 'NHWC'`);
    }

    const out = backend.makeOutput(convInfo.outShape, 'float32');
    const outId = backend.dataIdMap.get(out.dataId).id;
    const preluActivationWeightsId = preluActivationWeightsId || 0;

    const kernelConfig = {
      kernelName: FusedConv2D,
      backend: 'wasm',
      setupFunc: setupFunc, setup, kernelFunc: fusedConv2d as {} as KernelFunc
    };

    return out;
  }

  export const fusedConv2DConfig: KernelConfig = {
    kernelName: FusedConv2D,
    backendName: 'wasm',
    setupFunc: setupFunc, setup, kernelFunc: fusedConv2d as {} as KernelFunc
  };
import {backend_util, FusedDepthwiseConv2D, FusedDepthwiseConv2DAttrs, FusedDepthwiseConv2DInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {FusableActivation} from './types';

let wasmFusedDepthwiseConv2d:
    (xId: number, batchSize: number, inputHeight: number, inputWidth: number,
     filterId: number, filterHeight: number, filterWidth: number,
     biasId: number, padTop: number, padRight: number, padBottom: number, padLeft: number, isSamePad: number, dilationHeight: number, dilationWidth: number, strideHeight: number, strideWidth: number, inputChannels: number, outputChannels: number, activation: number, preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>
     void;

function setup(backend: BackendWasm) {
  wasmFusedDepthwiseConv2d =
    backend.wasm.cwrap(FusedDepthwiseConv2D, null /* void */, 
        ['number',  // xId
         'number',  // batchSize
         'number',  // inputHeight
         'number',  // inputWidth
         'number',  // filterId
         'number',  // filterHeight
         'number',  // filterWidth
         'number',  // biasId
         'number',  // padTop
         'number',  // padRight
         'number',  // padBottom
         'number',  // padLeft
         'number',  // isSamePad
         'number',  // dilationHeight
         'number',  // dilationWidth
         'number',  // strideHeight
         'number',  // strideWidth
         'number',  // inputChannels
         'number',  // outputChannels
         'number',  // activation
         'number',  // preluActivationWeightsId
         'number',  // leakyreluAlpha
         'number',  // outId
       ]);}

function fusedDepthwiseConv2d(args: {
  inputs: FusedDepthwiseConv2DInputs,
  backend: BackendWasm,
  attrs: FusedDepthwiseConv2DAttrs
}) {
  const {inputs, attrs, backend} = args;
  const {x, filter, bias, preluActivationWeights} = inputs;
  const {
    strides,
    pad,
    dilations,
    dataFormat,
    dimRoundingMode,
    activation,
    leakyreluAlpha
  } = attrs;

  const convInfo =
    backend_util.computeConv2DInfo(
        (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,
        pad, dimRoundingMode, true /* depthwise */);

  const fusedActivation =
      FusableActivation[activation as {} as keyof typeof FusableActivation];
  if (fusedActivation == null) {
    throw new Error(
        `${activation} activation not yet supported for FusedDepthwiseConv2D ` +
        `in the wasm backend.`);
  }

  const xId =
    backend.dataIdMap.get(x.dataId).id;
  const filterId = backend.dataIdMap.get(filter.dataId).id;

  const outputChannels = convInfo.outChannels;
  let biasId = 0;
  if (bias != null) {
    const biasData =
        backend.dataIdMap.get(bias.dataId);
    if (biasData.shape.length !== 1) {
      throw new Error(
          `FusedDepthwiseConv2D only supports rank-1 bias but got ` +
          `rank ${biasData.shape.length}.`);
    }
    if (biasData.shape[0] !== outputChannels) {
      throw new Error(
          `FusedDepthwiseConv2D bias shape ` +
          `(${biasData.shape}) does not ` +
          `match the number of output channels ` +
          `(${outputChannels})`);
    }
    biasId = biasData.id;
  }

  const filterHeight = convInfo.filterHeight;
  const filterWidth =
    convInfo.filterWidth;
  const padTop = convInfo.padInfo.top;
  const padRight = convInfo.padInfo.right;
  const padBottom = convInfo.padInfo.bottom;
  const padLeft = convInfo.padInfo.left;
  const dilationHeight =
    convInfo.dilationHeight;
  const dilationWidth =
    convInfo.dilationWidth;
  const strideHeight =
    convInfo.strideHeight;
  const strideWidth =
    convInfo.strideWidth;
  const inputChannels =
    convInfo.inChannels;
  const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;
  const batchSize =
    convInfo.batchSize;
  const inHeight =
    convInfo.inHeight;
  const inWidth =
    convInfo.inWidth;
  if (dataFormat !== 'NHWC') {
    throw new Error(
        `wasm backend FusedDepthwiseConv2D does not support ` +
        `dataFormat:'${dataFormat}'. Please use 'NHWC'.`);
  }

  const outId =
    backend.makeOutput(convInfo.outShape, 'float32');
  const out =
    backend.dataIdMap.get(out.dataId).id;

  const preluActivationWeightsId =
    preluActivationWeights == null ?
        0 :
    backend.dataIdMap.get(preluActivationWeights.dataId).id;
  const leakyreluAlpha =
    leakyreluAlpha || 0;

  const kernelConfig = {
    kernelName: FusedDepthwiseConv2D,
    backendConfig: 
      'wasm',
    setupFunc: setup,
    kernelFunc: FusedDepthwiseConv2D as {} as KernelFunc,
  };

code
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=============================================================================

import {gather_util, GatherNd, GatherNdInputs, KernelConfig, TensorInfo} from '@tensorflow/tfjs-
core\n
import {BackendWasm} from '../backend_wasm';

import {CppDType} from './types';

let wasmGatherNd: (xId: number, dtype: CppDType, indicesId: number, numSlices: number, sliceRank: number, sliceSize: number, strides: Uint8Array, outId: number) => void = void\n
function setup(backend: BackendWasm): void {
  wasmGatherNd = backend.wasm.cwrap(GatherNd, null /*void*/, [\n    'number',  // xId\n    'number',  // dtype\n    'number',  // indicesId\n    'number',  // numSlices\n    'number',  // sliceRank\n    'array', // strides\n    'number' // outId\n  ]);\n}

function gatherNd(args: {backend: BackendWasm, inputs: GatherNdInputs}): TensorInfo {
  const {backend, inputs} = args;
  const {params, indices} = inputs;

  const [resultShape, numSlices, sliceSize, strides] = gather_util.prepareAndValidate(params, indices);

  const xData = backend.dataIdMap.get(params.dataId);
  const xId = xData.id;
  const indicesData = backend.dataIdMap.get(indices.dataId);
  const indicesId = indicesData.id;

  const stridesBytes = new Uint8Array(new Int32Array(strides).buffer);
  const outId = backend.dataIdMap.get(out.dataId).id;

  wasmGatherNd(xId, CppDType[params.dtype], indicesId, numSlices, sliceRank, sliceSize, stridesBytes, outId);

  return out;
}

export const gatherNdConfig: KernelConfig = {
  kernelName: GatherNd,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: gatherNd
};

=============================================================================

import {backend_util, GatherV2, GatherV2Attrs, GatherV2Inputs, KernelConfig, KernelFunc, Tensor, TensorInfo, TypedArray, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '...

import {reshape} from './Reshape';
import {CppDType} from './types';

let wasmGatherV2: (xId: number, dtype: CppDType, xStrides: number, sliceSize: number, indicesId: number, batchSize: number, outStrides: Uint8Array, outId: number) => void = void;

function setup(backend: BackendWasm): void {
  wasmGatherV2 = backend.wasm.cwrap('Gather', null /*void*/, [\n    'number',  // xId\n    'number',  // dtype\n    'array', // xStrides\n    'number', // sliceSize\n    'number', // indicesId\n    'number', // batchSize\n    'array', // outStrides\n    'number' // outId\n  ]);
}

function gatherV2(args: {backend: BackendWasm, inputs: GatherV2Inputs, attrs: GatherV2Attrs}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {x, indices} = inputs;
  const [axis, batchDims] = attrs;

  const parsedAxis = util.parseAxisParam(axis, x.shape)[0];

  const indicesData = backend.readSync(indices.dataId) as TypedArray;

  const index = indicesData[parsedAxis];

  if (parsedAxis === 0) {
    const indexShape = indices.shape.slice(parsedAxis + 1);
    const indexShapeLength = indexShape.length - 1;
    const flatShape = backend.dataIdMap.get(out.dataId);
    const xData = backend.dataIdMap.get(x.dataId);
    const xId = xData.id;

    const indicesId = indicesData.id;
    const stridesBytes = new Uint8Array(new Int32Array(indices.strides).buffer);
    const outId = backend.dataIdMap.get(out.dataId).id;

    wasmGatherNd(xId, CppDType[x.dtype], indicesId, 1, x.shape.length - 1, x.shape, indices.dataId, flatShape.id, xId, 0, x.shape, x.shape, 0, x.shape, 0, outId);

    return out;
  }

  const parsedDims = batchDims.map(dim => dim === axis ? -1 : dim);

  const out = backend.dataIdMap.get(out.dataId);

  const flatShape = backend.dataIdMap.get(x.dataId);

  const xId = xData.id;

  const indicesId = indicesData.id;
  const stridesBytes = new Uint8Array(new Int32Array(indices.strides).buffer);
  const outId = backend.dataIdMap.get(out.dataId).id;

  wasmGatherNd(xId, CppDType[x.dtype], indicesId, 1, x.shape.length - 1, x.shape, indices.dataId, flatShape.id, xId, 0, x.shape, x.shape, 0, x.shape, 0, outId);

  return out;
}

export const gatherV2Config: KernelConfig = {
  kernelName: GatherV2,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: gatherV2
};
```javascript
{ shape: [shapeInfo.batchSize, indicesSize / shapeInfo.batchSize], \n  backend\n};

const flattenOutputShape =[
  \n  shapeInfo.batchSize, shapeInfo.outSize, indicesSize / shapeInfo.batchSize, \n  shapeInfo.sliceSize\n];

const out = backend.makeOutput(flattenOutputShape, x.dtype);
if (util.sizeFromShape(x.shape) === 0) {
  return out;
}
const stridesSize = flattenX.shape.length - 1;
const xData = backend.dataIdMap.get(flattenX.dataId);
const xId = xData.id;
const indicesData = backend.dataIdMap.get(flattenIndex.dataId);
const indicesId = indicesData.id;
const outId = backend.dataIdMap.get(out.dataId).

const xStridesBytes = new Uint8Array(new Int32Array(util.computeStrides(flattenX.shape)).buffer);
const outStridesBytes = new Uint8Array(new Int32Array(util.computeStrides(flattenOutputShape)).buffer);

wasmGather(xId, CppDType[x.dtype], xStridesBytes, stridesId, indicesId, \n  shapeInfo.batchSize, outStridesBytes, outId);

backend.disposeData(flattenX.dataId);
backend.disposeData(flattenIndex.dataId);

out.shape = shapeInfo.outputShape;
return out;
}

export const gatherV2Config: KernelConfig = {
  kernelName: GatherV2, \n  backendName: 'wasm', \n  setupFunc: setup, \n  kernelFunc: gatherV2 as {} as KernelFunc\n};

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 */
import {Greater, KernelConfig} from '@tensorflow/tfjs-core';

import {createBinaryKernelConfig} from './binary_kernel';

const supportsFullBroadcast = false;
export const greaterConfig: KernelConfig = createBinaryKernelConfig(Greater, supportsFullBroadcast, 'bool');

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 */

import {KernelConfig, KernelFunc, LeakyRelu, LeakyReluAttrs, LeakyReluInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {CppDType} from './types';

let wasmFunc: (xId: number, dtype: number, leakyreluAlpha: number, outId: number) => void;

function setupFunc(backend: BackendWasm): void {
  wasmFunc = backend.wasm.cwrap(LeakyRelu, null /* void */, [
    'number',  // x_id
    'number',  // dtype
    'number',  // leakyrelu_alpha
    'number'   // out_id
  ]);
}

export function leakyRelu(args:
    {inputs: LeakyReluInputs, attrs: LeakyReluAttrs,
     backend: BackendWasm}):
    TensorInfo {
  const {inputs: {x}, attrs: {alpha}, backend} = args;

  const xId = backend.dataIdMap.get(x.dataId);
  // According to TF API, LeakyRelu returns float32 when input is either
```
```javascript
float32 \n // or int32 \n const out = backend.makeOutput(x.shape, 'float32'); \n if (util.sizeFromShape(x.shape) !== 0) {
 \n    const outId = backend.dataIdMap.get(out.dataId).id; \n    wasmFunc(xId, CppDType[x.dtype], alpha, outId); \n    return out; \n}\nexport const leakyReluConfig: KernelConfig = {
    \n    kernelName: LeakyRelu, \n    backendName: wasm, \n    setupFunc, \n    kernelFunc: leakyRelu as {} as KernelFunc, \n    /* @license */
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```

