Explore and have fun with TensorFlow

An introductory to TensorFlow

Poo Kuan Hoong

https://www.facebook.com/groups/TensorFlowMY/

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Agenda

- Deep Learning Libraries
- What is TensorFlow?
- Why it is called TensorFlow?
- Steps to start TensorFlow
- TensorFlow Graph
- Variables & Placeholders
- Gradient
- TensorFlow Architecture
- Demo

About me

Poo Kuan Hoong, http://www.linkedin.com/in/kuanhoong

ADAX

- Senior Data Scientist

nielsen

- Senior Manager Data Science

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MULTIMEDIA UNIVERSITY

- Senior Lecturer
- Chairperson Data Science Institute

- Founder R User Group & TensorFlow User Group
- Speaker/Trainer

TensorFlow & Deep Learning Malaysia Group

The TensorFlow & Deep Learning Malaysia group's aims are:

- To enable people to create and deploy their own Deep Learning models built using primarily TensorFlow or other Deep Learning libraries.
- To build the key skill sets for this group from the combination of both beginner and intermediate models as well as advancing to the next level
- A knowledge sharing and presentations platform in relation to the cutting edge deep learning research papers and techniques.

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Github: https://github.com/TensorFlowMY

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Kuan Hoong created a poll.

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Kuala Lumpur, Malaysia
Founded Jul 4, 2017

About us...

Invite friends

Welcome!

+ Schedule a new Meetup

Upcoming (1) | Calendar

TensorFlow & Deep Learning Malaysia Inaugural Meetup

ASEAN Data Analytics Exchange (ADAX), Level 27, Tower B, The Vertical Business Suite, Avenue 3, Bangsar South, 59200, Kuala Lumpur (map)

Thu Jul 6
7:00 PM

I'm going

2 going
0 comments

The TensorFlow and Deep Learning Malaysia welcomes you to the inaugural meet-up for the month of July 2017. The group's aim is to enable people to create and deploy...

Learn more

What's new

NEW MEMBER
Yap Wen Jiun joined
Yesterday

NEW MEMBER
Ng Chin Kit joined
Yesterday

NEW MEMBER
Vishnu Monn joined
Yesterday

NEW RSVP
John See RSVPed Yes for TensorFlow & Deep Learning Malaysia Inaugural Meetup
Yesterday

https://www.meetup.com/tensorflow-deep-learning-malaysia

Malaysia R User Group - (myRUG)

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What's new

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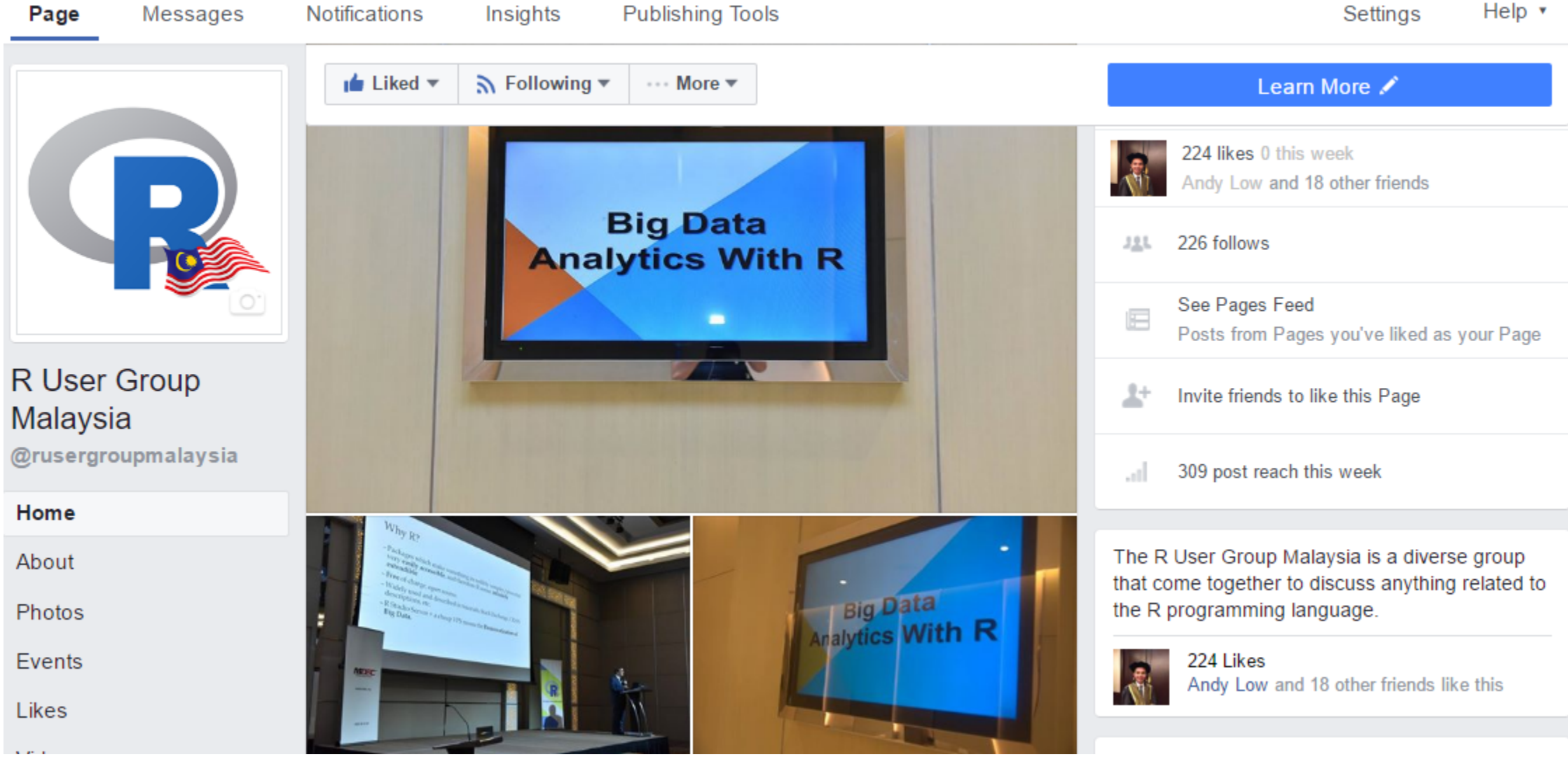