```javascript
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 */

```
import {backend_util, KernelConfig, KernelFunc, Max, MaxAttrs, MaxInputs, TensorInfo, util} from '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';

let wasmMax: (xId: number, dtype: number, reduceSize: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmMax = backend.wasm.cwrap(Max, null /*void*/, 
    'number',  // x_id
    'number',  // dtype
    'number',  // reduce_size
    'number',  // out_id
  );
}

function max(args: {backend: BackendWasm, inputs: MaxInputs, attrs: MaxAttrs}):
    TensorInfo {
  const {backend, inputs, attrs} = args;
  const {reductionIndices: axis, keepDims} = attrs;
  const {x} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  let inputId = xId;
  let input = x;

  const {transposed, axes, originalAxes, inputWasTransposed} =
      permuteAxesAndTranspose(x, axis, backend);

  if (inputWasTransposed) {
    const transposedId = backend.dataIdMap.get(transposed.dataId).id;
    input = transposed;
    inputId = transposedId;
  }

  const inputRank = input.shape.length;
  backend_util.assertAxesAreInnerMostDims('max', axes, originalAxes);
  const [outShape, reduceShape] =
    backend_util.computeOutAndReduceShapes(input.shape, axes);
  const reduceSize = util.sizeFromShape(reduceShape);

  const out = backend.makeOutput(outShape, x.dtype);
  if (util.sizeFromShape(input.shape) !== 0) {
    const outId = backend.dataIdMap.get(out.dataId).id;
    wasmMax(inputId, CppDType[x.dtype], reduceSize, outId);
  }

  if (inputWasTransposed) {
    // dispose of the transposed tensor.
    backend.disposeData(transposed.dataId);
  }

  if (keepDims) {
    // reshape
    const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);
    out.shape = newShape;
  }

  return out;
}

export const maxConfig: KernelConfig = {
  kernelName: Max,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: max as {} as KernelFunc
};
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padTop
    'number',  // padRight
    'number',  // padBottom
    'number',  // padLeft
    'number',  // dilationHeight
    'number',  // dilationWidth
    'number',  // strideHeight
    'number',  // strideWidth
    'number',  // inputChannels
    'number',  // outputChannels
    'number',  // outId
  ]);

function maxPool disadvantages float32 as use npack which only supports float32 add the following assert only for the WASM backend instead of at core opn // level.n /n // TODO: add support for int32 input as util.assert(x.dtype == 'float32')
    'number',  // dilationHeight
    'number',  // dilationWidth
    'number',  // strideHeight
    'number',  // strideWidth
    'number',  // inputChannels
    'number',  // outputChannels
    'number',  // outId
  ]);

const {filterSize, strides, pad, dimRoundingMode} = attrs;
const convInfo = backend_util.computePool2DInfo(x.shape, filterSize, strides, 1 /* dilations */, pad, dimRoundingMode); const filterHeight = convInfo.filterHeight;
const filterWidth = convInfo.filterWidth;
const padTop = convInfo.padTop;
const padRight = convInfo.padRight;
const padBottom = convInfo.padBottom;
const padLeft = convInfo.padLeft;
const dilationHeight = convInfo.dilationHeight;
const dilationWidth = convInfo.dilationWidth;
const strideHeight = convInfo.strideHeight;
const strideWidth = convInfo.strideWidth;
const inputChannels = convInfo.inChannels;
const outputChannels = convInfo.outChannels;
if (convInfo.dataFormat !== 'channelsLast') { throw new Error('wasm backend does not support dataFormat: ' + convInfo.dataFormat). Please use 'channelsLast'.
}

const out = backend.makeOutput(convInfo.outShape, 'float32');
const outId = backend.dataIdMap.get(out.dataId).id;
const inputId = backend.dataIdMap.get(x.dataId).id;

wasmMaxPool(xId, x.shape[0], x.shape[1], x.shape[2], filterHeight, filterWidth, padTop, padRight, padBottom, dilationHeight, dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels, outId); return out;

export const maxPoolConfig: KernelConfig = {
  kernelName: MaxPool,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: maxPool
};

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 *
 *=============================================================================
 */

import {backend_util, KernelConfig, KernelFunc, Mean, MeanAttrs, MeanInputs, TensorInfo, util} from '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';
import {cast} from './Cast';
import {permuteAxesAndTranspose} from './kernel_utils';

let wasmMean: (xId: number, reduceSize: number, outId: number) => void;

function setup(backend: BackendWasm): void {
wasmMean = backend.wasm.cwrap(Mean, null /*void*/, ['number, number, number']);
}

export function mean(
    args: {backend: BackendWasm, inputs: MeanInputs, attrs: MeanAttrs}):
    TensorInfo {
  const {backend, inputs, attrs} = args;
  const TensorInfo {
    const [backend, inputs, attrs] = args;
    const [axis, keepDims] = attrs;
    const {x} = inputs;
    const xId = backend.dataIdMap.get(x.dataId).id;
  }
  let inputId = xId;
  let input = x;
  const {transposed, axes, originalAxes, inputWasTransposed} =
      permuteAxesAndTranspose(x, axis, backend);
  const reductionAxes = axes;
  if (inputWasTransposed) { const transposedId = backend.dataIdMap.get(transposed.dataId).id;
    if (transposedId !== xId) { throw new Error('transpose was not a no-op. We will need to dispose of this input once we are done.

    input = transposed;
    inputId = transposedId;
    reductionAxes = backend.getInnerMostAxes(xId, {
      reductionAxes.length, originalAxes.length, inputWasTransposed.length, x.shape.length};
  })
  }
  const outputShape = backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);
  const reduceSize = util.sizeFromShape(outputShape);
  return cast((backend, inputs: {x: input}, attrs: {dtype: 'float32'}));
}

backend.dataIdMap.get(castedInput.dataId).id; 
} 

const out = backend.makeOutput(outShape, 'float32'); 
if (util.sizeFromShape(input.shape) !== 0) {
  const outId = backend.dataIdMap.get(out.dataId).id;
}

wasmMean(inputId, reduceSize, outId); 
} 

if (inputWasTransposed) {
  // dispose of the transposed tensor.
  backend.disposeData(transposed.dataId); 
}

if (keepDims) {
  // reshape
  const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);
  out.shape = newShape; 
} 

if (input.dtype !== 'float32') {
  backend.disposeData(castedInput.dataId);
}

return out;
}

export const meanConfig: KernelConfig = {
  kernelName: Mean, 
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: mean as {} as KernelFunc
};

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 */

import {backend_util, KernelConfig, KernelFunc, Min, MinAttrs, MinInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {permuteAxesAndTranspose} from './kernel_utils';
import {CppDType} from './types';

let wasmMin: (xId: number, dtype: number, reduceSize: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmMin = backend.wasm.cwrap(Min, null /*void*/, 
    ['number',  // x_id
     'number',  // dtype
     'number',  // reduce_size
     'number',  // out_id
  ]);}

function min(args: {backend: BackendWasm, inputs: MinInputs, attrs: MinAttrs}):
    TensorInfo {
  const {backend, inputs, attrs} = args;

  const {axis, keepDims} = attrs;
  const {x} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  let 
  inputId = xId;
  let input = x;

  const {transposed, axes, originalAxes, inputWasTransposed} =
    permuteAxesAndTranspose(x, axis, backend);

  if (inputWasTransposed) {
    const transposedId =
      backend.dataIdMap.get(transposed.dataId).id;
    if (transposedId !== xId) {
      // transpose was not a no-op. We 
      // will need to dispose of this
      // once we are done.
      input = transposed;
      inputId = transposedId;
    }
  }

  const inputRank = input.shape.length;
  backend_util.assertAxesAreInnerMostDims('min', axes, 
  inputRank);
  const [outShape, reduceShape] =
    backend_util.computeOutAndReduceShapes(input.shape, 
    axes);
  const reduceSize = util.sizeFromShape(reduceShape);

  const out = backend.makeOutput(outShape, input.dtype);
  if (util.sizeFromShape(input.shape) !== 0) {
    const outId =
      backend.dataIdMap.get(out.dataId).id;
    wasmMin(inputId, CppDType[x.dtype], reduceSize, outId);
  }

  if (inputWasTransposed) {
    // dispose of the transposed tensor.
    backend.disposeData(transposed.dataId); 
  }

  if (keepDims) {
    // reshape
    const newShape = backend_util.expandShapeToKeepDim(out.shape, 
    originalAxes);
    out.shape = newShape; 
  }

  return out;
}

export const minConfig: KernelConfig = {
  kernelName: Min, 
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: min as {} as KernelFunc
};

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 */

import {KernelConfig, Minimum} from '@tensorflow/tfjs-core';

import {createBinaryKernelConfig} from './binary_kernel';
const supportsFullBroadcast = false;
export const minimumConfig: KernelConfig =
  createBinaryKernelConfig(Minimum, supportsFullBroadcast);

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=============================================================================

*/

import {KernelConfig, KernelFunc, MirrorPad, MirrorPadAttrs, MirrorPadInputs} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {CppDType} from './types';

enum MirrorPaddingMode {
  reflect = 0,
  symmetric = 1
}

let wasmMirrorPad: (xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype: number,
    prePaddingsBytes: Uint8Array, postPaddingsBytes: Uint8Array, mode: number,
    outId: number) => void;

function setup(backend: BackendWasm) {
  wasmMirrorPad = backend.wasm.cwrap(MirrorPad, null /* void */, 
    ['number', // xId
     'array', // x.shape
     'number', // x.shape.length
     'number', // x.dtype
     'array', // pre-paddings
     'array', // post-paddings
     'number', // mode
     'number', // outId
   ]);
}

function mirrorPad(args: {
  inputs: MirrorPadInputs,
  backend: BackendWasm,
  attrs: MirrorPadAttrs
}) {
  const {inputs: {x}, backend, attrs: {paddings, mode}} = args;
  const outShape = paddings.map((p, i) => p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);
  const xId = backend.dataIdMap.get(x.dataId).id;
  const out = backend.makeOutput(outShape, x.dtype);
  const outId = backend.dataIdMap.get(out.dataId).id;
  const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);
  const prePaddingsFlat = paddings.map(padTuple => padTuple[0]);
  const postPaddingsFlat = paddings.map(padTuple => padTuple[1]);
  const prePaddingsBytes = new Uint8Array(new Int32Array(prePaddingsFlat).buffer);
  const postPaddingsBytes = new Uint8Array(new Int32Array(postPaddingsFlat).buffer);
  wasmMirrorPad(xId, xShapeBytes, x.shape.length, CppDType[x.dtype], prePaddingsBytes, postPaddingsBytes, mode, outId);
  return out;
}

export const mirrorPadConfig: KernelConfig = {
  kernelName: MirrorPad,
  backendName: 'wasm',
  kernelFunc: mirrorPad as {} as KernelFunc,
  setupFunc: setup
};

import {KernelConfig, Multiply} from '@tensorflow/tfjs-core';

import {createBinaryKernelConfig} from './binary_kernel';

const supportsFullBroadcast = true;
export const multiplyConfig: KernelConfig = createBinaryKernelConfig(Multiply, supportsFullBroadcast);

import {KernelConfig, Neg} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';
export const negConfig: KernelConfig = createUnaryKernelConfig(Neg);

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=============================================================================

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=============================================================================

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 *
=============================================================================

*/

import {KernelConfig, Multiply} from '@tensorflow/tfjs-core';

const supportsFullBroadcast = true;
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export const negConfig: KernelConfig = createUnaryKernelConfig(Neg);

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*/

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const supportsFullBroadcast = true;
export const multiplyConfig: KernelConfig = createBinaryKernelConfig(Multiply, supportsFullBroadcast);

import {KernelConfig, Neg} from '@tensorflow/tfjs-core';

export const negConfig: KernelConfig = createUnaryKernelConfig(Neg);
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=============================================================================
*/

import {BackendWasm} from '../backend_wasm';

// Analogous to `struct Result` in
`non_max_suppression_impl.h`.
interface Result {
  pSelectedIndices: number;
  selectedSize: number;
  pSelectedScores: number;
  pValidOutputs: number;
}/**
 * Parse the result of the c++ method, which has the
 * shape equivalent to
`Result`.
 */
export function parseResultStruct(
  backend: BackendWasm, resOffset: number): Result {
  const result = new Int32Array(backend.wasm.HEAPU8.buffer, resOffset, 4);
  const pSelectedIndices = result[0];
  const selectedSize = result[1];
  const pSelectedScores = result[2];
  const pValidOutputs = result[3];
  // Since the result was allocated on the heap, we have to delete it.
  backend.wasm._free(resOffset);
  return {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs};
}

import {KernelConfig, KernelFunc, NonMaxSuppressionV3, NonMaxSuppressionV3Attrs,
NonMaxSuppressionV3Inputs, TensorInfo} from '@tensorflow/tfjs-core';

import {BackendWasm} from
'../backend_wasm';

import {parseResultStruct} from './NonMaxSuppression_util';

let wasmFunc: (
  boxesId: number, scoresId: number, maxOutputSize: number,
  iouThreshold: number, scoreThreshold: number)
=> number;

function setup(backend: BackendWasm): void {
  wasmFunc = backend.wasm.cwrap(
    NonMaxSuppressionV3,
    'number',  // Result*
    
    'number',  // boxesId
    'number',  // scoresId
    'number',  // maxOutputSize
    'number',  // iouThreshold
    'number',  // scoreThreshold
  );
}

function kernelFunc(args: {
  backend: BackendWasm,
  inputs: NonMaxSuppressionV3Inputs,
  attrs: NonMaxSuppressionV3Attrs
}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {iouThreshold,
    maxOutputSize, scoreThreshold} = attrs;
  const {boxes, scores} = inputs;

  const boxesId = backend.dataIdMap.get(boxes.dataId).id;
  const scoresId = backend.dataIdMap.get(scores.dataId).id;

  const resOffset =
      wasmFunc(boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold);

  const
      {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} =
          parseResultStruct(backend, resOffset);

  // Since we are not using scores for V3, we have to delete it from the heap.
  backend.wasm._free(pSelectedScores);
  backend.wasm._free(pValidOutputs);
  const selectedIndicesTensor
      = backend.makeOutput([selectedSize], 'int32', pSelectedIndices);
  return selectedIndicesTensor;
}

export const nonMaxSuppressionV3Config: KernelConfig = {
  kernelName:
    NonMaxSuppressionV3,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: kernelFunc as {} as
    KernelFunc,
};

import {KernelConfig, KernelFunc, NonMaxSuppressionV4, NonMaxSuppressionV4Attrs,
NonMaxSuppressionV4Inputs, TensorInfo} from '@tensorflow/tfjs-core';

import {BackendWasm} from
'}

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import {parseResultStruct} from './NonMaxSuppression_util';

let wasmFunc: (boxesId: number, scoresId: number, maxOutputSize: number, iouThreshold: number, scoreThreshold: number, padToMaxOutputSize: boolean) => number;

function setup(backend: BackendWasm): void {
  wasmFunc = backend.wasm.cwrap('NonMaxSuppressionV4', 'number', ['number', 'number', 'number', 'number', 'number', 'number', 'boolean'],

    TensorInfo[]];

  const {iouThreshold, maxOutputSize, scoreThreshold, padToMaxOutputSize} = args;

  const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} = parseResultStruct(backend, resOffset);

  // Since we are not using scores for V4, we have to delete it from the heap.
  backend.wasm._free(pSelectedScores);

  const selectedIndicesTensor = backend.makeOutput([selectedSize], 'int32', pSelectedIndices);
  const validOutputsTensor = backend.makeOutput([], 'int32', pValidOutputs);

  return [selectedIndicesTensor, validOutputsTensor];
}

export const nonMaxSuppressionV4Config: KernelConfig = {
  kernelName: 'NonMaxSuppressionV4',
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: nonMaxSuppressionV4 as {} as KernelFunc,
};

import {KernelConfig, KernelFunc, NonMaxSuppressionV5, NonMaxSuppressionV5Attr, NonMaxSuppressionV5Inputs, TensorInfo} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {parseResultStruct} from './NonMaxSuppression_util';

let wasmFunc: (boxesId: number, scoresId: number, maxOutputSize: number, iouThreshold: number, scoreThreshold: number, softNmsSigma: number) => number;

function setup(backend: BackendWasm): void {
  wasmFunc = backend.wasm.cwrap('NonMaxSuppressionV5', 'number', ['number', 'number', 'number', 'number', 'number', 'number', 'number'],

  function nonMaxSuppressionV5(args: {backend: BackendWasm, inputs: NonMaxSuppressionV5Inputs, attr: NonMaxSuppressionV5Attr}){
    TensorInfo[]];

  const {iouThreshold, maxOutputSize, scoreThreshold, softNmsSigma} = args;

  const {boxes, scores} = inputs;

  const boxesId = backend.dataIdMap.get(boxes.dataId).id;
  const scoresId = backend.dataIdMap.get(scores.dataId).id;
  const resOffset = wasmFunc(boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold,

  const selectedIndicesTensor = backend.makeOutput([selectedSize], 'int32', pSelectedIndices);
  const selectedScoresTensor = backend.makeOutput([selectedSize], 'float32', pSelectedScores);

  return [selectedIndicesTensor, selectedScoresTensor];
}

export const nonMaxSuppressionV5Config: KernelConfig = {
  kernelName: 'NonMaxSuppressionV5',
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: nonMaxSuppressionV5 as {} as KernelFunc,
};

// back-end_wasm

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```typescript
import {BackendWasm} from '../backend_wasm';
import {concat} from './Concat';
import {expandDims} from './ExpandDims';
import {KernelConfig, KernelFunc, PadV2, PadV2Attrs, PadV2Inputs, util} from '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';

export function pack(
    args: {inputs: PackInputs, backend: BackendWasm, attr: PackAttrs}):
    TensorInfo {
  const {inputs, backend, attr} = args;
  const {axis} = attr;

  if (inputs.length === 1) {
    return expandDims(
        {inputs: [inputs[0]], backend, attr: {dim: axis}});
  }

  const shape = inputs[0].shape;
  const dtype = inputs[0].dtype;

  inputs.forEach(t => {
    util.assertShapesMatch(
        shape, t.shape,
        'All tensors passed to stack must have matching shapes');
    util.assert(
        dtype === t.dtype,
        () => 'All tensors passed to stack must have matching dtypes');
  });

  const intermediateTensorInfos: TensorInfo[] = [];
  const expandedTensors = inputs.map(t => {
    const expandedT =
        expandDims({inputs: [t], backend, attr: {dim: axis}});
    intermediateTensorInfos.push(expandedT);
    return expandedT;
  });

  const result = concat({inputs: expandedTensors, backend, attr: {axis}});

  intermediateTensorInfos.forEach(t =>
    backend.disposeData(t.dataId));

  return result;
}

export const packConfig: KernelConfig = {
  kernelName: Pack,
  backendName: 'wasm',
  kernelFunc: pack as {} as KernelFunc
};
```

```typescript
import {BackendWasm} from '../backend_wasm';
import {fill} from './Fill';
import {CppDType} from './types';

let wasmPadV2: (xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype: number,
    prePaddingsBytes: Uint8Array, postPaddingsBytes: Uint8Array, constantValue: number, outId:
    number) => void;

function setup(backend: BackendWasm) {
  wasmPadV2 = backend.wasm.cwrap(PadV2, null /* void */, 
    ['number',  // xId
    'array',   // x.shape
    'number',  // x.shape.length
    'number',  // x.dtype
    'array',   // pre-paddings
    'array',   // post-paddings
    'number',  // constantValue
    'number',  // outId
  ]);}

function pad(
    args: {inputs: PadV2Inputs, backend: BackendWasm, attr: PadV2Attrs}) {
  const {inputs: {x}, backend, attr: {paddings, constantValue}} = args;
  const outShape = paddings.map((p, i) =>
      p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);
  if (util.sizeFromShape(x.shape) === 0) {
    // Short-circuit the computation, since x doesn't have value, only
    // the shape is used to compute output shape to pad.
    return fill({
      backend,
      attr: {shape: outShape, value: constantValue, dtype: x.dtype}
    });
  }

  const xId = backend.dataIdMap.get(x.dataId).id;
  const out = backend.makeOutput(outShape, x.dtype);
  const outTensorData = backend.dataIdMap.get(out.dataId);
  const outId = outTensorData.id;

  const xShapeBytes =
      new Uint8Array(new Int32Array(x.shape).buffer);
  const prePaddingsBytes = paddings.map.padTUPLE map(p =>
      xShapeBytes.buffer);  // x.shape.length
  const postPaddingsBytes = paddings.map.padTUPLE map(p =>
      xShapeBytes.buffer);  // x.shape.length

  wasmPadV2(xId, xShapeBytes, x.shape.length,
    CppDType[x.dtype],
    prePaddingsBytes, postPaddingsBytes, constantValue, outId);

  const outTensorData = backend.dataIdMap.get(out.dataId);
  const outId = outTensorData.id;
  const xShapeBytes =
      new Uint8Array(new Int32Array(x.shape).buffer);
  const prePaddingsFlat = paddings.map.padTUPLE map(p =>
      xShapeBytes.length);  // x.shape.length
  const postPaddingsFlat = paddings.map.padTUPLE map(p =>
      xShapeBytes.length);  // x.shape.length

  wasmPadV2(xId, xShapeBytes, x.shape.length,
    CppDType[x.dtype],
    prePaddingsBytes, postPaddingsBytes, constantValue, outId);

  return out;
}

export const padV2Config: KernelConfig = {
  kernelName: PadV2,
  backendName: 'wasm',
  kernelFunc: pad as {} as KernelFunc
};
```

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 */
```
import {KernelConfig, Pow} from '@tensorflow/tfjs-core';

import {createBinaryKernelConfig} from './binary_kernel';

const supportsFullBroadcast = false;

export const powConfig: KernelConfig = createBinaryKernelConfig(Pow, supportsFullBroadcast);

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 *
 */

import {KernelConfig, KernelFunc, Prelu, PreluInputs} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {cast} from './Cast';

let wasmPrelu: (xId: number, weightsId: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmPrelu = backend.wasm.cwrap(Prelu, null /* void */, 
    ['number',  // x_id
    'number',  // weights_id
    'number'   // out_id
  ]);
}

function prelu(args: {inputs: PreluInputs, backend: BackendWasm}) {
  const {inputs, backend} = args;
  const {x, alpha} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  const weightsId = backend.dataIdMap.get(alpha.dataId).id;
  const inputId = xId;
  let input = x;
  let castedInput = input;
  if (input.dtype !== 'float32') {
    castedInput = cast({backend, inputs: {x}, attrs: {dtype: 'float32'}});
    inputId = backend.dataIdMap.get(castedInput.dataId).id;
  }

  const out = backend.makeOutput(x.shape, 'float32');
  const outId = backend.dataIdMap.get(out.dataId).id;
  wasmPrelu(inputId, weightsId, outId);

  if (input.dtype !== 'float32') {
    backend.disposeData(castedInput.dataId);
  }
  return out;
}

export const preluConfig: KernelConfig = {
  kernelName: Prelu,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: prelu as {} as KernelFunc
};

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 *
 */

import {backend_util, KernelConfig, KernelFunc, Prod, ProdAttrs, ProdInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {permuteAxesAndTranspose} from './kernel_utils';

import {CppDType} from './types';

let wasmProd: (xId: number, reduceSize: number, dtype: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmProd = backend.wasm.cwrap(Prod, null /*void*/, 
    ['number',
    'number',
    'number',
    'number']
  ]);
}

function prod(args: {
  backend: BackendWasm,
  inputs: ProdInputs,
  attrs: ProdAttrs
}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {axis, keepDims} = attrs;
  const {x} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  let inputId = xId;
  let input = x;

  const {transposed, axes, originalAxes, inputWasTransposed} =
      permuteAxesAndTranspose(x, axis, backend);

  const reductionAxes = axes;
  if (inputWasTransposed) {
    const transposedId = backend.dataIdMap.get(transposed.dataId).id;
    if (transposedId !== xId) {
      // transpose was not a no-op. We will need to dispose of this
      // once we are done
      input = transposed;
      inputId = transposedId;
      reductionAxes = backend_util.getInnerMostAxes(reductionAxes, x.shape.length);
      const prod = prod(args);
      const prodId = prod.dataId;
      backend.dataIdMap.get(prod.dataId).id;
    }
  }

  const outId = backend.dataIdMap.get(out.dataId).id;
  wasmProd(inputId, reduceSize, CppDType[out.dtype], outId);
  if (util.sizeFromShape(input.shape) !== 0) {
    backend.disposeData(castedDataId);
  }
  return out;
}
the transposed tensor.

```cpp
    backend.disposeData(transposed.dataId);
  }

  if (keepDims) {
    // reshape
    const
    newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);
    out.shape = newShape;
  }

  return out;
}

export const prodConfig: KernelConfig = {
  kernelName: Prod,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: prod as {} as KernelFunc
};

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 */

import {KernelConfig, KernelFunc, Range, RangeAttrs, TensorInfo} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';
import {rangeImplCPU} from '../kernel_utils/shared';

export const range =
  (args: {backend: BackendWasm, attrs: RangeAttrs}): TensorInfo => {
    const {backend, attrs} =
    args;
    const {start, stop, step, dtype} = attrs;
    const values = rangeImplCPU(start, stop, step, dtype);

    const out = backend.makeOutput([values.length], dtype);
    const outVals =
    backend.typedArrayFromHeap(out);
    outVals.set(values);
    return out;
  };

export const rangeConfig:
  KernelConfig = {
    kernelName: Range,
    backendName: 'wasm',
    kernelFunc: range as {} as
    KernelFunc
};

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 */

import {KernelConfig, RealDiv} from '@tensorflow/tfjs-core';

import {createBinaryKernelConfig} from
  './binary_kernel';

export const realDivConfig: KernelConfig =
  createBinaryKernelConfig(RealDiv, supportsFullBroadcast);

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 */

import {KernelConfig, Relu} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from
  './unary_kernel';

export const reluConfig: KernelConfig = createUnaryKernelConfig(Relu);

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 */

import {KernelConfig, Relu6} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from
  './unary_kernel';

export const relu6Config: KernelConfig = createUnaryKernelConfig(Relu6);

```
import {KernelConfig, KernelFunc, ResizeBilinear, ResizeBilinearAttrs, ResizeBilinearInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {cast} from './Cast';

let wasmResizeBilinear: (xId: number, batch: number, oldHeight: number, oldWidth: number, numChannels: number, newHeight: number, newWidth: number, alignCorners: number, halfPixelCenters: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmResizeBilinear = backend.wasm.cwrap(ResizeBilinear, null, ['number', 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number', 'number']);
}

function resizeBilinear(args: {
  backend: BackendWasm,
  inputs: ResizeBilinearInputs,
  attrs: ResizeBilinearAttrs
}): TensorInfo {
  const {backend, inputs, attrs} = args;

  const {images} = inputs;
  const {alignCorners, halfPixelCenters, size} = attrs;
  const [newHeight, newWidth] = size;

  const [batch, oldHeight, oldWidth, numChannels] = images.shape;
  const outShape = [batch, newHeight, newWidth, numChannels];

  let xData = backend.dataIdMap.get(images.dataId);
  let castedData;
  if (xData.dtype !== 'float32') {
    castedData = cast({backend, inputs: {x: images}, attrs: {dtype: 'float32'}});
    xData = backend.dataIdMap.get(castedData.dataId);
  }
  const xId = xData.id;

  const out = backend.makeOutput(outShape, 'float32');
  if (util.sizeFromShape(images.shape) === 0) {
    return out;
  }

  const outId = backend.dataIdMap.get(out.dataId).id;

  wasmResizeBilinear(xId, batch, oldHeight, oldWidth, numChannels, newHeight, newWidth, alignCorners ? 1 : 0, halfPixelCenters ? 1 : 0, outId);

  if (castedData != null) {
    backend.disposeData(castedData.dataId);
  }

  return out;
}

export const resizeBilinearConfig: KernelConfig = {
  kernelName: ResizeBilinear,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: resizeBilinear as {} as KernelFunc
};

import {KernelConfig, KernelFunc, Reverse, ReverseAttrs, ReverseInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {identity} from './Identity';
import {reshape} from './Reshape';

let wasmReverse: (xId: number, axes: Uint8Array, axesLength: number, outShape: Uint8Array, outShapeLength: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmReverse = backend.wasm.cwrap(Reverse, null, ['number', 'array', 'number', 'array', 'number', 'number']);
}

export function reverse(args: {inputs: ReverseInputs, backend: BackendWasm, attrs: ReverseAttrs}): TensorInfo {
  const {inputs, backend, attrs} = args;
  const {x} = inputs;
  const {dims} = attrs;

  const axes = util.parseAxisParam(dims, x.shape);

  if (x.shape.length === 0) {
    return identity({inputs: {x}, backend});
  }

  const out = backend.makeOutput(outShape, 'float32');
  const constOut = backend.dataIdMap.get(out.dataId).id;
  const xId = backend.dataIdMap.get(x.dataId).id;
  const newWidth = Math.floor(xId.length / outId.length);
  const newHeight = Math.floor(xId.length / outId.length);

  const outId = backend.dataIdMap.get(out.dataId).id;

  if (newWidth > outWidth) {
    const xData = backend.dataIdMap.get(x.dataId);
    const outData = backend.dataIdMap.get(out.dataId);
    const xId = backend.dataIdMap.get(x.dataId).id;
    const outId = backend.dataIdMap.get(out.dataId).id;
  }

  wasmReverse(xId, axes, axesLength, outShape, outShapeLength, outId);
  const constReshaped = reshape({inputs: [x], attrs: {shape: x.shape, backend}});
```javascript
backend.disposeData(out.dataId);\nreturn reshaped;\n}

export const reverseConfig: KernelConfig = {
  kernelName: 'Reverse',
  backendName: 'wasm',
  kernelFunc: reverse as {} as KernelFunc,
  setupFunc: setup\n};

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 */

import {KernelConfig, KernelFunc, RotateWithOffset, RotateWithOffsetAttrs, RotateWithOffsetInputs, TensorInfo} from '@tensorflow/tfjs-core';
import {backend_util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmRotate: (
    xId: number, batch: number, imageHeight: number, numChannels: number, radians: number, centerX: number, centerY: number,
    fillBytes: Uint8Array, fillLength: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmRotate = backend.wasm.cwrap(RotateWithOffset, null /* void */, 
    ['number', // xId
    'number',  // batch
    'number',  // imageHeight
    'number', // numChannels
    'number',  // radians
    'number',  // centerX
    'number',  // centerY
    'array',   // fillBytes
    'number',  // fillLength
    'number',  // outId
  ]);
}

export function rotateWithOffset(args: {
  inputs: RotateWithOffsetInputs,
  backend: BackendWasm,
  attrs: RotateWithOffsetAttrs
}): TensorInfo {
  const {inputs, backend, attrs} = args;
  const {image} = inputs;
  const {radians, fillValue, center} = attrs;

  const out = backend.makeOutput(image.shape, image.dtype);
  const imageId = backend.dataIdMap.get(image.dataId).id;
  const outId = backend.dataIdMap.get(out.dataId).id;

  const 
      [batch, imageHeight, imageWidth, numChannels] = image.shape;
  const [centerX, centerY] = backend_util.getImageCenter(center, imageHeight, imageWidth);

  const fillIsBlack = fillValue === 0;
  const fullOpacityValue = 255;
  const fillValues = typeof fillValue === 'number' ?
      [fillValue, fillValue, fillValue, fillIsBlack ? 0 : fullOpacityValue] :
      [...fillValue, fullOpacityValue];

  wasmRotate(\n      imageId, batch, imageHeight, imageWidth, numChannels, radians, centerX,
      centerY, fillBytes, fillValues.length, outId);

  return out;\n}

export const rotateWithOffsetConfig: KernelConfig = {
  kernelName: RotateWithOffset,
  backendName: 'wasm',
  kernelFunc: rotateWithOffset as {} as KernelFunc,
  setupFunc: setup\n};

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 */

import {KernelConfig, Round} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';

export const roundConfig: KernelConfig = createUnaryKernelConfig(Round);

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 */

import {KernelConfig, Rsqrt} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from ...
```
import {KernelConfig, KernelFunc, ScatterNd, ScatterNdAttrs, ScatterNdInputs, ScatterUtil, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {CppDType} from './types';

let wasmScatterNd: (indicesId: number, updatesId: number, dtype: CppDType, sliceRank: number, numUpdates: number, sliceSize: number, strides: Uint8Array, outputSize: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmScatterNd = backend.wasm.cwrap(ScatterNd, null /*void*/, 
    ['number',  // indicesId
    'number',  // updatesId
    'number',  // dtype
    'number',  // sliceRank
    'number']  // numUpdates
  );
}

function scatterNd(args: {'backend': BackendWasm, 'inputs': ScatterNdInputs, 'attrs': ScatterNdAttrs}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {indices, updates} = inputs;
  const {shape} = attrs;

  const out = backend.makeOutput(shape, updates.dtype);
  if (util.sizeFromShape(shape) === 0) {
    return out;
  }

  const {sliceRank, numUpdates, sliceSize, strides, outputSize} = ScatterUtil.calculateShapes(updates, indices, shape);

  const indicesData = backend.dataIdMap.get(indices.dataId);
  const indicesId = indicesData.id;

  const updatesData = backend.dataIdMap.get(updates.dataId);
  const updatesId = updatesData.id;

  const stridesBytes = new Uint8Array(new Int32Array(strides).buffer);

  const outId = backend.dataIdMap.get(out.dataId).id;

  wasmScatterNd(indicesId, updatesId, CppDType[updates.dtype], sliceRank, numUpdates, sliceSize, stridesBytes, outputSize, outId);

  return out;
}

export const scatterNdConfig: KernelConfig = {
  kernelName: ScatterNd,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: scatterNd as {} as KernelFunc
};

import {KernelConfig, KernelFunc, Select, SelectInputs, TensorInfo, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

let wasmSelect: (conditionId: number, tId: number, eId: number, offset: number, outId: number) => void;

function setup(backend: BackendWasm): void {
  wasmSelect = backend.wasm.cwrap('SelectV2', null, 
    ['number',  // conditionId
    'number',  // tId
    'number',  // eId
    'number',  // offset
    'number',  // outId
  ]);}

function select(args: {'inputs': SelectInputs, 'backend': BackendWasm}): TensorInfo {
  const {inputs, backend} = args;
  const {condition, t, e} = inputs;

  const conditionId = backend.dataIdMap.get(condition.dataId).id;
  const tId = backend.dataIdMap.get(t.dataId).id;
  const eId = backend.dataIdMap.get(e.dataId).id;

  const cRank = condition.shape.length;
  const tRank = t.shape.length;

  const cShape = condition.shape.slice(1);
  const tShape = t.shape.slice(1);

  if (util.sizeFromShapeShape(cShape) === 0) {
    return out;
  }

  const cData = backend.dataIdMap.get(condition.dataId).id;
  const tData = backend.dataIdMap.get(t.dataId).id;
  const eData = backend.dataIdMap.get(e.dataId).id;

  const cRank = condition.shape.length;
  const tRank = t.shape.length;

  const cOffset = cRank === 0 || cRank > 1 || tRank === 1 ? 0 : cRank - 1;
  const tOffset = tRank === 0 || tRank > 1 || cRank === 1 ? 0 : tRank - 1;

  const cTensor = backend.dataIdMap.get(condition.dataId).id;
  const tTensor = backend.dataIdMap.get(t.dataId).id;

  const cConst = new Int32Array(condition.shape.slice(1));
  const tConst = new Int32Array(t.shape.slice(1));

  wasmSelect(conditionId, tId, eId, cOffset, cData, tData);
  return t;
}

export const selectConfig: KernelConfig = {
  kernelName: Select,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: select as {} as KernelFunc
};

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import {backend_util, KernelConfig, KernelFunc, ReshapeAttrs, ReshapeInputs, SpaceToBatchND, SpaceToBatchNDAttrs, SpaceToBatchNDInputs, TensorInfo, TransposeAttrs, TransposeInputs, util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {padV2Config} from './PadV2';
import {reshape} from './Reshape';
import {transpose} from './Transpose';

function spaceToBatchND(args: {
  inputs: SpaceToBatchNDInputs,
  backend: BackendWasm,
  attrs: SpaceToBatchNDAttrs
}) {
  const {inputs, backend, attrs} = args;
  const {x} = inputs;
  const {blockShape, paddings} = attrs;

  const prod = util.sizeFromShape(blockShape);

  const completePaddings: Array<[number, number]> = [[0, 0]];
  completePaddings.push(...(paddings as Array<[number, number]>));

  for (let i = 1 + blockShape.length; i < x.shape.length; ++i) {
    completePaddings.push([0, 0]);
  }

  const paddedX = padV2Config.kernelFunc({
    inputs: {x},
    backend,
    attrs: {paddings: completePaddings, constantValue: 0}
  }) as TensorInfo;

  const reshapedPaddedShape = backend_util.getReshaped(paddedX.shape, blockShape, prod, false);
  const permutedReshapedPaddedPermutation = backend_util.getPermuted(reshapedPaddedShape.length, blockShape.length, false);

  const flattenShape = backend_util.getReshapedPermuted(paddedX.shape, blockShape, prod, false);

  const paddedXT = transpose({inputs: {x: paddedX}, backend, attrs: {perm: permutedReshapedPaddedPermutation}});

  const resultReshapeInputs: ReshapeInputs = {x: paddedXT};
  const resultReshapeAttrs: ReshapeAttrs = {shape: flattenShape};
  const result = reshape({inputs: resultReshapeInputs, backend, attrs: resultReshapeAttrs});

  backend.disposeData(paddedX.dataId);
  backend.disposeData(paddedXT.dataId);
  return result;
}

export const spaceToBatchNDConfig: KernelConfig = {
  kernelName: SpaceToBatchND,
  backendName: 'wasm',
  kernelFunc: spaceToBatchND as {} as KernelFunc
};

import {KernelConfig, KernelFunc, SplitV, SplitVAttrs, SplitVInputs, util} from '@tensorflow/tfjs-core';
import {backend_util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {slice} from './Slice';

export function splitV(args: {inputs: SplitVInputs, attrs: SplitVAttrs, backend: BackendWasm}) {
  const {inputs, attrs, backend} = args;
  const {x} = inputs;
  const {numOrSizeSplits, axis} = attrs;

  const $axis = util.parseAxisParam(axis, x.shape)[0];

  const splitSizes = backend_util.prepareSplitSize(x, numOrSizeSplits, $axis);
  const begin = new Array(x.shape.length).fill(0);

  const size = x.shape.slice();
  return splitSizes.map(s => {
    const xSliceSize = [...size];
    xSliceSize[$axis] = s;
    const xSlice = slice({inputs: {x}, attrs: {begin, size: xSliceSize}, backend});
    begin[$axis] += s;
    return xSlice;
  });
}

export const splitVConfig: KernelConfig = {
  kernelName: SplitV,
  backendName: 'wasm',
  kernelFunc: splitV as {} as KernelFunc
};
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=============================================================================

*/

import {KernelConfig, Sqrt} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';

export const sqrtConfig: KernelConfig = createUnaryKernelConfig(Sqrt);

/*=============================================================================

*/

import {KernelConfig, Square} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';

export const squareConfig: KernelConfig = createUnaryKernelConfig(Square);

/*=============================================================================

*/

import {KernelConfig, SquaredDifference} from '@tensorflow/tfjs-core';

import {createBinaryKernelConfig} from './binary_kernel';

const supportsFullBroadcast = true;

export const squaredDifferenceConfig: KernelConfig = createBinaryKernelConfig(SquaredDifference,
  supportsFullBroadcast);

/*=============================================================================

*/

import {KernelConfig, KernelFunc, Step, StepAttrs, StepInputs, TensorInfo} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {CppDType} from './types';

let wasmStep:
(xId: number, alpha: number, dtype: number, outId: number) =>
void;

function setup(backend:
BackendWasm): void {
  wasmStep = backend.wasm.cwrap(Step,
  void /*void*/, ['number', // x_id

  'number', // alpha

  'number', // dtype

  'number', // out_id

  null /*void*/],

  'void',

  ['number',

  'number',

  'number',

  'number']);
}

function step(
    args: {backend:
      BackendWasm, inputs: StepInputs,
      attrs: StepAttrs}):
    TensorInfo {
  const {backend, inputs, attrs} = args;

  const {alpha} = attrs;

  const {x} = inputs;

  const xId = backend.dataIdMap.get(x.dataId).id;

  const out = backend.makeOutput(x.shape,
  x.dtype);

  const outId = backend.dataIdMap.get(out.dataId).id;

  wasmStep(xId,

  alpha, CppDType[x.dtype],

  outId);

  return out;
}

export const stepConfig: KernelConfig = {
  kernelName: Step,

  backendName: 'wasm',

  setupFunc: setup,

  kernelFunc: step as {} as KernelFunc
};

/*=============================================================================

*/

import {KernelConfig, KernelFunc, Step, StepAttrs, StepInputs, TensorInfo,
import {BackendWasm} from '@tensorflow/tfjs-core';

util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '@tensorflow/tfjs-core';

util} from '@tensorflow/tfjs-core';

import {BackendWasm} from '@tensorflow/tfjs-core';
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```javascript
import {backend_util, KernelConfig, Sum, SumAttrss, SumInputs, TensorInfo, util} from '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';

let wasmSum: (xId: number, reduceSize: number, dtype: number, outId: number) =>
    void;

function setup(backend:
    BackendWasm): void {
  wasmSum = backend.wasm.cwrap(Sum, null /*void*/, [
    'number',  // input_id
    'number',  // reduce_size
    'number',  // dtype
    'number',  // out_id
  ]);}

function sum(args: {backend:
    BackendWasm, inputs: SumInputs, attrs: SumAttrss}): TensorInfo {
  const {backend, inputs, attrs} = args;
  const {axis, keepDims} = attrs;
  const {x} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  let
  let x = x;
  let xId = xId;

  const {transposed, axes, originalAxes, inputWasTransposed} =
  permuteAxesAndTranspose(x, axis, backend);

  let reductionAxes = axes;
  if (inputWasTransposed) {
    const
    transposedId = backend.dataIdMap.get(transposed.dataId).id;
    if (transposedId !== xId) {
      // transpose was
      // not a no-op. We will need to dispose of this
      // once we are done.
      input = transposed;
      inputId = transposedId;
      reductionAxes = backend_util.getInnerMostAxes(
          reductionAxes.length,
          input.shape.length);
    }
  }

  backend_util.assertAxesAreInnerMostDims(
      'sum', reductionAxes,
      input.shape.length);
  const
  const outShape = backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);
  const outId = backend.dataIdMap.get(out.dataId).id;

  if (util.sizeFromShape(out.shape) !== 0) {
    util.disposeTensor(out);
  }

  // reshape
  const
  newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);
  out.shape = newShape;

  return out;
}

export const sumConfig: KernelConfig = {
  kernelName: Sum,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: sum as {} as KernelFunc
};
```