https://www.facebook.com/rusergroupmalaysia/

Deep learning libraries

Microsoft CNTK

torch

theano

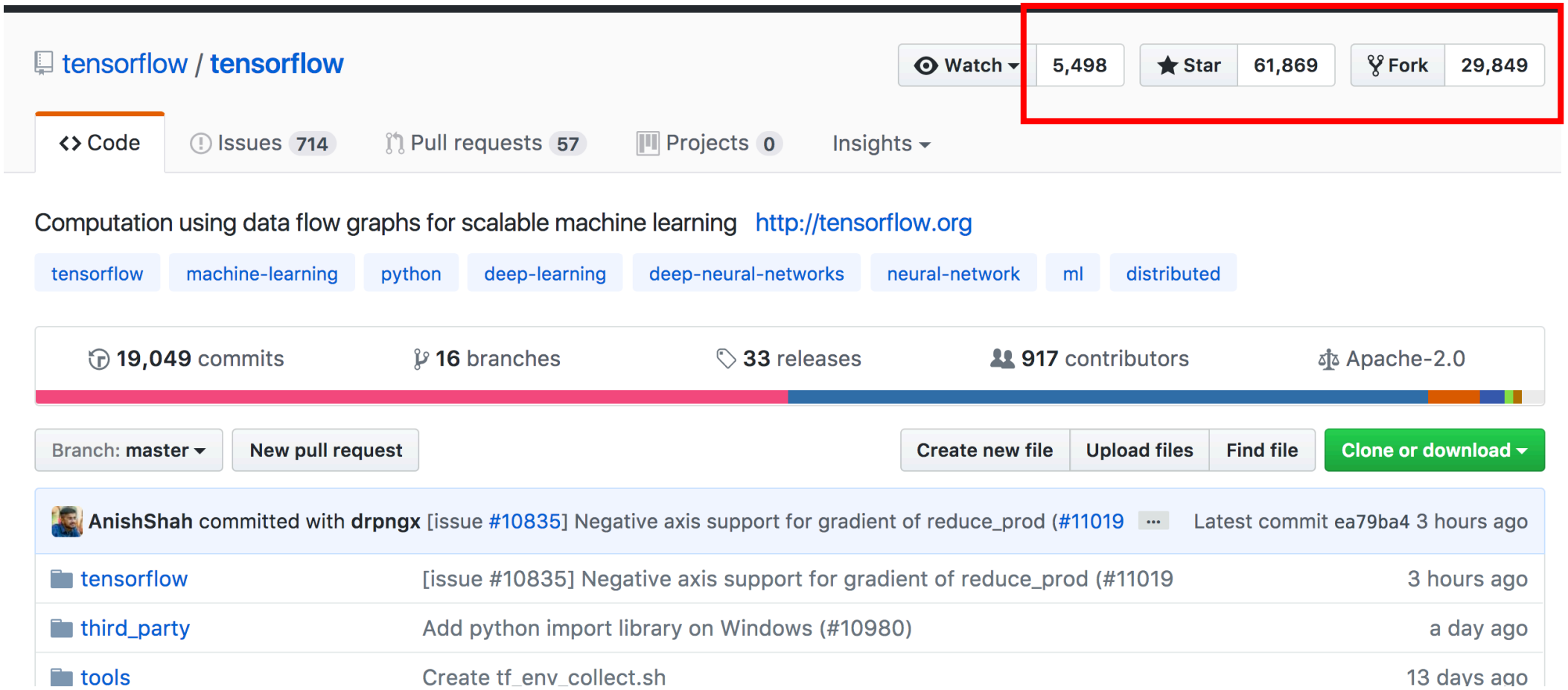
Caffe

mxnet

What is TensorFlow?

- URL: https://www.tensorflow.org/
- Released under the open source license on November 9, 2015
- Current version 1.2
- Open source software library for numerical computation using data flow graphs
- Originally developed by Google Brain Team to conduct machine learning and deep neural networks research
- General enough to be applicable in a wide variety of other domains as well
- TensorFlow provides an extensive suite of functions and classes that allow users to build various models from scratch.