---

```javascript
import {KernelConfig, Tan} from '@tensorflow/tfjs-core';

const
  tanConfig: KernelConfig = createUnaryKernelConfig(Tan);

---

```javascript
import {KernelConfig, Tanh} from '@tensorflow/tfjs-core';

const
  tanhConfig: KernelConfig = createUnaryKernelConfig(Tanh);
```

---

```javascript
*/

import {KernelConfig, Tan} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from
    './unary_kernel';

export const tanConfig: KernelConfig = createUnaryKernelConfig(Tan);

---

```javascript
import {KernelConfig, Tanh} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from
    './unary_kernel';

export const tanhConfig: KernelConfig = createUnaryKernelConfig(Tanh);
```

---

*/

import {KernelConfig, Tan} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from
    './unary_kernel';

export const tanConfig: KernelConfig = createUnaryKernelConfig(Tan);

---

```javascript
import {KernelConfig, Tanh} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from
    './unary_kernel';

export const tanhConfig: KernelConfig = createUnaryKernelConfig(Tanh);
```

---

*/

import {KernelConfig, Tan} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from
    './unary_kernel';

export const tanConfig: KernelConfig = createUnaryKernelConfig(Tan);

---

```javascript
import {KernelConfig, Tanh} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from
    './unary_kernel';

export const tanhConfig: KernelConfig = createUnaryKernelConfig(Tanh);
```
import {KernelConfig, KernelFunc, Tile, TileAttrs, TileInputs} from '@tensorflow/tfjs-core';

import {BackendWasm} from 'tensorflow-backend-wasm';

import {CppDType} from '@tensorflow/tfjs-core';

let wasmTile: (xId: number, xShape: Uint8Array, xShapeSize: number, newShape: number[], dtype: number, outId: number) => void;

function setup(backend: BackendWasm) {
  wasmTile = backend.wasm.cwrap(Tile, null /* void */, [null, 'number', 'number', 'number', 'number', 'number']);
}

function tile(args: {inputs: TileInputs, backend: BackendWasm, attrs: TileAttrs}) {
  const {inputs, backend, attrs} = args;
  const {x} = inputs;
  const xId = backend.dataIdMap.get(x.dataId).id;
  const {reps} = attrs;

  const newShape: number[] = new Array(x.shape.length);
  for (let i = 0; i < newShape.length; i++) {
    newShape[i] = x.shape[i] * reps[i];
  }
  const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);
  const newShapeBytes = new Uint8Array(new Int32Array(newShape).buffer);

  const out = backend.makeOutput(newShape, x.dtype);
  const outId = backend.dataIdMap.get(out.dataId).id;
  wasmTile(xId, xShapeBytes, x.shape.length, newShapeBytes, newShape.length, CppDType[out.dtype], outId);
  return out;
}

export const tileConfig: KernelConfig = {
  kernelName: Tile,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: tile as {} as KernelFunc
};

export const topk = (args: {inputs: TopKInputs, backend: BackendWasm, attrs: TopKAttrs}) => {
  const {x} = inputs;
  const {k, sorted} = attrs;

  const xId = backend.dataIdMap.get(x.dataId).id;
  const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);
  const outputShape = x.shape.slice();
  outputShape[outputShape.length - 1] = k;
  const outValues = backend.makeOutput(outputShape, x.dtype);
  const outValuesId = backend.dataIdMap.get(outValues.dataId, id);
  const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);
  return outValuesId;
};

export const topKConfig: KernelConfig = {
  kernelName: TopK,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: topk as {} as KernelFunc
};

export const transform = (args: {inputs: TransformInputs, backend: BackendWasm, attrs: TransformAttrs}) => {
  const {x} = inputs;
  const {k, sorted} = attrs;

  const xId = backend.dataIdMap.get(x.dataId, id);
  const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);
  return outValuesId;
};

export const transformConfig: KernelConfig = {
  kernelName: Transform,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: transform as {} as KernelFunc
};

export const tile = (args: {inputs: TileInputs, backend: BackendWasm, attrs: TileAttrs}) => {
  const {x} = inputs;
  const xId = backend.dataIdMap.get(x.dataId, id);
  const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);
  return outValuesId;
};

export const topk = (args: {inputs: TopKInputs, backend: BackendWasm, attrs: TopKAttrs}) => {
  const {x} = inputs;
  const {k, sorted} = attrs;

  const xId = backend.dataIdMap.get(x.dataId, id);
  const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);
  return outValuesId;
};

export const transform = (args: {inputs: TransformInputs, backend: BackendWasm, attrs: TransformAttrs}) => {
  const {x} = inputs;
  const {k, sorted} = attrs;

  const xId = backend.dataIdMap.get(x.dataId, id);
  const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);
  return outValuesId;
};

export const transformConfig: KernelConfig = {
  kernelName: Transform,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: transform as {} as KernelFunc
};

export const transform = (args: {inputs: TransformInputs, backend: BackendWasm, attrs: TransformAttrs}) => {
  const {x} = inputs;
  const {k, sorted} = attrs;

  const xId = backend.dataIdMap.get(x.dataId, id);
  const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);
  return outValuesId;
};

export const transformConfig: KernelConfig = {
  kernelName: Transform,
  backendName: 'wasm',
  setupFunc: setup,
  kernelFunc: transform as {} as KernelFunc
};
number, transformsId: number, isBatchTransform: boolean, batch: number, outHeight: number, outWidth: number, numChannels: number, imageWidth: number, imageSize: number, strides: Uint8Array, stridesLength: number, interpolationModeId: number, fillModelId: number, fillValue: number, outId: number) => void;)

function transform(
    args:
        {backend: BackendWasm, inputs: TransformInputs, attrs: TransformAttrs}):
    TensorInfo {
  const {backend, inputs, attrs} = args;
  const {image, transforms} = inputs;

  const {interpolation, fillMode, fillValue, outputShape} = attrs;

  const [batch, imageHeight, imageWidth, numChannels] = image.shape;
  const [outHeight, outWidth] = outputShape != null ? outputShape : [imageHeight, imageWidth];
  const outShape = [batch, outHeight, outWidth, numChannels] as [number, number, number, number];
  const strides = new Uint8Array(new Int32Array(util.computeStrides(image.shape)).buffer);

  const out = backend.makeOutput(outShape, image.dtype);
  const outId = backend.dataIdMap.get(out.dataId).id;

  const imageData = backend.dataIdMap.get(image.dataId);
  const imageId = imageData.id;

  const transformsData = backend.dataIdMap.get(transforms.dataId);
  const transformsId = transformsData.id;

  const interpolationModeId = interpolation === 'nearest' ? 1 : 2;
  let fillModeId;
  switch (fillMode) {
    case 'constant':
      fillModeId = 1;
      break;
    case 'reflect':
      fillModeId = 2;
      break;
    case 'wrap':
      fillModeId = 3;
      break;
    case 'nearest':
      fillModeId = 4;
      break;
    default:
      fillModeId = 1;
      break;
  }

  wasmTransform(imageId, transformsId, (transforms.shape[0] > 1), batch, outHeight, outWidth, numChannels, imageHeight, strides, image.shape.length - 1, interpolationModeId, fillModelId, fillValue, outId);

  return out;
}

export const transformConfig: KernelConfig = {
  kernelName: Transform,
  backendName: 'wasm',
  setupFunc: setup as {} as KernelFunc
};

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 */

import {KernelConfig, KernelFunc, TensorInfo, Unpack, UnpackAttrs, UnpackInputs} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {slice} from './Slice';

function unpack(
    args: {inputs: UnpackInputs, backend: BackendWasm, attrs: UnpackAttrs}):
    TensorInfo[] {
  const {inputs, backend, attrs} = args;
  const {value} = inputs;
  let {axis} = attrs;

  if (axis < 0) {
    axis += value.shape.length;
  }

  const numOutputs = value.shape[axis];
  const rank = value.shape.length;
  const outShape = [number] = new Array(rank - 1);
  let outIndex = 0;
  for (let i = 0; i < rank; i++) {
    if (i !== axis) {
      outIndex += value.shape[i];
    }
    const out = slice({inputs: {x: value}, attrs: {begin: i, size: [value.shape[i]]}, backend});
    outShape[outIndex++] = value.shape[i];
  }
  const outs: TensorInfo[] = new Array(numOutputs);
  const begin = new Array(rank).fill(0);
  const size = value.shape.slice();
  size[axis] = 1;
  for (let i = 0; i < outs.length; i++) {
    const begin = slice({inputs: [value], attrs: {begin, size}, backend});
    outs[i] = slice({inputs: [value], attrs: {begin, size}, backend});
  }

  return outs.map((out, index) => {
    return out;
  });
}

export const unpackConfig: KernelConfig = {
  kernelName: Unpack,
  backendName: 'wasm',
  setupFunc: setup, kernelFunc: transform as {} as KernelFunc
};

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=============================================================================

*/

import {KernelConfig, KernelFunc, ZerosLike, ZerosLikeInputs} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';\nfunction zerosLike(args: {inputs: ZerosLikeInputs, backend: BackendWasm}) \n{ \nconst inputs: {x}, backend: args; \nconst out = backend.makeOutput(x.shape, x.dtype);\nconst outVals = backend.typedArrayFromHeap(out);\noutVals.fill(0);\nreturn out;\n}\n
export const zerosLikeConfig: KernelConfig = {\n  kernelName: ZerosLike,\n  backendName: 'wasm',\n  kernelFunc: zerosLike \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\nthe contents of this file and import only the kernels that are
needed.\nimport {KernelConfig, registerKernel} from '@tensorflow/tfjs-core';\nimport {fusedMatMulConfig} from './kernels/_FusedMatMul';\nimport {absConfig} from './kernels/Abs';\nimport {addConfig} from './kernels/Add';\nimport {addNConfig} from './kernels/AddN';\nimport {allConfig} from './kernels/All';\nimport {anyConfig} from './kernels/Any';\nimport {argMaxConfig} from './kernels/ArgMax';\nimport {avgPoolConfig} from './kernels/AvgPool';\nimport {batchMatMulConfig} from './kernels/BatchMatMul';\nimport {batchToSpaceNDConfig} from './kernels/BatchToSpaceND';\nimport {castConfig} from './kernels/Cast';\nimport {ceilConfig} from './kernels/Ceil';\nimport {clipByValueConfig} from './kernels/ClipByValue';\nimport {concatConfig} from './kernels/Concat';\nimport {conv2DConfig} from './kernels/Conv2D';\nimport {conv2DBackpropInputConfig} from './kernels/Conv2DBackpropInput';\nimport {coshConfig} from './kernels/Cosh';\nimport {cropAndResizeConfig} from './kernels/CropAndResize';\nimport {cumsumConfig} from './kernels/Cumsum';\nimport {depthToSpaceConfig} from './kernels/DepthToSpace';\nimport {eluConfig} from './kernels/Elu';\nimport {equalConfig} from './kernels/Equal';\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 {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 {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';
import {nonMaxSuppressionV3Config} from './kernels/NonMaxSuppressionV4';
import {nonMaxSuppressionV5Config} from './kernels/NonMaxSuppressionV5';
import {notEqualConfig} from './kernels/NotEqual';
import {oneHotConfig} from './kernels/OneHot';
import {onesLikeConfig} from './kernels/OnesLike';
import {packConfig} from './kernels/Pack';
import {padV2Config} from './kernels/PadV2';
import {powConfig} from './kernels/Pow';
import {preluConfig} from './kernels/Prelu';
import {prodConfig} from './kernels/Prod';
import {rangeConfig} from './kernels/Range';
import {realDivConfig} from './kernels/RealDiv';
import {reluConfig} from './kernels/Relu';
import {relu6Config} from './kernels/Relu6';
import {reshapeConfig} from './kernels/Reshape';
import {reverseConfig} from './kernels/Reverse';
import {rsqrtConfig} from './kernels/Rsqrt';
import {selectConfig} from './kernels/Select';
import {sigmoidConfig} from './kernels/Sigmoid';
import {sinConfig} from './kernels/Sin';
import {sliceConfig} from './kernels/Slice';
import {softmaxConfig} from './kernels/Softmax';
import {spaceToBatchNDConfig} from './kernels/SpaceToBatchND';
import {splitVConfig} from './kernels/SplitV';
import {sqrtConfig} from './kernels/Sqrt';
import {squareConfig} from './kernels/Square';
import {squaredDifferenceConfig} from './kernels/SquaredDifference';
import {stepConfig} from './kernels/Step';
import {stridedSliceConfig} from './kernels/StridedSlice';
import {subConfig} from './kernels/Sub';
import {sumConfig} from './kernels/Sum';
import {tanConfig} from './kernels/Tan';
import {tanhConfig} from './kernels/Tanh';
import {tileConfig} from './kernels/Tile';
import {topKConfig} from './kernels/TopK';
import {transposeConfig} from './kernels/Transpose';
import {transposeVConfig} from './kernels/TransposeV';
import {unpackConfig} from './kernels/Unpack';
import {zerosLikeConfig} from './kernels/ZerosLike';

const kernelConfigs: KernelConfig[] = [absConfig, addConfig, addNConfig, allConfig, anyConfig, argMaxConfig, avgPoolConfig, batchMatMulConfig, batchToSpaceNDConfig, castConfig, ceilConfig, clipByValueConfig, concatConfig, conv2DConfig, conv2DBackpropInputConfig, cosConfig, coshConfig, cropAndResizeConfig, cumsumConfig, depthToSpaceConfig, depthwiseConv2dNativeConfig, eluConfig, equalConfig, expConfig, expandDimsConfig, fillConfig, flipLeftRightConfig, floorConfig, floorDivConfig, fusedMatMulConfig, fusedBatchNormConfig, fusedConv2DConfig, fusedDepthwiseConv2DConfig, gatherNdConfig, gatherV2Config, greaterConfig, greaterEqualConfig, identityConfig, leakyReluConfig, lessConfig, lessEqualConfig, logConfig, logicalAndConfig, maximumConfig, maxPoolConfig, meanConfig, minConfig, minimumConfig, mirrorPadConfig, multiplyConfig, negConfig, nonMaxSuppressionV3Config, nonMaxSuppressionV4Config, nonMaxSuppressionV5Config, notEqualConfig, oneHotConfig, onesLikeConfig, packConfig, padV2Config, powConfig, preluConfig, prodConfig, rangeConfig, realDivConfig, reluConfig, relu6Config, reshapeConfig, reshapeLikeConfig, reverseConfig, rotateWithOffsetConfig, rsqrtConfig, roundConfig, scatterNdConfig, selectConfig, sigmoidConfig, sinConfig, sliceConfig, softmaxConfig, spaceToBatchNDConfig, splitVConfig, sqrtConfig, squareConfig, squaredDifferenceConfig, stepConfig, stridedSliceConfig, subConfig, sumConfig, tanConfig, tanhConfig, tileConfig, topKConfig, transformConfig, transposeConfig, unpackConfig, zerosLikeConfig];

// From: https://github.com/GoogleChromeLabs/wasm-feature-detect
ENV.registerFlag('wasi', 'true');

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// This typed array
passed in to WebAssembly.validate is WebAssembly binary
    // code. In this case it is a small program that contains SIMD
    // instructions.
    'WASM_HAS_SIMD_SUPPORT', async () => WebAssembly.validate(new Uint8Array([0, 97, 115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3, 2, 1, 0, 5, 4, 1, 3, 1, 10, 11, 1, 9, 0, 65, 0, 254, 16, 2, 0, 26, 11]), new Uint8Array([0, 97, 115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3, 2, 1, 0, 5, 4, 1, 3, 1, 10, 11, 1, 9, 0, 65, 0, 254, 16, 2, 0, 26, 11]));

/**
 * True if threads are supported.
 */
// From: https://github.com/GoogleChromeLabs/wasm-feature-detect
ENV.registerFlag('WASM_HAS_MULTITHREAD_SUPPORT', async () => {
  // Test for transferability of SABs (needed for Firefox)
  // TODO(annxingyuan): Enable node support once this is resolved:
  // https://github.com/tensorflow/tfjs/issues/3830
  if (ENV.get('IS_NODE')) {
    return false;
  }
  try {
    new MessageChannel().port1.postMessage(new SharedArrayBuffer(1));
    return WebAssembly.validate(new Uint8Array([0, 97, 115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3, 2, 1, 0, 5, 4, 1, 3, 1, 10, 11, 1, 9, 0, 65, 0, 254, 16, 2, 0, 26, 11]), catch (e) {
      return false;
    });
  } catch (e) {
    return false;
  }
});

var WasmBackendModuleThreadedSimd = (function() {
  if (typeof __filename !== 'undefined') _scriptDir = _scriptDir || __filename;
  return (function(WasmBackendModuleThreadedSimd) {
    WasmBackendModuleThreadedSimd = WasmBackendModuleThreadedSimd || {};

    function GROWABLE_HEAP_I8() { if (wasmMemory.buffer !== buffer) { updateGlobalBufferAndViews(wasmMemory.buffer) } return HEAP8 } function GROWABLE_HEAP_U8() { if (wasmMemory.buffer !== buffer) { updateGlobalBufferAndViews(wasmMemory.buffer) } return HEAPU8 } function GROWABLE_HEAP_I32() { if (wasmMemory.buffer !== buffer) { updateGlobalBufferAndViews(wasmMemory.buffer) } return HEAP32 } function GROWABLE_HEAP_U32() { if (wasmMemory.buffer !== buffer) { updateGlobalBufferAndViews(wasmMemory.buffer) } return HEAPU32 } function GROWABLE_HEAP_F64() { if (wasmMemory.buffer !== buffer) { updateGlobalBufferAndViews(wasmMemory.buffer) } return HEAPF64 } var module = typeof WasmBackendModuleThreadedSimd !== 'undefined' ? WasmBackendModuleThreadedSimd : {};
  var readyPromiseResolve, readyPromiseReject; Module["ready"] = new Promise(function(resolve, reject) {
    readyPromiseResolve = resolve;
    readyPromiseReject = reject;
  });
  var moduleOverrides = {};
  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;
  };
WebAssembly.Memory({"initial":INITIAL_MEMORY/65536,"maximum":2147483648/65536,"shared":false});  

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(EENVIRONMENT_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_cors()}});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__)}

addOnPreRun(cb){__ATPRERUN__.unshift(cb)}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 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+\"\";}))}}function abort(what){if(Module["onAbort"]){Module["onAbort"](what)}if(ENVIRONMENT_IS_PTHREAD)console.error("WebAssembly.RuntimeError: abort("+what+"). Build with -s ASSERTIONS=1 for more info.");throw new WebAssembly.RuntimeError(what)}
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"]["Iv"];
    wasmModule = module;
    if (!ENVIRONMENT_IS_PTHREAD) {
      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) {
      if (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(function(receiveInstantiatedSource) {
            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(exports);
        return exports; catch(e) {
          err("Module.instantiateWasm callback failed with error: "+e);
          return false
        }
      } catch(e) {
        err("callback module.
```