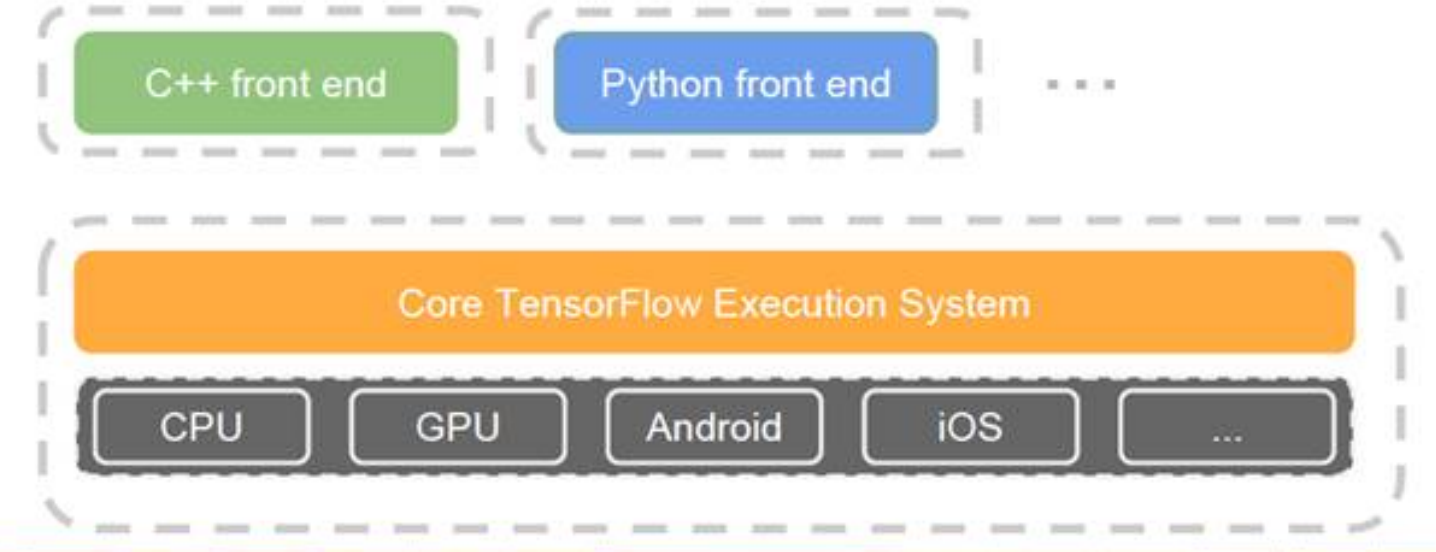
Most popular on Github



https://github.com/tensorflow/tensorflow

TensorFlow architecture

- Core in C++
  - Low overhead
- Different front ends for specifying/driving the computation
  - Python, C++, R and many more



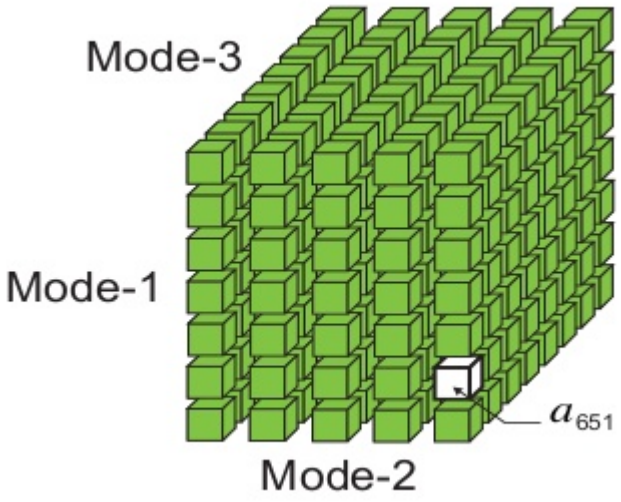
CPU - GPU

- In TensorFlow, the supported device types are CPU and GPU. They are represented as strings. For example:
  - "/cpu:0": The CPU of your machine.
  - "/gpu:0": The GPU of your machine, if you have one.
  - "/gpu:1": The second GPU of your machine, etc.

```
# Creates a graph.
with tf.device('/gpu:2'):
  a = tf.constant([1.0, 2.0, 3.0, 4.0, 5.0, 6.0], shape=[2, 3], name='a')
  b = tf.constant([1.0, 2.0, 3.0, 4.0, 5.0, 6.0], shape=[3, 2], name='b')
  c = tf.matmul(a, b)
# Creates a session with log_device_placement set to True.
sess = tf.Session(config=tf.ConfigProto(log_device_placement=True))
# Runs the op.
print(sess.run(c))
```

Why it is called TensorFlow?

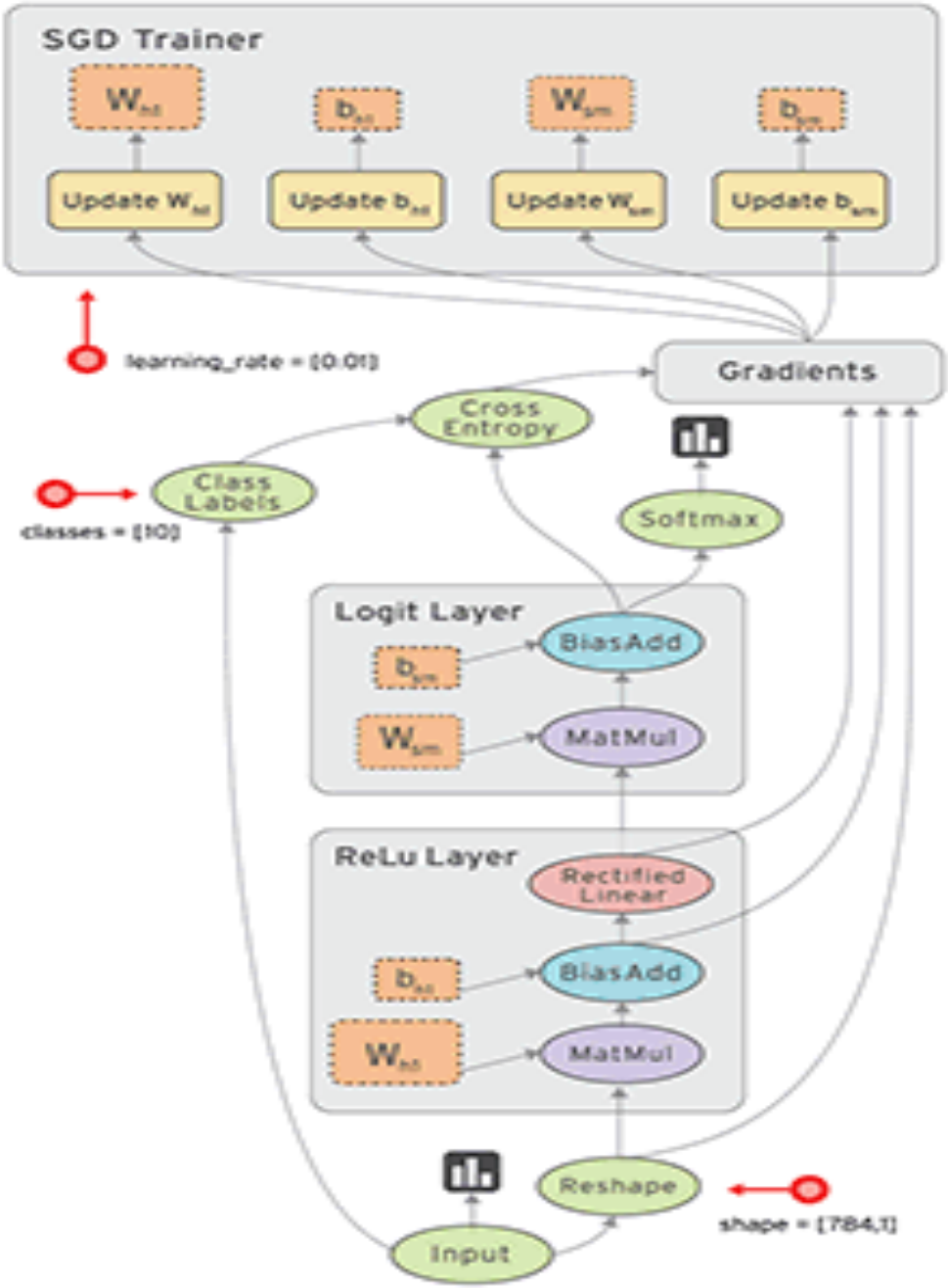
- What is a Tensor?



Dimensions	Example	Terminology
1	0 1 2	Vector
2	0 1 2 3 4 5 6 7 8	Matrix
3	0 1 2 3 4 5 6 7 8	3D Array (3rd order Tensor)
N	... ...	ND Array

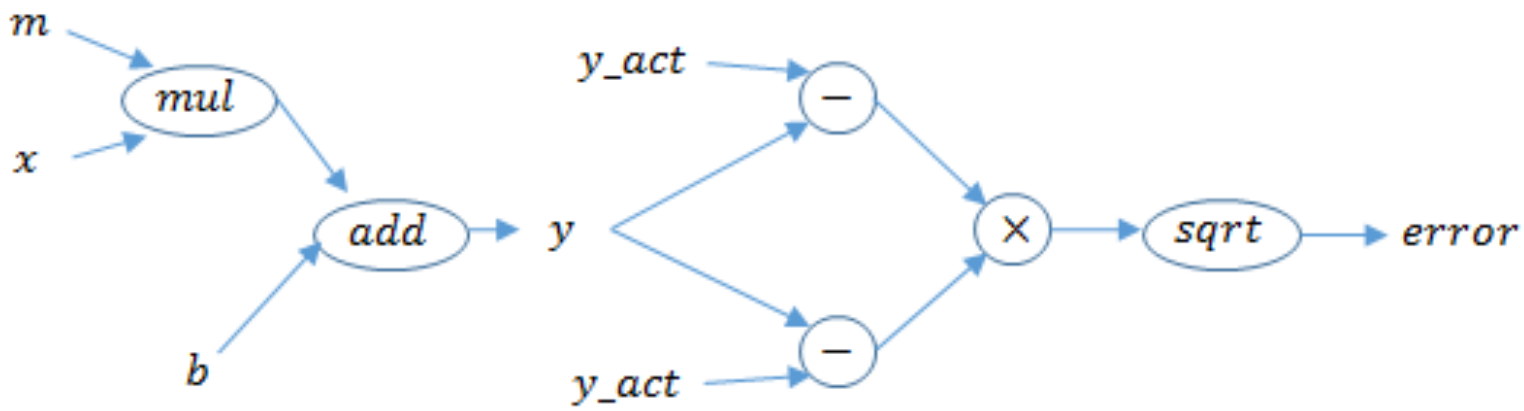
Why it is called TensorFlow?