```
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
kilThread!";GROWABLE HEAP_I32()[pthread_ptr+12>>2]=0;var
pthread=PThread.pthreads[pthread_ptr];pthread.worker.terminate();PThread.freeThreadData(pthread);PThread.runni
ngWorkers.splice(PThread.runningWorkers.indexOf(pthread.worker),1);pthread.worker.pthread=undefined}functio
n cancelThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw"Internal Error! cancelThread() can only
ever be called from main application thread!";if(pthread_ptr)throw"Internal Error! Null pthread_ptr in
cancelThread!";var
pthread=PThread.pthreads[pthread_ptr];pthread.worker.postMessage({"cmd":"cancel"})}function
cleanupThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw"Internal Error! cleanupThread() can only
ever be called from main application thread!";if(pthread_ptr)throw"Internal Error! Null pthread_ptr in
cleanupThread!";var
pthread=PThread.pthreads[pthread_ptr];if(pthread){GROWABLE HEAP_I32()[pthread_ptr+12>>2]=0;var
worker=pthread.worker;PThread.returnWorkerToPool(worker);PThread.unusedWorkers.push(worker);PThread.runni
ngWorkers.splice(PThread.runningWorkers.indexOf(worker),1);worker.terminate();worker.stackBase=0}function
freeThreadData(pthread){if(pthread){var
tlsMemory=GROWABLE_HEAP_I32()[pthread.threadInfoStruct+100>>2];GROWABLE HEAP_I32()[pthread.thre
adInfoStruct+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.runningWorkers.splice(PThread.runningWorkers.indexOf(worker),1);PThread.freeThreadData(worker.pthread);worker.pthread=null},returnWorkerToPool:function(worker){PThread.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;id(d["targetThread"]&d["targetThread"]=worker_pthread[0]);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==="load"){worker.loaded=true;if(onFinishedLoading)onFinishedLoading(worker);if(worker.runPthread){worker.runPthread();delete worker.runPthread}else if(cmd==="printErr"){out("Thread "+d["threadId"]+"": "+d["text"]})else if(cmd==="print"){out("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{err("worker sent an unknown command "+cmd");PThread.currentProxiedOperationCallerThread=undefined;worker.onerror=function(e){err("pthread sent an error! "+e.errno+":"+e.lineno+":
"+e.message));if(ENVIRONMENT_IS_NODE){worker.on("message",function(data){worker.onmessage(data);worker.onerror(data);worker.postMessage(data);worker.on("exit",function(data){}))}}PThread.on("message",function(data){worker.onmessage(data);worker.onerror(data);worker.postMessage(data);worker.on("exit",function(data){}))}}}}}}};function allocateUnusedWorker(){var pthreadMainJs=locateFile("tfjs-backend-wasm-threaded-simd.worker.js");PThread.unusedWorkers.push(new Worker(pthreadMainJs))},getNewWorker(){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(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_futex_wait(addr,val,timeout){if(addr<=0||addr>GROWABLE_HEAP_I32().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}else 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 isEmAsmConst=index<0;var func=!isEmAsmConst?proxiedFunctionTable[index]:ASM_CONSTS[-index-1];return func.apply(null,_emscripten_receive_on_main_thread_js_callArgs);stackRestore(stack);return func}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(requestedSize);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}

function _emscripten_resize_heap(requestedSize){
var oldSize=_emscripten_get_heap_size(requestedSize);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}

JSEvents={inEventHandler:0,removeAllEventListeners:function(){for(var i=JSEvents.eventHandlers.length-1;i>=0;--i){JSEvents._removeHandler(i)}JSEvents.eventHandlers=[];JSEvents.deferredCalls=[];JSEvents.removeEventListenersRegistered=false;JSEvents.removeEventListenersRegistered=false}
JSEvents.registerRemoveEventListeners:function(){if(!JSEvents.removeEventListenersRegistered){__ATEXIT__.push(JSEvents.removeAllEventListeners);JSEvents.removeEventListenersRegistered=true}}
JSEvents.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))}{JSEvents.deferredCalls.push({targetFunction:targetFunction,precedence:precedence,argsList:argsList})}JSEvents.deferredCalls.sort(function(x,y){return x.precedence>y.precedence})}
JSEvents.removeDeferredCalls:function(targetFunction){for(var i=0;i<JSEvents.deferredCalls.length;++i){if(JSEvents.deferredCalls[i].targetFunction==targetFunction){JSEvents.deferredCalls.splice(i,1);--i}}}
JSEvents.canPerformEventHandlerRequests:function(){return JSEvents.inEventHandler&&JSEvents.currentEventHandler.allowsDeferredCalls}
JSEvents.runDeferredCalls:function(){if(!JSEvents.canPerformEventHandlerRequests()){return}for(var i=0;i<JSEvents.deferredCalls.length;++i){var call=JSEvents.deferredCalls[i];call.targetFunction.apply(null,call.argsList);JSEvents.deferredCalls.splice(i,1);--i}}
JSEvents.removeFromEventTarget:function(target,eventTypeString){for(var i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==target&&eventTypeString==JSEvents.eventHandlers[i].eventTypeString){JSEvents._removeHandler(i--)}}}
JSEvents.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.addEventListener(eventTypeString,jsEventHandler,useCapture);JSEvents.eventHandlers.push(eventHandler);JSEvents.registerRemoveEventListeners();}else for(var i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==eventHandler&&JSEvents.eventHandlers[i].eventTypeString==eventTypeString){JSEvents._removeHandler(i--)}}}
JSEvents._removeHandler:function(i){var h=JSEvents.eventHandlers[i].h;JSEvents.eventHandlers.splice(i,1);JSEvents._removeHandler(h.h.typeString,h.eventListenerFunc,h.useCapture);JSEvents.eventHandlers.splice(i,1);JSEvents.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.addEventListener(eventTypeString,jsEventHandler,useCapture);JSEvents.eventHandlers.push(eventHandler);JSEvents.registerRemoveEventListeners();}else for(var i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==eventHandler&&JSEvents.eventHandlers[i].eventTypeString==eventTypeString){JSEvents._removeHandler(i--)}}}
JSEvents.addTargetOnThread_iiii:function(targetThread,threadHandlerFunc,threadTypeId,userData){var stackTop=stackSave();var varargs=stackAlloc(12);GROWABLE_HEAP_I32()[varargs+2]=threadTypeId;GROWABLE_HEAP_I32()[varargs+4+>>2]=userData;__emscripten_call_on_thread(0,targetThread,637534208,threadHandlerFunc,userData,varargs);stackRestore(stackTop);JSEvents.getTargetThreadForEventCallback:function(targetThread){switch(targetThread){case 1:return 0;case 2:return PTThread.currentProxiedOperationCallerThread;default:return targetThread}}
JSEvents.addNodeNameForTarget:function(target){if(!target)\";if(target==window)\";\"#window\";if(target==screen)\";\"#screen\";return

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return WasmBackendModuleThreadedSimd.ready
);}
})();
if (typeof exports === 'object' && typeof module === 'object')
    module.exports = WasmBackendModuleThreadedSimd;
else if (typeof define === 'function' && define['amd'])
    define([], function() { return WasmBackendModuleThreadedSimd; });
else if (typeof exports === 'object')
    exports['WasmBackendModuleThreadedSimd'] = WasmBackendModuleThreadedSimd;
module(wasmFactoryThreadedSimd)

interface

TensorData {
  id: number;
  memoryOffset: number;
  shape: number[];
  dtype: DataType;
  refCount: number;
}

 Only used for string tensors, storing encoded bytes. */

stringBytes?: Uint8Array[];

/*

export
type

DataId = object; // object instead of {} to force non-primitive.*/

export class BackendWasm extends KernelBackend {
  // 0 is reserved for null data ids.
  private dataIdNextNumber = 1;

  constructor(public wasm:
    BackendWasmModule|BackendWasmThreadedSimdModule) {
    super();
  }

  async time(f: () => void): Promise<BackendTimingInfo> {
    const start = util.now();
    f();
    const kernelMs = util.now() - start;
    return {kernelMs};
  }

  disposeData(dataId: DataId, force = false): boolean {
    if (this.dataIdMap.has(dataId)) {
      const data = this.dataIdMap.get(dataId);
      data.refCount--;
      if (!force && data.refCount > 0) {
        return false;
      }
      this.wasm._free(data.memoryOffset);
      this.wasm.tfjs.disposeData(data.id);
      this.dataIdMap.delete(dataId);
    }
    return true;
  }

  memory() {
    return {unreliable: false};
  }

  // Make a tensor info for the output of an op. If ‘memoryOffset’ is not
  // present, this method allocates memory on the WASM heap. If ‘memoryOffset’
  // is present, the memory was allocated elsewhere (in c++) and we just record
  // the pointer where that memory lives. */

  makeOutput(shape: number[], dtype: DataType, memoryOffset?: number): TensorInfo {
    let dataId: {};
    if (memoryOffset == null) {
      dataId = this.write(null /* values */, shape, dtype, refCount: 1);
    } else {
      const id = this.dataIdNextNumber++;
      dataId = {id};
      this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype, refCount: 1});
      const size = util.sizeFromShape(shape);
      this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype, refCount: 1});
    }
    return typedArrayFromBuffer(dataId.memoryOffset.buffer, dtype);
  }
memoryOffset);
    }
    return {dataId, shape, dtype};
  }

  typedArrayFromHeap({shape, dtype, dataId}: TensorInfo):
      backend_util.TypedArray {
    const buffer = this.wasm.HEAPU8.buffer;
    const
    memoryOffset = this.dataIdMap.get(dataId);
    const size = util.sizeFromShape(shape);
    switch (dtype) {
      case 'float32':
        return new Float32Array(buffer, memoryOffset, size);
      case 'int32':
        return new Int32Array(buffer, memoryOffset, size);
      case 'bool':
        return new Uint8Array(buffer, memoryOffset, size);
      default:
        throw new Error(`Unknown dtype ${dtype}`);
    }
  }

function createInstantiateWasmFunc(path: string) {
  // this will be replace by rollup plugin patchWechatWebAssembly
  // in
  // minprogram's output.
  // tslint:disable-next-line:no-any
  return (imports: any, callback: any) => {
    util.fetch(path, {credentials: 'same-origin'}).then((response) => {
      if (!response.ok) {
        imports.env.a(`failed to load wasm binary file at '${path}'`);
      }
      response.arrayBuffer().then((binary) => {
        WebAssembly.instantiate(binary, imports).then(output => {
          callback(output.instance, output.module);
        });
      });
    });
    return {};
  };

/**
 * Returns the path of the WASM binary.
 * @param simdSupported whether SIMD is supported
 * @param threadsSupported whether multithreading is supported
 * @param wasmModuleFolder the directory containing the WASM binaries.
 */
function getPathToWasmBinary(
    simdSupported: boolean, threadsSupported: boolean,
    wasmModuleFolder: string) {
  if (wasmPath != null) {
    // If wasmPath is defined, the user has supplied a full path to
    // the vanilla .wasm binary.
    return wasmPath;
  }

  let path: WasmBinaryName = 'tfjs-backend-wasm.wasm';
  if (simdSupported && threadsSupported) {
    path = 'tfjs-backend-wasm-threaded-simd.wasm';
  } else if (simdSupported) {
    path = 'tfjs-backend-wasm-simd.wasm';
  }

  if (wasmFileMap != null) {
    if (wasmFileMap[path] != null) {
      return wasmFileMap[path];
    }
  }

  return wasmModuleFolder + path;
}

/**
 * Initializes the wasm
 * module and creates the js <--> wasm bridge.
 *
 * NOTE: We wrap the wasm module in a object with property
 * 'wasm' instead of
 * returning Promise<BackendWasmModule> to avoid freezing Chrome (last tested
 * in Chrome 76);
 * @param async function init(): Promise<BackendWasmModule>
 * @param initAborted
 * threadSupported: boolean, threadsSupported: boolean, wasmModuleFolder: string)
 */
export async function init(): Promise<{wasm: BackendWasmModule}> {
  // Use the instantiateWasm override when system fetch is not available.
  // Reference:
  // https://github.com/emscripten-core/emscripten/blob/2bca083cbdd5a4133db61fb7d4d04f7eefcfa907/tests/manual_wasm_instantiate.html#L170
  const [simdSupported, threadsSupported] = await Promise.all(
    [env().getAsync('WASM_HAS_SIMD_SUPPORT'),
     env().getAsync('WASM_HAS_MULTITHREAD_SUPPORT')
  ]);

  // This function overrides the Emscripten
  module locateFile utility.
  factoryConfig.locateFile = (path, prefix) => {
    if (path.endsWith('.worker.js')) {
      const response = wasmWorkerContents;
      const blob = new Blob([response], {type: 'application/javascript'});
      return URL.createObjectURL(blob);
    }

    if (path.endsWith('.wasm')) {
      return getPathToWasmBinary(
          simdSupported, threadsSupported,
          wasmPathPrefix != null ? wasmPathPrefix : prefix);
    }
    return prefix + path;
  }

  const factoryConfig: WasmFactoryConfig = {
    onAbort: () => {
      // Emscripten already called console.warn so no need to
      // double log.
      if (initAborted) {
        // Emscripten calls `onAbort` twice, resulting in double
        // error messages.
        return;
      }
      initAborted = true;
      const rejectMsg =
          'Make sure the server can serve the `.wasm` file relative to the ' +
          'bundled js file. For more details see
      reject({message: rejectMsg});
    }

    onAbort: (error) => {
      // Make sure the server can serve the `.wasm` file relative to the ' +
      // bundled js file. For more details see
    }

    wasmPathPrefix: ''
  };

  if (customFetch) {
    factoryConfig.instance = wasmFactoryThreadedSimd;
  }

  return new Promise((resolve, reject) => {
    const wasm = factoryConfig.instance;

    if (wasmPathPrefix !== null) {
      wasmPathPrefix = null;
    }

    // Use the instantiateWasm override when system fetch is not available.
    // Reference:
    // https://github.com/emscripten-core/emscripten/blob/2bca083cbdd5a4133db61fb7d4d04f7eefcfa907/tests/manual_wasm_instantiate.html#L170
    factoryConfig.instance = (path, prefix) => {
      if (path.endsWith('.wasm')) {
        const blob = new Blob([response], {type: 'application/javascript'});
        return URL.createObjectURL(blob);
      }

      if (path.endsWith('.worker.js')) {
        const response = wasmWorkerContents;
        const blob = new Blob([response], {type: 'application/javascript'});
        return URL.createObjectURL(blob);
      }

      const factoryConfig: WasmFactoryConfig = {
        onAbort: () => {
          // Emscripten already called console.warn so no need to
          // double log.
          if (initAborted) {
            // Emscripten calls `onAbort` twice, resulting in double
            // error messages.
            return;
          }
          initAborted = true;
          const rejectMsg =
              'Make sure the server can serve the `.wasm` file relative to the ' +
              'bundled js file. For more details see
          reject({message: rejectMsg});
        }

        onAbort: (error) => {
          // Make sure the server can serve the `.wasm` file relative to the ' +
          // bundled js file. For more details see
        }

        wasmPathPrefix: null
      };

      // Use the instantiateWasm override when system fetch is not available.
    }

    factoryConfig.instance = wasmFactoryThreadedSimd;
  });
binaries.
  wasm = wasmFactory(factoryConfig);
} // The WASM module has been successfully
// created by the factory. // Any error will be caught by the onAbort callback defined above.
in
wasm.then(module) => {
  if (module) {
    // The WASM factory has been initialized.
    // Any error will be caught by the onAbort callback defined above.
    initWithThreadsCount(module, factoryConfig);
    module.wasm = wasmFactory(factoryConfig);
    wasm = wasmFactory(factoryConfig);
  }
}

// The WASM module has been successfully
// created by the factory.
module.exports = {
  init: module.cwrap('init', null, []),
  initWithThreadsCount: module.cwrap('init_with_threads_count', 'number', []),
  registerTensor: module.cwrap('register_tensor', 'number', [])
};

const voidReturnType = null;
module.tfjs = {
  init: module.cwrap('init', voidReturnType, []),
  initWithThreadsCount: module.cwrap('init_with_threads_count', voidReturnType, []),
  getThreadsCount: module.cwrap('get_threads_count', 'number', []),
  dispose: module.cwrap('dispose', voidReturnType, [])
};

wasm.then((module) => {
  initialized = true;
  initAborted = false;

  const voidReturnType = null;
  module.tfjs = {
    init: module.cwrap('init', voidReturnType, []),
    initWithThreadsCount: module.cwrap('init_with_threads_count', voidReturnType, []),
    getThreadsCount: module.cwrap('get_threads_count', 'number', []),
    dispose: module.cwrap('dispose', voidReturnType, [])
  };
numThreads;\n}/**\n* Gets the actual threads count that is used by XNNPACK.\n* It is set after the backend is initialized.\n*\n* @param {number} function getThreadsCount: number \n* @returns {number} return actualThreadsCount;\n*/\n
/**\n* Gets the actual threads count that is used by XNNPACK.\n* It is set after the backend is initialized.\n*\n* @returns {number} return actualThreadsCount;\n*/

/**\n@license See the LICENSE file.\n*/

export function getThreadsCount(): number {
  if (actualThreadsCount === -1) {
    throw new Error(`WASM backend not initialized.`);
  }
  return actualThreadsCount;
}

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import './flags_wasm';

import {registerBackend} from '@tensorflow/tfjs-core';

import {BackendWasm, init} from './backend_wasm';

export {BackendWasm, getThreadsCount, setThreadsCount, setWasmPath, setWasmPaths} from './backend_wasm';
export {version as version_wasm} from './version';

const WASM_PRIORITY = 2;
registerBackend('wasm', async () => {
  const {wasm} = await init();
  return new BackendWasm(wasm);
}, WASM_PRIORITY);

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import './flags_wasm';