- TensorFlow is based on computation data flow graph
- TensorFlow separates definition of computations from their execution



Steps to start with TensorFlow

- **Step 1:** Assemble a computational graph
- **Step 2:** Use a session to execute operations in the graph



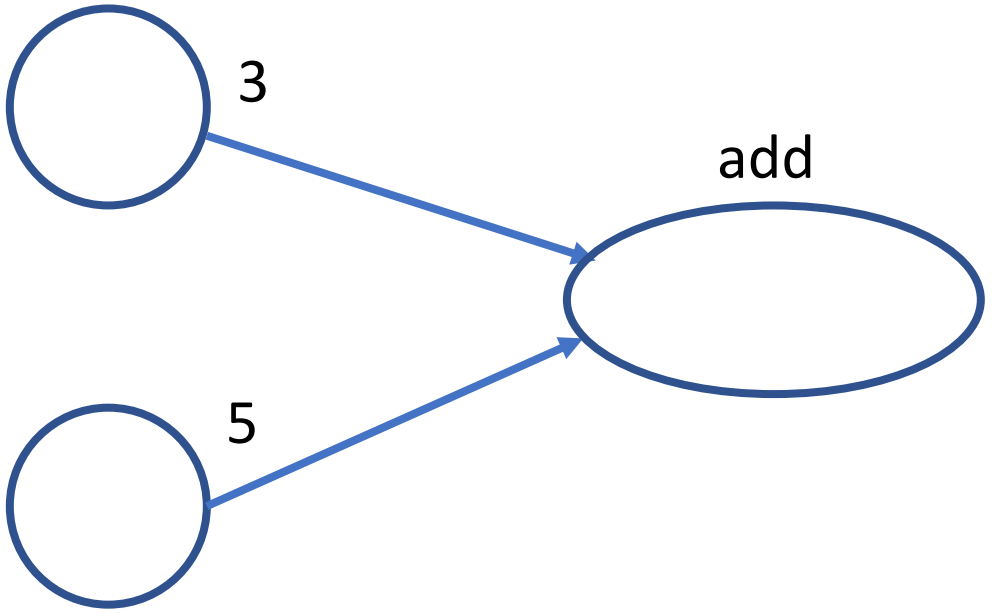
TensorFlow Graph

```
import tensorflow as tf
a = tf.add(3,5)
print(a)
```

```
Tensor("Add:0", shape=(), dtype=int32)
```

```
import numpy as np
a = np.add(3,5)
print(a)
```

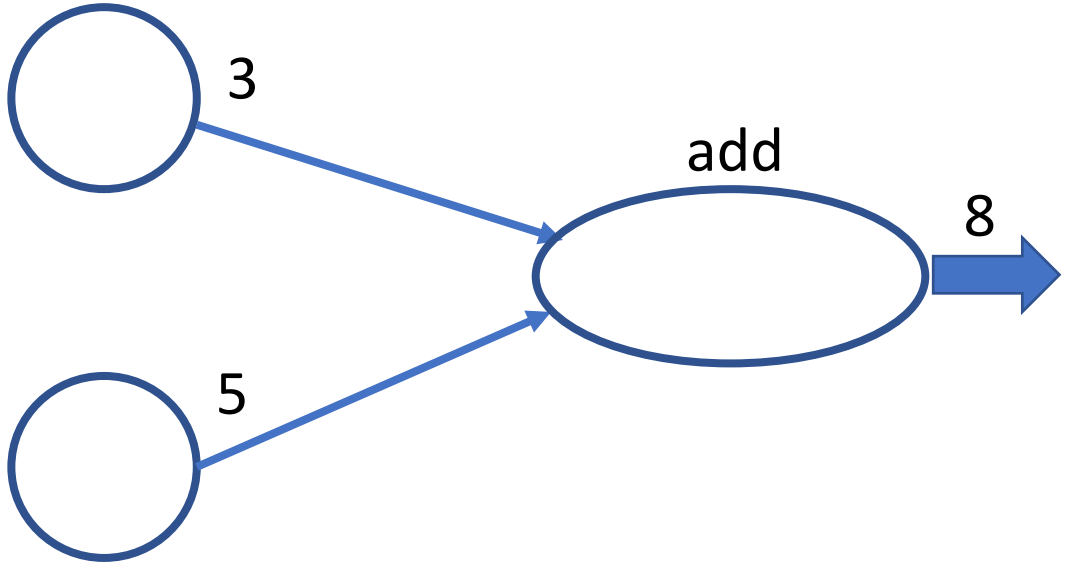
```
8
```



TensorFlow Graph

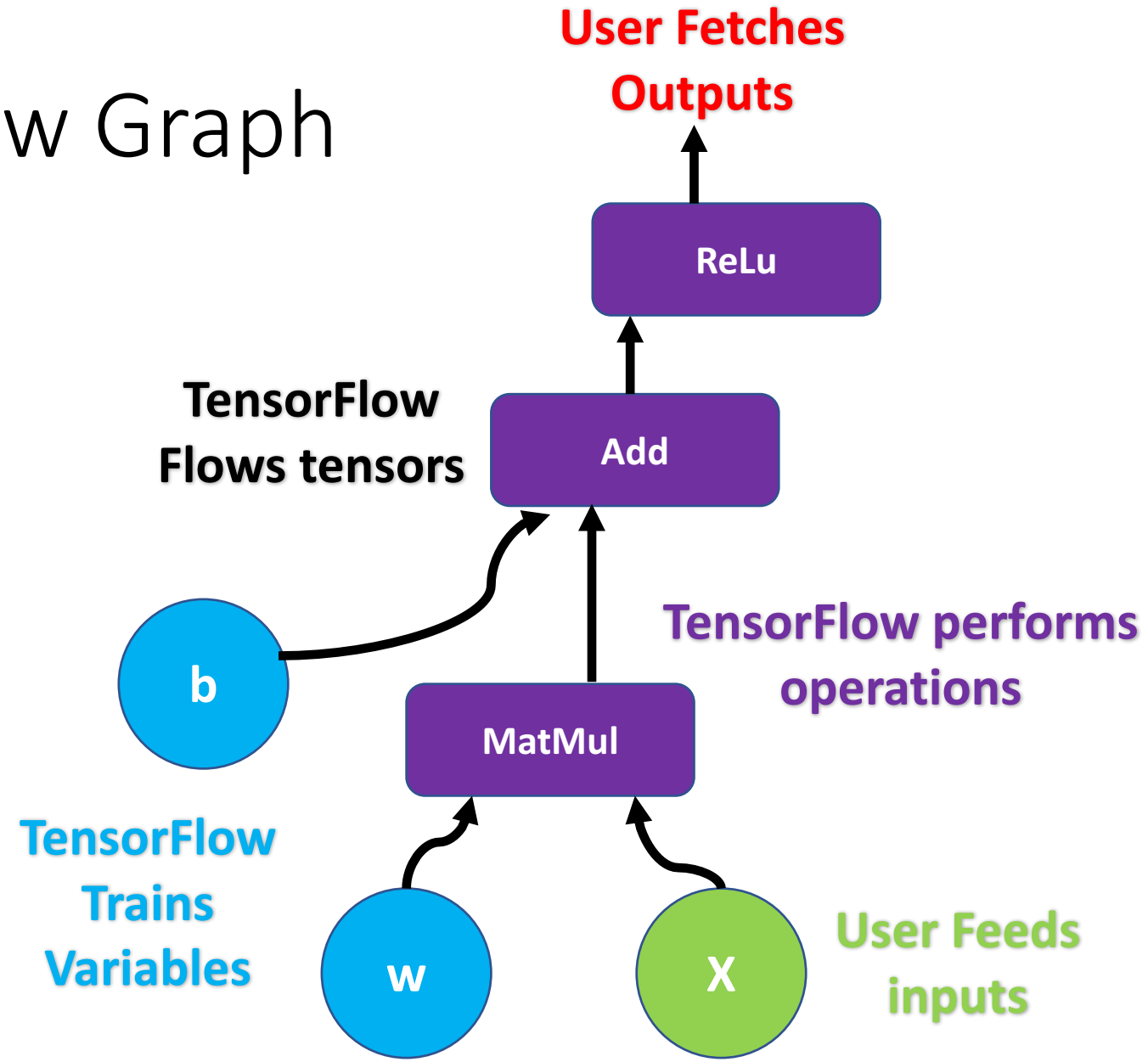
- To get the value of a
- Create a **session**, assign it to variable ‘sess’ so we can call it later
- Within the session, evaluate the graph to fetch the value of *a*

```
import tensorflow as tf
a = tf.add(3, 5)
sess = tf.Session()
print (sess.run(a))
sess.close()
```



- A Session object encapsulates the environment in which Operation objects are executed, and Tensor objects are evaluated.

TensorFlow Graph



Variables

- Variables to hold and update parameters.
- Variables are in-memory buffers containing tensors.
- Must be explicitly initialized and can be saved to disk during and after training

```
# create variable a with scalar value
a = tf.Variable(2, name="scalar")

# create variable b as a vector
b = tf.Variable([2, 3], name="vector")

# create variable c as a 2x2 matrix
c = tf.Variable([[0, 1], [2, 3]], name="matrix")

init = tf.global_variables_initializer()
with tf.Session() as sess:
    sess.run(init)
```

Placeholder

- A placeholder is simply a variable that will be assigned data to at a later date.
- It allows operations to be created and computation graph to be built, without needing the data.