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import {BackendWasm, init} from './backend_wasm';

export {BackendWasm, getThreadsCount, setThreadsCount, setWasmPath, setWasmPaths} from './backend_wasm';
export {version as version_wasm} from './version';

const WASM_PRIORITY = 2;
registerBackend('wasm', async () => {
  const {wasm} = await init();
  return new BackendWasm(wasm);
}, WASM_PRIORITY);
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5737
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```typescript
import {KernelConfig, KernelFunc, TensorInfo, Unpack, UnpackAttrs, UnpackInputs} from '@tensorflow/tfjs-core';

import {BackendWasm} from '../backend_wasm';

import {slice} from './Slice';

function unpack(
    args: {inputs: UnpackInputs, backend: BackendWasm, attrs: UnpackAttrs}):

  const {inputs, backend, attrs} = args;
  const {value} = inputs;
  let {axis} = attrs;

  if (axis < 0) {
    axis += value.shape.length;
  }

  const numOutputs = value.shape[axis];
  const rank =
```
value.shape.length; const outShape: number[] = new Array(rank - 1);
  let outIndex = 0;
  for (let i = 0; i < rank; i++) {
    if (i !== axis) {
      outShape[outIndex++] = value.shape[i];
    }
  }
  const outs: TensorInfo[] = new Array(numOutputs);
  const begin = new Array(rank).fill(0);
  const size = value.shape.slice();
  size[axis] = 1;
  for (let i = 0; i < outs.length; i++) {
    begin[axis] = i;
    outs[i] = slice({inputs: {x: value}, attrs: {begin, size},
      backend});
  }
  return outs.map(({dataId, dtype}) => ({dataId, dtype, shape: outShape}));
}

export const unpackConfig: KernelConfig = {
  kernelName: Unpack,
  backendName: 'wasm',
  kernelFunc: unpack as {} as KernelFunc,
};

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 */

import {Cos, KernelConfig} from '@tensorflow/tfjs-core';

import {createUnaryKernelConfig} from './unary_kernel';

export const cosConfig: KernelConfig = createUnaryKernelConfig(Cos);
```
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 *
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export const coshConfig: KernelConfig = createUnaryKernelConfig(Cosh);
```

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 *
=============================================================================

import {KernelConfig, KernelFunc, Range, RangeAttrs, TensorInfo} from '@tensorflow/tfjs-core';

export const range =
    (args: {backend: BackendWasm, attrs: RangeAttrs}): TensorInfo => {
      const {backend, attrs} = args;
      const {start, stop, step, dtype} = attrs;
      const values = rangeImplCPU(start, stop, step, dtype);

      const out = backend.makeOutput([values.length], dtype);
      const outVals = backend.typedArrayFromHeap(out);
      outVals.set(values);
      return out;
    };

export const rangeConfig:
```

```
```

---

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KernelConfig = {
  kernelName: Range,
  backendName: \"wasm\",
  kernelFunc: range as {} as KernelFunc
};

Found in path(s):
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Range.js.map

1.312 flyway-test 6.4.0
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* /opt/cola/permits/1129909867_1612394256.07/0/flyway-test-6-4-0-sources-jar/org/flywaydb/test/annotation/package-info.java
* /opt/cola/permits/1129909867_1612394256.07/0/flyway-test-6-4-0-sources-jar/org/flywaydb/test/annotation/FlywayTest.java
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* /opt/cola/permits/1135840663_1613613063.73/0/reactive-streams-1-0-3-sources-3-jar/org/reactivestreams/Publisher.java
* /opt/cola/permits/1135840663_1613613063.73/0/reactive-streams-1-0-3-sources-3-jar/org/reactivestreams/FlowAdapters.java
* /opt/cola/permits/1135840663_1613613063.73/0/reactive-streams-1-0-3-sources-3-jar/org/reactivestreams/Processor.java
* /opt/cola/permits/1135840663_1613613063.73/0/reactive-streams-1-0-3-sources-3-jar/org/reactivestreams/Subscription.java
* /opt/cola/permits/1135840663_1613613063.73/0/reactive-streams-1-0-3-sources-3-jar/org/reactivestreams/Subscriber.java

1.315 mpdecimal 2.4.2

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Other developers who have contributed code are:

* Brian Langel

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1.324 kerberos 1.11.1

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 lib/krb5/kdb/kdb_log.c
 lib/krb5/kdb/kdb_log.h
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 lib/libgss/g_utils.c
 lib/libgss/g_verify.c
 lib/libgss/gssd_pname_to_uid.c
 uts/common/gssapi/include/gssapi_err_generic.h
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The implementations of GSSAPI mechglue in GSSAPI-SPNEGO in "src/lib/gssapi", including the following files:

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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
lib/gssapi/mechglue/g_seal.c
lib/gssapi/mechglue/g_sign.c
lib/gssapi/mechglue/g_store_cred.c
lib/gssapi/mechglue/g_unseal.c
lib/gssapi/mechglue/g_userok.c
lib/gssapi/mechglue/g_utils.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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@page
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```

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```
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@var{signature of Ty Coon}, 1 April 1990
Ty Coon, President of Vice
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Although the Lesser General Public License is Less protective of the users' freedom, it does ensure that the user of a program that is linked with the Library has the freedom and the wherewithal to run that program using a modified version of the Library.

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, whereas the latter must be combined with the library in order to run.

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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.

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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.

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a) Accompany the work with the complete corresponding 
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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 
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In addition, mere aggregation of another work not based on the Program with the Program (or with a work based on the Program) 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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c) Accompany it with the information you received as to the offer to distribute corresponding source code. (This alternative is
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* /opt/cola/permits/1135888248_1613626225.19/0/spring-jdbc-5-2-8-release-sources-1-
jar/org/springframework/jdbc/support/MetaDataAccessException.java
* /opt/cola/permits/1135888248_1613626225.19/0/spring-jdbc-5-2-8-release-sources-1-
jar/org/springframework/jdbc/config/JdbcNamespaceHandler.java
* /opt/cola/permits/1135888248_1613626225.19/0/spring-jdbc-5-2-8-release-sources-1-
jar/org/springframework/jdbc/datasource/embedded/SimpleDriverDataSourceFactory.java
* /opt/cola/permits/1135888248_1613626225.19/0/spring-jdbc-5-2-8-release-sources-1-
jar/org/springframework/jdbc/support/xml/XmlResultProvider.java
* /opt/cola/permits/1135888248_1613626225.19/0/spring-jdbc-5-2-8-release-sources-1-
jar/org/springframework/jdbc/support/SqlValue.java
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* /opt/cola/permits/1135888248_1613626225.19/0/spring-jdbc-5-2-8-release-sources-1-
jar/org/springframework/jdbc/config/JdbcNamespaceHandler.java
* /opt/cola/permits/1135888248_1613626225.19/0/spring-jdbc-5-2-8-release-sources-1-
jar/org/springframework/jdbc/datasource/embedded/SimpleDriverDataSourceFactory.java
* /opt/cola/permits/1135888248_1613626225.19/0/spring-jdbc-5-2-8-release-sources-1-
jar/org/springframework/jdbc/support/xml/XmlResultProvider.java
* /opt/cola/permits/1135888248_1613626225.19/0/spring-jdbc-5-2-8-release-sources-1-
jar/org/springframework/jdbc/support/SqlValue.java
* /opt/cola/permits/1135888248_1613626225.19/0/spring-jdbc-5-2-8-release-sources-1-
jar/org/springframework/jdbc/datasource/lookup/SingleDataSourceLookup.java
* /opt/cola/permits/1135888248_1613626225.19/0/spring-jdbc-5-2-8-release-sources-1-jar/org/springframework/jdbc/datasource/lookup/DataSourceLookupFailureException.java
* /opt/cola/permits/1135888248_1613626225.19/0/spring-jdbc-5-2-8-release-sources-1-jar/org/springframework/jdbc/datasource/SmartDataSource.java
* /opt/cola/permits/1135888248_1613626225.19/0/spring-jdbc-5-2-8-release-sources-1-jar/org/springframework/jdbc/datasource/lookup/JndiDataSourceLookup.java
* /opt/cola/permits/1135888248_1613626225.19/0/spring-jdbc-5-2-8-release-sources-1-jar/core/InterruptibleBatchPreparedStatementSetter.java
* /opt/cola/permits/1135888248_1613626225.19/0/spring-jdbc-5-2-8-release-sources-1-jar/org/springframework/jdbc/support/incrementer/AbstractSequenceMaxValueIncrementer.java
* /opt/cola/permits/1135888248_1613626225.19/0/spring-jdbc-5-2-8-release-sources-1-jar/jdbc/support/xml/XmlCharacterStreamProvider.java
* /opt/cola/permits/1135888248_1613626225.19/0/spring-jdbc-5-2-8-release-sources-1-jar/jdbc/support/xml/XmlBinaryStreamProvider.java
* /opt/cola/permits/1135888248_1613626225.19/0/spring-jdbc-5-2-8-release-sources-1-jar/jdbc/support/xml/SqlXmlFeatureNotImplementedException.java
* /opt/cola/permits/1135888248_1613626225.19/0/spring-jdbc-5-2-8-release-sources-1-jar/jdbc/core/BatchPreparedStatementSetter.java
* /opt/cola/permits/1135888248_1613626225.19/0/spring-jdbc-5-2-8-release-sources-1-jar/jdbc/core/SqlProvider.java

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* /opt/cola/permits/1135888248_1613626225.19/0/spring-jdbc-5-2-8-release-sources-1.jar/org/springframework/jdbc/datasource/init/CannotReadScriptException.java
* /opt/cola/permits/1135888248_1613626225.19/0/spring-jdbc-5-2-8-release-sources-1.jar/org/springframework/jdbc/datasource/init/UncategorizedScriptException.java
* /opt/cola/permits/1135888248_1613626225.19/0/spring-jdbc-5-2-8-release-sources-1.jar/org/springframework/jdbc/datasource/DriverManagerDataSource.java
* /opt/cola/permits/1135888248_1613626225.19/0/spring-jdbc-5-2-8-release-sources-1.jar/org/springframework/jdbc/datasource/SingleConnectionDataSource.java
* /opt/cola/permits/1135888248_1613626225.19/0/spring-jdbc-5-2-8-release-sources-1.jar/org/springframework/jdbc/core/metadata/GenericTableMetaDataProvider.java
* /opt/cola/permits/1135888248_1613626225.19/0/spring-jdbc-5-2-8-release-sources-1.jar/org/springframework/jdbc/datasource/SimpleDriverDataSource.java
* /opt/cola/permits/1135888248_1613626225.19/0/spring-jdbc-5-2-8-release-sources-1.jar/org/springframework/jdbc/datasource/init/DatabasePopulatorUtils.java
* /opt/cola/permits/1135888248_1613626225.19/0/spring-jdbc-5-2-8-release-sources-1.jar/org/springframework/jdbc/core/metadata/CallMetaDataProviderFactory.java
* /opt/cola/permits/1135888248_1613626225.19/0/spring-jdbc-5-2-8-release-sources-1.jar/org/springframework/jdbc/core/namedparam/NamedParameterJdbcTemplate.java
* /opt/cola/permits/1135888248_1613626225.19/0/spring-jdbc-5-2-8-release-sources-1.jar/org/springframework/jdbc/datasource/init/SqlReturnType.java
* /opt/cola/permits/1135888248_1613626225.19/0/spring-jdbc-5-2-8-release-sources-1.jar/org/springframework/jdbc/datasource/init/DatabasePopulatorUtils.java
* /opt/cola/permits/1135888248_1613626225.19/0/spring-jdbc-5-2-8-release-sources-1.jar/org/springframework/jdbc/datasource/init/ScriptUtils.java
* /opt/cola/permits/1135888248_1613626225.19/0/spring-jdbc-5-2-8-release-sources-1.jar/org/springframework/jdbc/core/metdata/CallMetaDataProviderFactory.java
* /opt/cola/permits/1135888248_1613626225.19/0/spring-jdbc-5-2-8-release-sources-1.jar/org/springframework/jdbc/core/metdata/CallMetaDataProviderFactory.java
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* /opt/cola/permits/1135888248_1613626225.19/0/spring-jdbc-5-2-8-release-sources-1-jar/org/springframework/jdbc/datasource/init/ResourceDatabasePopulator.java
* /opt/cola/permits/1135888248_1613626225.19/0/spring-jdbc-5-2-8-release-sources-1-jar/org/springframework/jdbc/core/simple/AbstractJdbcTemplate.java
* /opt/cola/permits/1135888248_1613626225.19/0/spring-jdbc-5-2-8-release-sources-1-jar/org/springframework/jdbc/support/SQLExceptionTranslator.java
* /opt/cola/permits/1135888248_1613626225.19/0/spring-jdbc-5-2-8-release-sources-1-jar/org/springframework/jdbc/core/SingleColumnRowMapper.java
* /opt/cola/permits/1135888248_1613626225.19/0/spring-jdbc-5-2-8-release-sources-1-jar/org/springframework/jdbc/datasource/LazyConnectionDataSourceProxy.java
* /opt/cola/permits/1135888248_1613626225.19/0/spring-jdbc-5-2-8-release-sources-1-jar/org/springframework/jdbc/core/StatementCreatorUtils.java
* /opt/cola/permits/1135888248_1613626225.19/0/spring-jdbc-5-2-8-release-sources-1-jar/org/springframework/jdbc/datasource/DataSourceFactory.java
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* /opt/cola/permits/1135888248_1613626225.19/0/spring-jdbc-5-2-8-release-sources-1-jar/org/springframework/jdbc/core/namedparam/SqlParameterSource.java
* /opt/cola/permits/1135888248_1613626225.19/0/spring-jdbc-5-2-8-release-sources-1-jar/org/springframework/jdbc/core/namedparam/NamedParameterJdbcOperations.java
* /opt/cola/permits/1135888248_1613626225.19/0/spring-jdbc-5-2-8-release-sources-1-jar/org/springframework/jdbc/core/StatementCreatorUtils.java
* /opt/cola/permits/1135888248_1613626225.19/0/spring-jdbc-5-2-8-release-sources-1-jar/org/springframework/jdbc/datasource/DataSourceFactory.java
* /opt/cola/permits/1135888248_1613626225.19/0/spring-jdbc-5-2-8-release-sources-1-jar/org/springframework/jdbc/datasource/DataSourceTransactionManager.java
* /opt/cola/permits/1135888248_1613626225.19/0/spring-jdbc-5-2-8-release-sources-1-jar/org/springframework/jdbc/core/SingleColumnRowMapper.java
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*/
* Implement this interface when parameters need to be customized based
  * on the connection. We might need to do this to make use of proprietary
  * features, available only with a specific Connection type.
  *
  * @author Rod Johnson
  * @author Thomas Risberg
  * @see CallableStatementCreatorFactory#newCallableStatementCreator(ParameterMapper)
  * @see org.springframework.jdbc.object.StoredProcedure#execute(ParameterMapper)
  */

**
* Create a Map of input parameters, keyed by name.
* @param con a JDBC connection. This is useful (and the purpose of this interface)
* if we need to do something RDBMS-specific with a proprietary Connection
* implementation class. This class conceals such proprietary details. However,
* it is best to avoid using such proprietary RDBMS features if possible.
* @return a Map of input parameters, keyed by name (never { @code null })
* @throws SQLException if an SQLException is encountered setting
* parameter values (that is, there's no need to catch SQLException)
 */

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* limitations under the License.
*/
/**
* Strategy interface for translating between {@link SQLException SQLExceptions}
* and Spring's data access strategy-agnostic {@link DataAccessException} hierarchy.
* 
* Implementations can be generic (for example, using
* [SQLState] codes for JDBC) or wholly
* proprietary (for example, using Oracle error codes) for greater precision.
* 
* @author Rod Johnson
* @author Juergen Hoeller
* @see org.springframework.dao.DataAccessException
*/

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/**
* The classes in this package make JDBC easier to use and
* reduce the likelihood of common errors. In particular, they:
* <ul>
* 
* </ul>
* <li>Simplify error handling, avoiding the need for try/catch/finally blocks in application code.
* <li>Present exceptions to application code in a generic hierarchy of unchecked exceptions, enabling applications to catch data access exceptions without being dependent on JDBC, and to ignore fatal exceptions there is no value in catching.
* <li>Allow the implementation of error handling to be modified to target different RDBMSes without introducing proprietary dependencies into application code.
* </ul>

* This package and related packages are discussed in Chapter 9 of
  * by Rod Johnson (Wrox, 2002).
*/

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*/

/*
 * Close this LobCreator session and free its temporarily created BLOBs and CLOBs.
 * Will not need to do anything if using PreparedStatement's standard methods,
 * but might be necessary to free database resources if using proprietary means.
 * <p><b>NOTE</b>: Needs to be invoked after the involved PreparedStatements have
 * been executed or the affected O/R mapping sessions have been flushed.
 * Otherwise, the database resources for the temporary BLOBs might stay allocated.
 */

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  jar/org/springframework/jdbc/core/namedparam/NamedParameterBatchUpdateUtils.java
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- jar/org/springframework/jdbc/core/CallableStatementCallback.java
- jar/org/springframework/jdbc/datasource/embedded/EmbeddedDatabaseFactory.java
- jar/org/springframework/jdbc/datasource/DataSourceUtils.java
- jar/org/springframework/jdbc/BadSqlGrammarException.java
- jar/org/springframework/jdbc/core/support/AbstractInterruptibleBatchPreparedStatementSetter.java
- jar/org/springframework/jdbc/support/incrementer/HsqlSequenceMaxValueIncrementer.java
- jar/org/springframework/jdbc/core/SqlRowSetResultSetExtractor.java
- jar/org/springframework/jdbc/datasource/lookup/MapDataSourceLookup.java
- jar/org/springframework/jdbc/support/incrementer/H2SequenceMaxValueIncrementer.java
- jar/org/springframework/jdbc/InvalidResultSetAccessException.java
- jar/org/springframework/jdbc/support/SQLErrorCodes.java
- jar/org/springframework/jdbc/datasource/embedded/HsqlEmbeddedDatabaseConfigurer.java
- jar/org/springframework/jdbc/core/metadata/TableMetaDataContext.java
- jar/org/springframework/jdbc/datasource/EmbeddedDatabaseType.java
- jar/org/springframework/jdbc/support/incrementer/AbstractColumnMaxValueIncrementer.java
- jar/org/springframework/jdbc/core/ColumnMapRowMapper.java
- jar/org/springframework/jdbc/datasource/UserCredentialsDataSourceAdapter.java
- jar/org/springframework/jdbc/core/metadata/HanaCallMetaDataProvider.java
- jar/org/springframework/jdbc/datasource/lookup/MapDataSourceLookup.java
- jar/org/springframework/jdbc/support/incrementer/SybaseAnywhereMaxValueIncrementer.java
- jar/org/springframework/jdbc/core/RowMapperResultSetExtractor.java
- jar/org/springframework/jdbc/core/support/JdbcDaoSupport.java
- jar/org/springframework/jdbc/JdbcUpdateAffectedIncorrectNumberOfRowsException.java
- jar/org/springframework/jdbc/core/metadata/HsqlEmbeddedDatabaseConfigurer.java
- jar/org/springframework/jdbc/support/incrementer/AbstractColumnMaxValueIncrementer.java
- jar/org/springframework/jdbc/support/GeneratedKeyHolder.java
- jar/org/springframework/jdbc/JdbcUpdateAffectedIncorrectNumberOfRowsException.java
- jar/org/springframework/jdbc/datasource/UserCredentialsDataSourceAdapter.java
- jar/org/springframework/jdbc/core/support/JdbcDaoSupport.java
- jar/org/springframework/jdbc/support/GeneratedKeyHolder.java
- jar/org/springframework/jdbc/JdbcUpdateAffectedIncorrectNumberOfRowsException.java
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* /opt/cola/permits/1135888248_1613626225.19/0/spring-jdbc-5-2-8-release-sources-1.jar/org/springframework/jdbc/core/ResultSetExtractor.java
* /opt/cola/permits/1135888248_1613626225.19/0/spring-jdbc-5-2-8-release-sources-1.jar/org/springframework/jdbc/core/support/incrementer/HanaSequenceMaxValueIncrementer.java
* /opt/cola/permits/1135888248_1613626225.19/0/spring-jdbc-5-2-8-release-sources-1.jar/org/springframework/jdbc/core/namedparam/EmptySqlParameterSource.java
* /opt/cola/permits/1135888248_1613626225.19/0/spring-jdbc-5-2-8-release-sources-1.jar/org/springframework/jdbc/core/SqlReturnUpdateCount.java
* /opt/cola/permits/1135888248_1613626225.19/0/spring-jdbc-5-2-8-release-sources-1.jar/org/springframework/jdbc/support/incrementer/DerbyMaxValueIncrementer.java
* /opt/cola/permits/1135888248_1613626225.19/0/spring-jdbc-5-2-8-release-sources-1.jar/org/springframework/jdbc/core/SqlOutParameter.java
* /opt/cola/permits/1135888248_1613626225.19/0/spring-jdbc-5-2-8-release-sources-1.jar/org/springframework/jdbc/core/support/AbstractSqlTypeValue.java
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1.334 attr 2.4.48-5