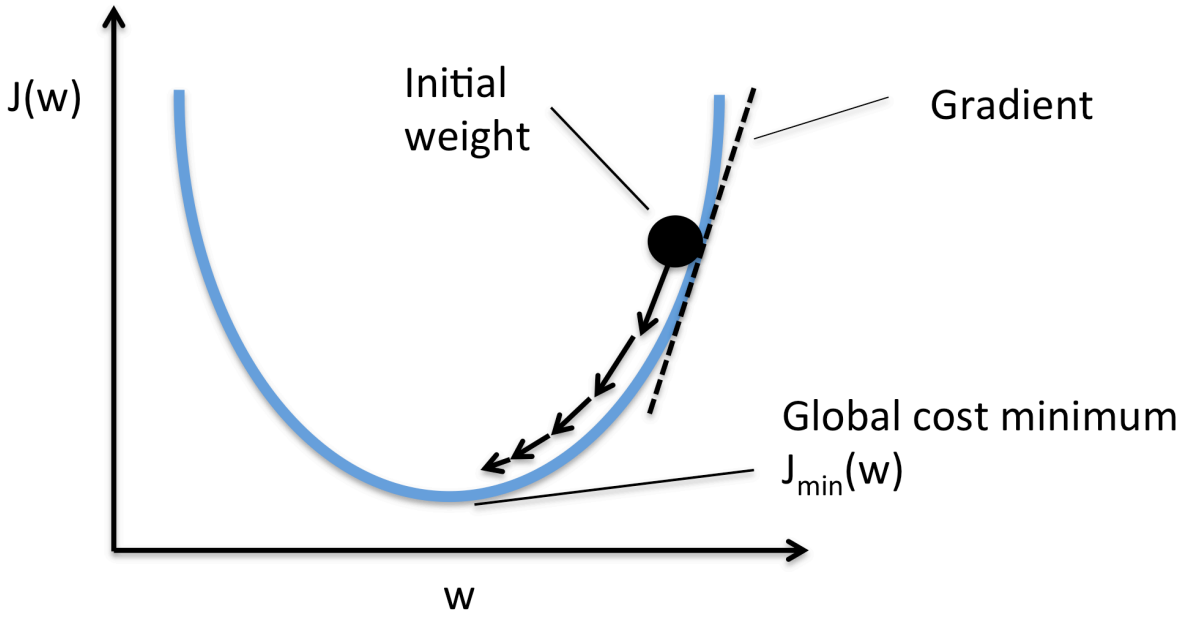
```
x = tf.placeholder("float", None)
y = x * 2

with tf.Session() as session:
    result = session.run(y, feed_dict={x: [1, 2, 3]})
    print(result)
```

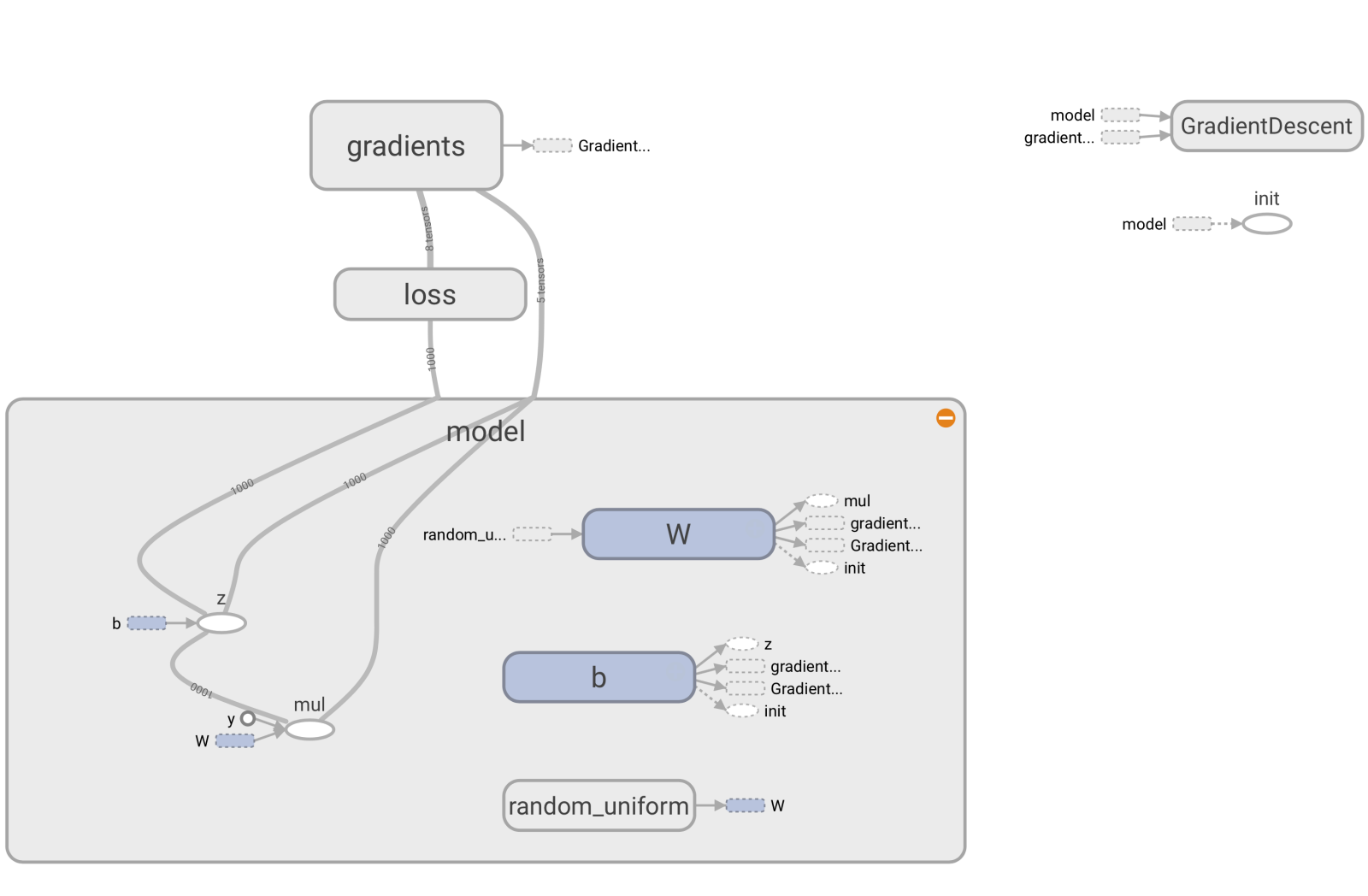
```
[ 2.  4.  6.]
```

Learn Parameters: Optimization

- The Optimizer base class provides methods to compute gradients for a loss and apply gradients to variables.
- A collection of subclasses implement classic optimization algorithms such as GradientDescent and Adagrad.
- TensorFlow provides functions to compute the derivatives for a given TensorFlow computation graph, adding operations to the graph.