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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/protobuf/ProtobufVarint32FrameDecoder.java
  */opt/ws_local/PERMITS_SQL/1072948336_1595240763.12/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/protobuf/ProtobufDecoder.java
  */opt/ws_local/PERMITS_SQL/1072948336_1595240763.12/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/protobuf/ProtobufVarint32LengthFieldPrepender.java
  */opt/ws_local/PERMITS_SQL/1072948336_1595240763.12/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/protobuf/ProtobufDecoderNano.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/marshalling/MarshallerProvider.java
* /opt/ws_local/PERMITS_SQL/1072948336_1595240763.12/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/serialization/PrematureChannelClosureException.java
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  jar/io/netty/handler/codec/string/LineSeparator.java
* /opt/ws_local/PERMITS_SQL/1072948336_1595240763.12/0/netty-codec-4-1-51-final-sources-
  jar/io/netty/handler/codec/compression/ByteBufChecksum.java
* /opt/ws_local/PERMITS_SQL/1072948336_1595240763.12/0/netty-codec-4-1-51-final-sources-
  jar/io/netty/handler/codec/DatagramPacketDecoder.java
* /opt/ws_local/PERMITS_SQL/1072948336_1595240763.12/0/netty-codec-4-1-51-final-sources-
  jar/io/netty/handler/codec/string/LineEncoder.java
* /opt/ws_local/PERMITS_SQL/1072948336_1595240763.12/0/netty-codec-4-1-51-final-sources-
  jar/io/netty/handler/codec/CodecOutputList.java
* /opt/ws_local/PERMITS_SQL/1072948336_1595240763.12/0/netty-codec-4-1-51-final-sources-
  jar/io/netty/handler/codec/compression/CompressionUtil.java
* /opt/ws_local/PERMITS_SQL/1072948336_1595240763.12/0/netty-codec-4-1-51-final-sources-
  jar/io/netty/handler/codec/DateFormatter.java
* /opt/ws_local/PERMITS_SQL/1072948336_1595240763.12/0/netty-codec-4-1-51-final-sources-
  jar/io/netty/handler/codec/DatagramPacketEncoder.java

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A decoder that splits the received ByteBufs 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.

[@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.

  * `<tt>lengthFieldOffset = 0</tt>`
  * `<tt>lengthFieldLength = 2</tt>`
  * `<tt>lengthAdjustment = 0</tt>`
  * `<tt>initialBytesToStrip = 0 (= do not strip header)</tt>`

  * 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 `<tt>ByteBuf#readableBytes()</tt>`, 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.

  * `<tt>lengthFieldOffset = 0</tt>`
  * `<tt>lengthFieldLength = 2</tt>`
  * `<tt>lengthAdjustment = 0</tt>`
  * `<tt>initialBytesToStrip = 2 (= the length of the Length field)</tt>`

  * 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
* lengthAdjustment. Because the length value in this example message
* is always greater than the body length by lengthAdjustment, we specify lengthAdjustment - 2
* as lengthAdjustment for compensation.

```
* 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. lengthAdjustment is zero
* again because the decoder always takes the length of the prepended data into
* account during frame length calculation.

```
* <pre>
* <b>lengthFieldOffset</b>   = 2 (= the length of Header 1)
* <b>lengthFieldLength</b>   = 3
* 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 lengthAdjustment 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 |
* | 0x00000C | 0xCAFE | "HELLO, WORLD" |
* +----------------+----------------|
* </pre>

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

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

* BEFORE DECODE (17 bytes) AFTER DECODE (17 bytes)
* +----------------+----------------|
* | Length | Header 1 | Actual Content |
* | 0x00000C | 0xCAFE | "HELLO, WORLD" |
* +----------------+----------------|
* </pre>

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

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

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

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

* BEFORE DECODE (16 bytes) AFTER DECODE (13 bytes)
* +----------------+----------------|
* | HDR1 | Length | HDR2 | Actual Content |
* | 0xCA | 0x000C | 0xFE | "HELLO, WORLD" |
* +----------------+----------------|
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1.342 giflib 5.2.1

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1.344 curl 7.62.0-DEV
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===============

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===============

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1.357 spring-security-core 5.3.4.RELEASE

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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/annotation/AuthenticationPrincipal.java

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 */
/**
 * Determines if the [link #getAuthentication()] has permission to access the target
 * given the permission
 * @param target the target domain object to check permission on
 * @param permission the permission to check on the domain object (i.e. "read",
 * "write", etc).
 * @return true if permission is granted to the [link #getAuthentication()], else
 * false
 */

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* /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/springframework/security/crypto/keygen/Base64StringKeyGenerator.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources.jar/springframework/security/authentication/DelegatingReactiveAuthenticationManager.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources.jar/springframework/security/core/Transient.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources.jar/springframework/security/core/userdetails/ReactiveUserDetailsPasswordService.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources.jar/springframework/security/crypto/password/MessageDigestPasswordEncoder.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources.jar/springframework/security/scheduling/DelegatingSecurityContextTaskScheduler.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources.jar/springframework/security/authorization/AuthorityReactiveAuthorizationManager.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources.jar/springframework/security/jackson2/UnmodifiableListDeserializer.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources.jar/springframework/security/provisioning/JdbcUserDetailsManager.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources.jar/springframework/security/access/annotation/DefaultMethodSecurityExpressionHandler.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources.jar/springframework/security/core/token/KeyBasedPersistenceTokenService.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources.jar/springframework/security/jackson2/UnmodifiableListMixin.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources.jar/springframework/security/concurrent/DelegatingSecurityContextCallable.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources.jar/springframework/security/concurrent/DelegatingSecurityContextRunnable.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources.jar/springframework/security/access/prepost/PrePostAdviceReactiveMethodInterceptor.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources.jar/springframework/security/authentication/CachingUserDetailsService.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources.jar/springframework/security/crypto/password/Md4PasswordEncoder.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources.jar/springframework/security/crypto/password/DelegatingPasswordEncoder.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources.jar/springframework/security/jackson2/BadCredentialsExceptionMixin.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources.jar/springframework/security/crypto/password/Pbkdf2PasswordEncoder.java

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/op/permits_sql/1081949690_1599626417.25/0/spring-security-core-5.3.4-release-sources.jar/org/springframework/security/access/expression/method/MethodSecurityEvaluationContext.java
/op/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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/**
 */
/**
 * @param authentication represents the user in question. Should not be null.
 * @param targetDomainObject the domain object for which permissions should be
 * checked. May be null in which case implementations should return false, as the null
 * condition can be checked explicitly in the expression.
 * @param permission a representation of the permission object as supplied by the
 * expression system. Not null.
 * @return true if the permission is granted, false otherwise
 */
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* /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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* /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/crypto/password/PasswordEncoderUtils.java
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jar/org/springframework/security/authentication/ReactiveAuthenticationManager.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-
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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/SpringSecurityCoreVersion.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/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/AuthenticatingPrincipal.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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*/
/**
* Base64 encoder which is a reduced version of Robert Harder's public domain
* implementation (version 2.3.7). See <a
for more information.

For internal use only.

@tutorial Luke Taylor
@since 3.0
@deprecated Use java.util.Base64

*/

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A token issued by \{@link TokenService\}.

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.

@author Ben Alex
@since 2.0.1

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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.

Special consideration should be given to using an <code>AfterInvocationManager</code> on bean methods that modify a database. Typically an <code>AccessDeniedException</code> will cause a rollback of the changes made by the transaction.

@author Ben Alex

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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/oracle/OracleParser.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/mysql/MySQLParser.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/jdbc/CockroachRetryingTransactionalExecutionTemplate.java
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jar/org/flywaydb/core/internal/command/DbBaseline.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
  jar/org/flywaydb/core/internal/util/SqlCallable.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
  jar/org/flywaydb/core/internal/info/AppliedMigrationAttributes.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
  jar/org/flywaydb/core/internal/resolver/sql/DefaultSqlMigrationExecutorFactory.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
  jar/org/flywaydb/core/internal/database/mysql/MySQLTable.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
  jar/org/flywaydb/core/internal/database/informix/InformixTable.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
  jar/org/flywaydb/core/internal/callback/Warning.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
  jar/org/flywaydb/core/Flyway.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
  jar/org/flywaydb/core/internal/database/sqlserver/SQLServerSchema.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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  jar/org/flywaydb/core/internal/callback/package-info.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
  jar/org/flywaydb/core/Internal resolver/java/ResolvedJavaMigration.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
  jar/org/flywaydb/core/internal/logging/javautil/JavaUtilLogCreator.java
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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
  jar/org/flywaydb/core/internal/database/cockroachdb/CockroachDBTable.java
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  jar/org/flywaydb/core/Internal database/saphana/SAPHANAConnection.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
  jar/org/flywaydb/core/Internal callback/NoopClassProvider.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
  jar/org/flywaydb/core/Internal database/redshift/RedshiftType.java
1.361 commons-collections 4.4

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Here is a list of the main contributors to lm-sensors version 3.

* Frodo Looijaard
  Original author of libsensors, sensors-detect, sensors and isadump.
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  Original author of sensord.
* Bob Schlaermann
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  libsensors and sensors.
* Mark M. Hoffman
  Many improvements to the libsensors configuration file scanner.
* Jean Delvare
  New libsensors API, and migration of sensors and sensord thereto.
  Many optimizations in libsensors and sensors.
  Configuration file converter.
  Rewrite of sensors-detect.
  Support for multiple configuration files in libsensors.

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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

Chinese
- EUC-CN, HZ, GBK, CP936, GB18030, EUC-TW, BIG5, CP950, BIG5-HKSCS,
- ISO-2022-CN-EXT

Korean

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 specific
- 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
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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Homepage
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   http://www.gnu.org/software/libiconv/

Bug reports to
--------------

   <bug-gnu-libiconv@gnu.org>

Bruno Haible <bruno@clisp.org>

1.367 glibc 2.31-0ubuntu9.2
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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): $(sdir)/%.c  
$(COMPILE.c) $(STATICCPPFLAGS) $(STATICCFLAGS) -o $@ $<  
%.o: $(sdir)/%.c  
$(COMPILE.c) $(DYNAMICCPPFLAGS) $(DYNAMICCFLAGS) -o $@ $<  