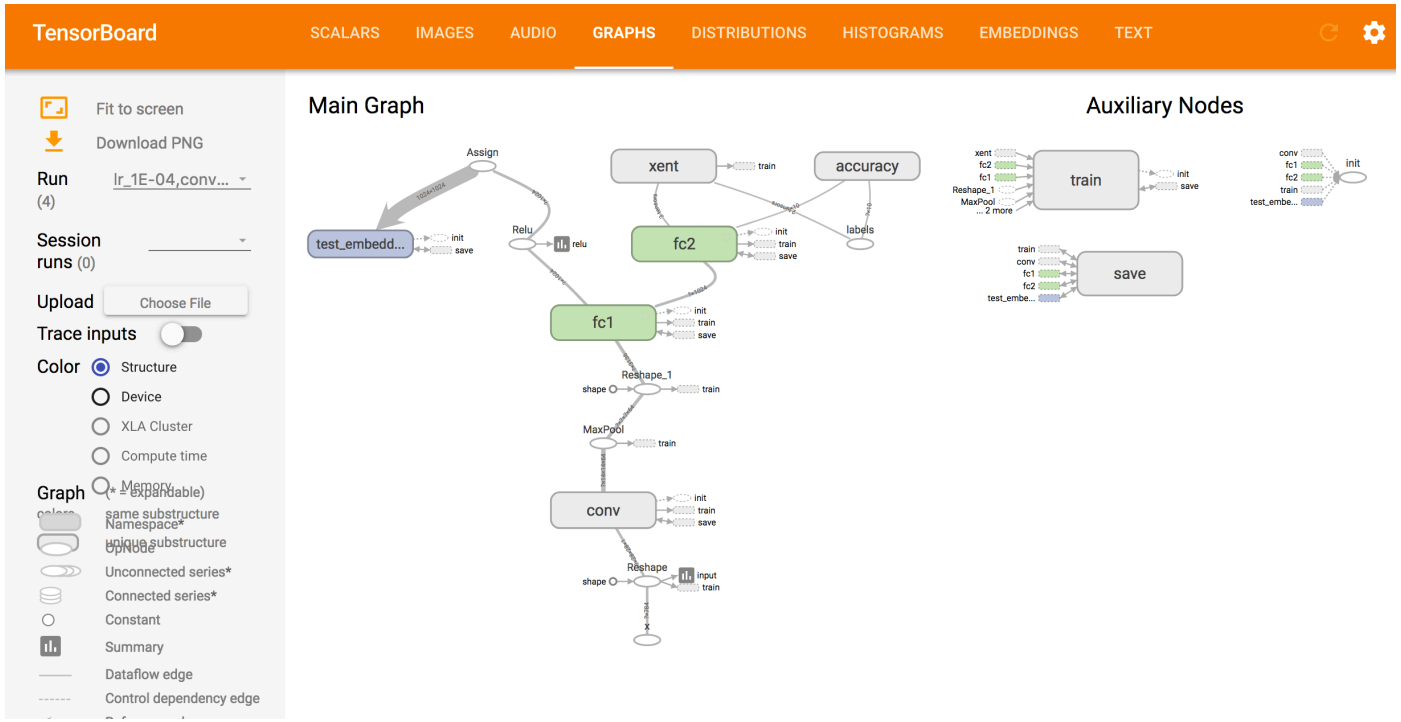


Learn parameters: Optimization



TensorBoard

- Visualize your TensorFlow graph
- Plot quantitative metrics about the execution of your graph
- Show additional data like images that pass through it



TensorFlow Models

https://github.com/tensorflow/models

Models

- adversarial_crypto: protecting communications with adversarial neural cryptography.
- adversarial_text: semi-supervised sequence learning with adversarial training.
- attention_ocr: a model for real-world image text extraction.
- autoencoder: various autoencoders.
- cognitive_mapping_and_planning: implementation of a spatial memory based mapping and planning architecture for visual navigation.
- compression: compressing and decompressing images using a pre-trained Residual GRU network.
- differential_privacy: privacy-preserving student models from multiple teachers.
- domain_adaptation: domain separation networks.
- im2txt: image-to-text neural network for image captioning.
- inception: deep convolutional networks for computer vision.

Take away

- There are 4 steps:
  - Step 1: Assemble the graph –
    - 1. Define placeholders for input and output
    - 2. Define the weights
    - 3. Define the inference model
    - 4. Define loss function
    - 5. Define optimizer
  - Step 2: Train the Model
  - Step 3: Optimize the Model

The world has too many problems and not enough people solving them.

Thanks!

Questions?

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Demo

Slides & Codes available from Github:
http://bit.ly/TensorFlowMY