%.$(STATIC_O): $(sdir)/%.cpp  
$(COMPILE.cc) $(STATICCPPFLAGS) $(STATICCXXFLAGS) -o $@ $<  
%.o: $(sdir)/%.cpp  
$(COMPILE.cc) $(DYNAMICCPPFLAGS) $(DYNAMICCXXFLAGS) -o $@ $<
```

---

**Open Source Used In Cisco Meeting Server (formerly Acano Server) 3.4 6376**
## Dependency rules

%.d: $(srchdir)/%.c
@echo "generating dependency information for $<"
@(SHELL) -ec "$(GEN_DEPS.c) $< \n | sed '""s/\(\%\)\o\[:,:]\+/\1.o $@ : /g"" > $@; \n [ -s $@ ] || rm -f $@'

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

## Versioned libraries rules

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

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

## Bind internal references

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

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

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

## End BSD-specific setup
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Protocol Buffers for Go with Gadgets

Go support for Protocol Buffers - Google's data interchange format

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https://github.com/golang/protobuf

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c) Accompany it with the information you received as to the offer to distribute corresponding source code. (This alternative is allowed only for noncommercial distribution and only if you received the program in object code or executable form with such an offer, in accord with Subsection b above.)

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

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1.375 apr 1.6.5

1.376 cryptsetup 1.7.5

1.376.1 Available under license:

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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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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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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,
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* 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.
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* HP UX 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().
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* Fixed m4/acx_pthread.m4 problem for some Linux distributions.
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* Fixed detection of sched_yield on Solaris.
* Added atomicops for Solaris
Andrew Paprocki <andrew@ishiboo.com>

* Fixed minor IBM xIC compiler build issues
* Added atomicops for AIX (POWER)

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1.380 go-runtime 1.8

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1.381 spring-web-mvc 5.2.8.RELEASE

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* /opt/cola/permits/1135888060_1613626348.76/0/spring-webmvc-5-2-8-release-sources-2-jar/org/springframework/web/servlet/support/SessionFlashMapManager.java
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* /opt/cola/permits/1135888060_1613626348.76/0/spring-webmvc-5-2-8-release-sources-2-jar/org/springframework/web/servlet/view/groovy/GroovyMarkupConfig.java

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* /opt/cola/permits/1135888060_1613626348.76/0/spring-webmvc-5-2-8-release-sources-2-jar/org/springframework/web/servlet/view/document/AbstractXlsxView.java
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* /opt/cola/permits/1135888060_1613626348.76/0/spring-webmvc-5-2-8-release-sources-2-jar/org/springframework/web/servlet/view/groovy/GroovyMarkupViewResolver.java
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* /opt/cola/permits/1135888060_1613626348.76/0/spring-webmvc-5-2-8-release-sources-2-jar/org/springframework/web/servlet/view/groovy/GroovyMarkupConfig.java
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 */
/**
 * XSLT-driven View that allows for response context to be rendered as the
 * result of an XSLT transformation.
 */
*<p>The XSLT Source object is supplied as a parameter in the model and then
* {[@link #locateSource detected]} during response rendering. Users can either specify
* a specific entry in the model via the {[@link #setSourceKey sourceKey]} property or
* have Spring locate the Source object. This class also provides basic conversion
* of objects into Source implementations. See {[@link #getSourceTypes() here]}
* for more details.
*
*<p>All model parameters are passed to the XSLT Transformer as parameters.
* In addition the user can configure {[@link #setOutputProperties output properties]}
* to be passed to the Transformer.
*
* @author Rob Harrop
* @author Juergen Hoeller
* @since 2.0
*/

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jar/org/springframework/web/servlet/mvc/AbstractUrlViewController.java
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jar/org/springframework/web/servlet/mvc/LastModified.java
* /opt/cola/permits/1135888060_1613626348.76/0/spring-webmvc-5-2-8-release-sources-2-
jar/org/springframework/web/servlet/mvc/support/RedirectAttributes.java
* /opt/cola/permits/1135888060_1613626348.76/0/spring-webmvc-5-2-8-release-sources-2-
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* /opt/cola/permits/1135888060_1613626348.76/0/spring-webmvc-5-2-8-release-sources-2-jar/org/springframework/web/servlet/mvc/method/annotation/RequestAttributeMethodArgumentResolver.java
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/**
* A contract for inspecting and potentially modifying request data values such
* as URL query parameters or form field values before they are rendered by a
* view or before a redirect.
* <p>Implementations may use this contract for example as part of a solution
* to provide data integrity, confidentiality, protection against cross-site
* request forgery (CSRF), and others or for other tasks such as automatically
* adding a hidden field to all forms and URLs.
* <p>View technologies that support this contract can obtain an instance to
* delegate to via [RequestContext#getRequestDataValueProcessor()].
* @author Rossen Stoyanchev
* @since 3.1
*/
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Found in path(s):
* /opt/cola/permits/1135888060_1613626348.76/0/spring-webmvc-5-2-8-release-sources-2-jar/org/springframework/web/servlet/view/tiles3/SimpleSpringPreparerFactory.java
* /opt/cola/permits/1135888060_1613626348.76/0/spring-webmvc-5-2-8-release-sources-2-jar/org/springframework/web/servlet/resource/ContentVersionStrategy.java
* /opt/cola/permits/1135888060_1613626348.76/0/spring-webmvc-5-2-8-release-sources-2-jar/org/springframework/web/servlet/resource/FixedVersionStrategy.java
* /opt/cola/permits/1135888060_1613626348.76/0/spring-webmvc-5-2-8-release-sources-2-jar/org/springframework/web/servlet/tags/ArgumentTag.java
* /opt/cola/permits/1135888060_1613626348.76/0/spring-webmvc-5-2-8-release-sources-2-jar/org/springframework/web/servlet/tags/RequestContextAwareTag.java
* /opt/cola/permits/1135888060_1613626348.76/0/spring-webmvc-5-2-8-release-sources-2-jar/org/springframework/web/servlet/view/AbstractView.java
* /opt/cola/permits/1135888060_1613626348.76/0/spring-webmvc-5-2-8-release-sources-2-jar/org/springframework/web/servlet/tags/EvalTag.java
* /opt/cola/permits/1135888060_1613626348.76/0/spring-webmvc-5-2-8-release-sources-2-jar/org/springframework/web/servlet/config/ResourcesBeanDefinitionParser.java
* /opt/cola/permits/1135888060_1613626348.76/0/spring-webmvc-5-2-8-release-sources-2-jar/org/springframework/web/servlet/config/GroovyMarkupConfigurerBeanDefinitionParser.java
* /opt/cola/permits/1135888060_1613626348.76/0/spring-webmvc-5-2-8-release-sources-2-jar/org/springframework/web/servlet/mvc/method/annotation/MatrixVariableMapMethodArgumentResolver.java
* /opt/cola/permits/1135888060_1613626348.76/0/spring-webmvc-5-2-8-release-sources-2-jar/org/springframework/web/servlet/mvc/condition/NameValueExpression.java
* /opt/cola/permits/1135888060_1613626348.76/0/spring-webmvc-5-2-8-release-sources-2-jar/org/springframework/web/servlet/ModelAndView.java
* /opt/cola/permits/1135888060_1613626348.76/0/spring-webmvc-5-2-8-release-sources-2-jar/org/springframework/web/servlet/resource/AbstractVersionStrategy.java
* /opt/cola/permits/1135888060_1613626348.76/0/spring-webmvc-5-2-8-release-sources-2-jar/org/springframework/web/servlet/resource/AbstractVersionStrategy.java
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jar/org/springframework/web/servlet/tags/form/FormTag.java
* /opt/cola/permits/113588060_1613626348.76/0/spring-webmvc-5-2-8-release-sources-2-jar/org/springframework/web/servlet/theme/CookieThemeResolver.java
* /opt/cola/permits/113588060_1613626348.76/0/spring-webmvc-5-2-8-release-sources-2-jar/org/springframework/web/servlet/HandlerExceptionResolver.java
* /opt/cola/permits/113588060_1613626348.76/0/spring-webmvc-5-2-8-release-sources-2-jar/org/springframework/web/servlet/resource/ResourceResolverChain.java
* /opt/cola/permits/113588060_1613626348.76/0/spring-webmvc-5-2-8-release-sources-2-jar/org/springframework/web/servlet/tags/form/ButtonTag.java
* /opt/cola/permits/113588060_1613626348.76/0/spring-webmvc-5-2-8-release-sources-2-jar/org/springframework/web/servlet/tags/ThemeTag.java
* /opt/cola/permits/113588060_1613626348.76/0/spring-webmvc-5-2-8-release-sources-2-jar/org/springframework/web/servlet/mvc/method/AbstractHandlerMethodAdapter.java
* /opt/cola/permits/113588060_1613626348.76/0/spring-webmvc-5-2-8-release-sources-2-jar/org/springframework/web/servlet/view/json/MappingJackson2JsonView.java
* /opt/cola/permits/113588060_1613626348.76/0/spring-webmvc-5-2-8-release-sources-2-jar/org/springframework/web/servlet/tags/form/TextareaTag.java
* /opt/cola/permits/113588060_1613626348.76/0/spring-webmvc-5-2-8-release-sources-2-jar/org/springframework/web/servlet/tags/BindErrorsTag.java
* /opt/cola/permits/113588060_1613626348.76/0/spring-webmvc-5-2-8-release-sources-2-jar/org/springframework/web/servlet/view/document/AbstractPdfStamperView.java
* /opt/cola/permits/113588060_1613626348.76/0/spring-webmvc-5-2-8-release-sources-2-jar/org/springframework/web/servlet/tags/form/AbstractFormTag.java
* /opt/cola/permits/113588060_1613626348.76/0/spring-webmvc-5-2-8-release-sources-2-jar/org/springframework/web/servlet/tags/ParamTag.java
* /opt/cola/permits/113588060_1613626348.76/0/spring-webmvc-5-2-8-release-sources-2-jar/org/springframework/web/servlet/view/xml/MarshallingView.java
* /opt/cola/permits/113588060_1613626348.76/0/spring-webmvc-5-2-8-release-sources-2-jar/org/springframework/web/servlet/tags/MessageTag.java
* /opt/cola/permits/113588060_1613626348.76/0/spring-webmvc-5-2-8-release-sources-2-jar/org/springframework/web/servlet/view/xml/MarshallingView.java
* /opt/cola/permits/113588060_1613626348.76/0/spring-webmvc-5-2-8-release-sources-2-jar/org/springframework/web/servlet/support/RequestContextUtils.java
* /opt/cola/permits/113588060_1613626348.76/0/spring-webmvc-5-2-8-release-sources-2-jar/org/springframework/web/servlet/tags/form/AbstractSingleCheckedElementTag.java

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1.382 ehcache-core 3.8.1

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* /opt/cola/permits/1135872870_1613620715.23/0/ehcache-core-3-8-1-sources-1.jar/org/ehcache/core/spi/time/package-info.java
* /opt/cola/permits/1135872870_1613620715.23/0/ehcache-core-3-8-1-sources-1.jar/org/ehcache/core/store/StoreSupport.java
* /opt/cola/permits/1135872870_1613620715.23/0/ehcache-core-3-8-1-sources-1.jar/org/ehcache/core/statistics/TierOperationOutcomes.java
* /opt/cola/permits/1135872870_1613620715.23/0/ehcache-core-3-8-1-sources-1.jar/org/ehcache/core/spi/store/AbstractWrapperStoreProvider.java
* /opt/cola/permits/1135872870_1613620715.23/0/ehcache-core-3-8-1-sources-1.jar/org/ehcache/core/spi/store/events/StoreEventFilter.java
* /opt/cola/permits/1135872870_1613620715.23/0/ehcache-core-3-8-1-sources-1.jar/org/ehcache/core/spi/time/TimeSourceService.java
* /opt/cola/permits/1135872870_1613620715.23/0/ehcache-core-3-8-1-sources-1.jar/org/ehcache/core/stats/StoreOperationOutcomes.java
* /opt/cola/permits/1135872870_1613620715.23/0/ehcache-core-3-8-1-sources-1.jar/org/ehcache/core/stats/StoreOperationOutcomes.java
* /opt/cola/permits/1135872870_1613620715.23/0/ehcache-core-3-8-1-sources-1.jar/org/ehcache/core/CacheConfigurationProperty.java
* /opt/cola/permits/1135872870_1613620715.23/0/ehcache-core-3-8-1-sources-1.jar/org/ehcache/core/exceptions/StorePassThroughException.java
* /opt/cola/permits/1135872870_1613620715.23/0/ehcache-core-3-8-1-sources-1.jar/org/ehcache/core/config/package-info.java
* /opt/cola/permits/1135872870_1613620715.23/0/ehcache-core-3-8-1-sources-1.jar/org/ehcache/core/InternalRuntimeConfiguration.java
* /opt/cola/permits/1135872870_1613620715.23/0/ehcache-core-3-8-1-sources-1.jar/org/ehcache/core/spi/tiering/LowerCachingTier.java
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jar/org/ehcache/core/spi/service/DiskResourceService.java
* /opt/cola/permits/1135872870_1613620715.23/0/ehcache-core-3-8-1-sources-1-
jar/org/ehcache/core/events/CacheEventListenerConfiguration.java
* /opt/cola/permits/1135872870_1613620715.23/0/ehcache-core-3-8-1-sources-1-
jar/org/ehcache/core/statistics/SuppliedValueStatistic.java
* /opt/cola/permits/1135872870_1613620715.23/0/ehcache-core-3-8-1-sources-1-
jar/org/ehcache/core/spi/store/tiering/HigherCachingTier.java
* /opt/cola/permits/1135872870_1613620715.23/0/ehcache-core-3-8-1-sources-1-
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* /opt/cola/permits/1135872870_1613620715.23/0/ehcache-core-3-8-1-sources-1-
jar/org/ehcache/core/exceptions/ExceptionFactory.java
* /opt/cola/permits/1135872870_1613620715.23/0/ehcache-core-3-8-1-sources-1-
jar/org/ehcache/core/events/StateChangeListener.java
* /opt/cola/permits/1135872870_1613620715.23/0/ehcache-core-3-8-1-sources-1-
jar/org/ehcache/core/internal/util/ValueSuppliers.java
* /opt/cola/permits/1135872870_1613620715.23/0/ehcache-core-3-8-1-sources-1-
jar/org/ehcache/core/spi/service/ServiceFactory.java
* /opt/cola/permits/1135872870_1613620715.23/0/ehcache-core-3-8-1-sources-1-
jar/org/ehcache/core/osgi/EhcacheActivator.java
* /opt/cola/permits/1135872870_1613620715.23/0/ehcache-core-3-8-1-sources-1-
jar/org/ehcache/core/collections/ConcurrentWeakIdentityHashMap.java
* /opt/cola/permits/1135872870_1613620715.23/0/ehcache-core-3-8-1-sources-1-
jar/org/ehcache/core/statistics/DefaultStatisticsServiceFactory.java
* /opt/cola/permits/1135872870_1613620715.23/0/ehcache-core-3-8-1-sources-1-
jar/org/ehcache/core/statistics/ZeroOperationStatistic.java
* /opt/cola/permits/1135872870_1613620715.23/0/ehcache-core-3-8-1-sources-1-
jar/org/ehcache/core/EhcacheRuntimeConfiguration.java
* /opt/cola/permits/1135872870_1613620715.23/0/ehcache-core-3-8-1-sources-1-
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* /opt/cola/permits/1135872870_1613620715.23/0/ehcache-core-3-8-1-sources-1-
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* /opt/cola/permits/1135872870_1613620715.23/0/ehcache-core-3-8-1-sources-1-
jar/org/ehcache/core/events/EventListenerWrapper.java
* /opt/cola/permits/1135872870_1613620715.23/0/ehcache-core-3-8-1-sources-1-
jar/org/ehcache/core/config/CoreConfigurationBuilder.java
* /opt/cola/permits/1135872870_1613620715.23/0/ehcache-core-3-8-1-sources-1-
jar/org/ehcache/core/spi/time/TimeSource.java
* /opt/cola/permits/1135872870_1613620715.23/0/ehcache-core-3-8-1-sources-1-
jar/org/ehcache/core/statistics/DelegatedMappedOperationStatistics.java
* /opt/cola/permits/1135872870_1613620715.23/0/ehcache-core-3-8-1-sources-1-
1.383 glib 2.28.8

1.384 systemd 231

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DOCUMENTATION ROADMAP
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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.
RELATED SOFTWARE Other stuff you should get.
FILE FORMAT WARS Software *not* to get.
TO DO Plans for future IJG releases.

Other documentation files in the distribution are:

User documentation:
install.doc How to configure and install the IJG software.
usage.doc Usage instructions for cjpeg, djpeg, jpegtran,
rdjpgcom, and wrjpcom.
*.1 Unix-style man pages for programs (same info as usage.doc).
wizard.doc Advanced usage instructions for JPEG wizards only.
change.log Version-to-version change highlights.

Programmer and internal documentation:
libjpeg.doc How to use the JPEG library in your own programs.
example.c Sample code for calling the JPEG library.
structure.doc Overview of the JPEG library’s internal structure.
filelist.doc Road map of IJG files.
coderules.doc Coding style rules --- please read if you contribute code.

Please read at least the files install.doc and usage.doc. Useful 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 compression and decompression. JPEG (pronounced "jay-peg") is a standardized compression method for full-color and gray-scale images. JPEG is intended for compressing "real-world" scenes; line drawings, cartoons and other non-realistic images are not its strong suit. JPEG is lossy, meaning that the output image is not exactly identical to the input image. Hence you must not use JPEG if you have to have identical output bits. However, on typical photographic images, very good compression levels can be obtained with no visible change, and remarkably high compression levels are possible if you can tolerate a low-quality image. For more details, see the references, or just experiment with various compression settings.

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. For legal reasons, we are not distributing code for the arithmetic-coding variants of JPEG; see LEGAL ISSUES. 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.
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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, ltconfig, ltmain.sh). Another support script, install-sh, is copyright by M.I.T. but is also freely distributable.

It appears that the arithmetic coding option of the JPEG spec is covered by patents owned by IBM, AT&T, and Mitsubishi. Hence arithmetic coding cannot legally be used without obtaining one or more licenses. For this reason, support for arithmetic coding has been removed from the free JPEG software. (Since arithmetic coding provides only a marginal gain over the unpatented Huffman mode, it is unlikely that very many implementations will support it.) So far as we are aware, there are no patent restrictions on the remaining code.

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
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We highly 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 ftp://ftp.uu.net/graphics/jpeg/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 JPEG standard itself is not available electronically; you must order a paper copy through ISO or ITU. (Unless you feel a need to own a certified official copy, we recommend buying the Pennebaker and Mitchell book instead; it's much cheaper and includes a great deal of useful explanatory material.) In the USA, copies of the standard may be ordered from ANSI Sales at (212) 642-4900, or from Global Engineering Documents at (800) 854-7179. (ANSI doesn't take credit card orders, but Global does.) It's not cheap: as of 1992, ANSI was charging $95 for Part 1 and $47 for Part 2, plus 7% shipping/handling. The 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.

Some extensions to the original JPEG standard are defined in JPEG Part 3, a newer ISO standard numbered ISO/IEC IS 10918-3 and ITU-T T.84. IJG
currently does not support any Part 3 extensions.

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. A copy of the JFIF spec is available from:

Literature Department
C-Cube Microsystems, Inc.
1778 McCarthy Blvd.
Milpitas, CA 95035
phone (408) 944-6300, fax (408) 944-6314

A PostScript version of this document is available by FTP at ftp://ftp.uu.net/graphics/jpeg/jfif.ps.gz. There is also a plain text version at ftp://ftp.uu.net/graphics/jpeg/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 ftp.sgi.com or from ftp://ftp.uu.net/graphics/jpeg/. 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. libtiff is available from ftp://ftp.sgi.com/graphics/tiff/.

ARCHIVE LOCATIONS

The "official" archive site for this software is ftp.uu.net (Internet address 192.48.96.9). The most recent released version can always be found there in directory graphics/jpeg. This particular version will be archived as ftp://ftp.uu.net/graphics/jpeg/jpegsrc.v6b.tar.gz. If you don't have direct Internet access, UUNET's archives are also available via UUCP; contact help@uunet.uu.net for information on retrieving files that way.

Numerous Internet sites maintain copies of the UUNET files. However, only ftp.uu.net is guaranteed to have the latest official version.

You can also obtain this software in DOS-compatible "zip" archive format from the SimTel archives (ftp://ftp.simtel.net/pub/simtelnet/msdos/graphics/), or on CompuServe in the Graphics Support forum (GO CIS:GRAPHSUP), library 12 "JPEG Tools". Again, these versions may sometimes lag behind the ftp.uu.net release.

The JPEG FAQ (Frequently Asked Questions) article is a useful source of
general information about JPEG. It is updated constantly and therefore is not included in this distribution. The FAQ is posted every two weeks to Usenet newsgroups comp.graphics.misc, news.answers, and other groups. 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

RELATED SOFTWARE
===============

Numerous viewing and image manipulation programs now support JPEG. (Quite a few of them use this library to do so.) The JPEG FAQ described above lists some of the more popular free and shareware viewers, and tells where to obtain them on Internet.

If you are on a Unix machine, we highly recommend Jef Poskanzer's free PBMPLUS software, which provides many useful operations on PPM-format image files. In particular, it can convert PPM images to and from a wide range of other formats, thus making cjpeg/djpeg considerably more useful. The latest version is distributed by the NetPBM group, and is available from numerous sites, notably ftp://wuarchive.wustl.edu/graphics/graphics/packages/NetPBM/.

Unfortunately PBMPLUS/NETPBM is not nearly as portable as the IJG software is; you are likely to have difficulty making it work on any non-Unix machine.

A different free JPEG implementation, written by the PVRG group at Stanford, is available from ftp://havefun.stanford.edu/pub/jpeg/. This program is designed for research and experimentation rather than production use; it is slower, harder to use, and less portable than the IJG code, but it is easier to read and modify. Also, the PVRG code supports lossless JPEG, which we do not. (On the other hand, it doesn't do progressive JPEG.)

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

Some JPEG programs produce files that are not compatible with our library. The root of the problem is that the ISO JPEG committee failed to specify a concrete file format. Some vendors "filled in the blanks" on their own, creating proprietary formats that no one else could read. (For example, none of the early commercial JPEG implementations for the Macintosh were able to exchange compressed files.)

The file format we have adopted is called JFIF (see REFERENCES). This format
has been agreed to by a number of major commercial JPEG vendors, and it has become the de facto standard. JFIF is a minimal or "low end" representation. We recommend the use of TIFF/JPEG (TIFF revision 6.0 as modified by TIFF Technical Note #2) for "high end" applications that need to record a lot of additional data about an image. TIFF/JPEG is fairly new and not yet widely supported, unfortunately.

The upcoming JPEG Part 3 standard defines a file format called SPIFF. SPIFF is interoperable with JFIF, in the sense that most JFIF decoders should be able to read the most common variant of SPIFF. SPIFF has some technical advantages over JFIF, but its major claim to fame is simply that it is an official standard rather than an informal one. At this point it is unclear whether SPIFF will supersede JFIF or whether JFIF will remain the de-facto standard. IJG intends to support SPIFF once the standard is frozen, but we have not decided whether it should become our default output format or not. (In any case, our decoder will remain capable of reading JFIF indefinitely.)

Various proprietary file formats incorporating JPEG compression also exist. We have little or no sympathy for the existence of these formats. Indeed, one of the original reasons for developing this free software was to help force convergence on common, open format standards for JPEG files. Don't use a proprietary file format!

TO DO
=====

The major thrust for v7 will probably be improvement of visual quality. The current method for scaling the quantization tables is known not to be very good at low Q values. We also intend to investigate block boundary smoothing, "poor man's variable quantization", and other means of improving quality-vs-file-size performance without sacrificing compatibility.

In future versions, we are considering supporting some of the upcoming JPEG Part 3 extensions --- principally, variable quantization and the SPIFF file format.

As always, speeding things up is of great interest.

Please send bug reports, offers of help, etc. to jpeg-info@uunet.uu.net.

1.386 runc 1.0.0-rc9

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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/OpenSslITlsv13X509ExtendedTrustManager.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/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
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslCachingX509KeyManagerFactory.java
* /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/AbstractSniHandler.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/SslCompletionEvent.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/SslCloseCompletionEvent.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/SslClientHelloHandler.java
* /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/OpenSslSslSocketChannel.java
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1.391 nlohmann-json 3.9.1

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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. This code is in the public domain; do with it what you wish.

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

To compute the message digest of a chunk of bytes, declare an MD5Context structure, pass it to MD5Init, call MD5Update as needed on buffers full of bytes, and then call MD5Final, which will fill a supplied 16-byte array with the digest.

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- 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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  jar/io/netty/handler/codec/socksx/v5/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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Protocol Buffers for Go with Gadgets

Go support for Protocol Buffers - Google's data interchange format

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procs provides functions to retrieve system, kernel and process metrics from the pseudo-filesystem proc.

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1.412 jq 1.6-1

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1.413 xorg-randr 1.5.0

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