# Welcome to TensorFlow!

Thanks Danijar Hafner for the logo!

# Contents

- Overview of TensorFlow
- Build TensorFlow environment
- Graphs and Sessions
- TensorFlow for basic image process
- TensorFlow for liner regression
- TensorFlow for neural network
- CNN(Convolutional neural network)

# Overview of TensorFlow

- What is TensorFlow
- Why TensorFlow

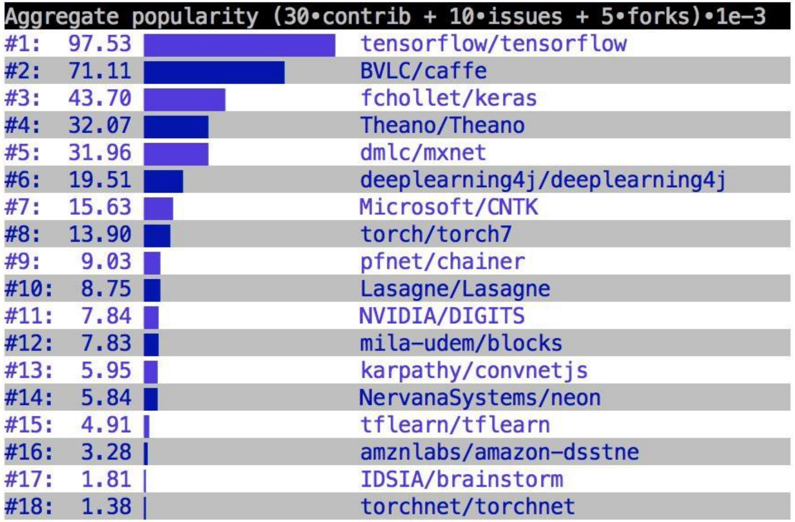
# What’s TensorFlow™?

Open source software library for
numerical computation using data flow graphs

developed by the Google Brain Team within Google's Machine Intelligence research organization for machine learning and deep neural networks research

# Why TensorFlow?

- Flexibility + Scalability
  Originally developed by Google as a single infrastructure for machine learning in both production and research



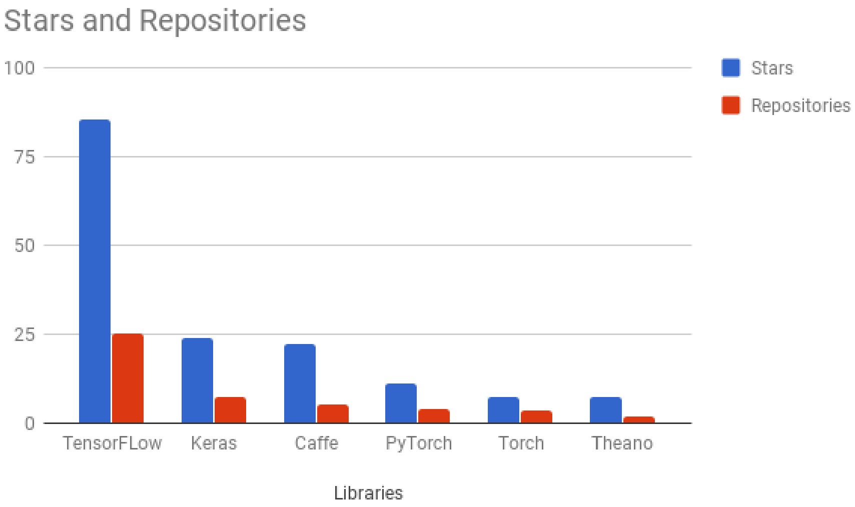
Aggregate popularity (30•contrib + 10•issues + 5•forks)•1e-3

| | | |
|---|---|---|
| #1: | 97.53 | tensorflow/tensorflow |
| #2: | 71.11 | BVLC/caffe |
| #3: | 43.70 | fchollet/keras |
| #4: | 32.07 | Theano/Theano |
| #5: | 31.96 | dmlc/mxnet |
| #6: | 19.51 | deeplearning4j/deeplearning4j |
| #7: | 15.63 | Microsoft/CNTK |
| #8: | 13.90 | torch/torch7 |
| #9: | 9.03 | pfnet/chainer |
| #10: | 8.75 | Lasagne/Lasagne |
| #11: | 7.84 | NVIDIA/DIGITS |
| #12: | 7.83 | mila-udem/blocks |
| #13: | 5.95 | karpathy/convnetjs |
| #14: | 5.84 | NervanaSystems/neon |
| #15: | 4.91 | tflearn/tflearn |
| #16: | 3.28 | amznlabs/amazon-dsstne |
| #17: | 1.81 | IDSIA/brainstorm |
| #18: | 1.38 | torchnet/torchnet |

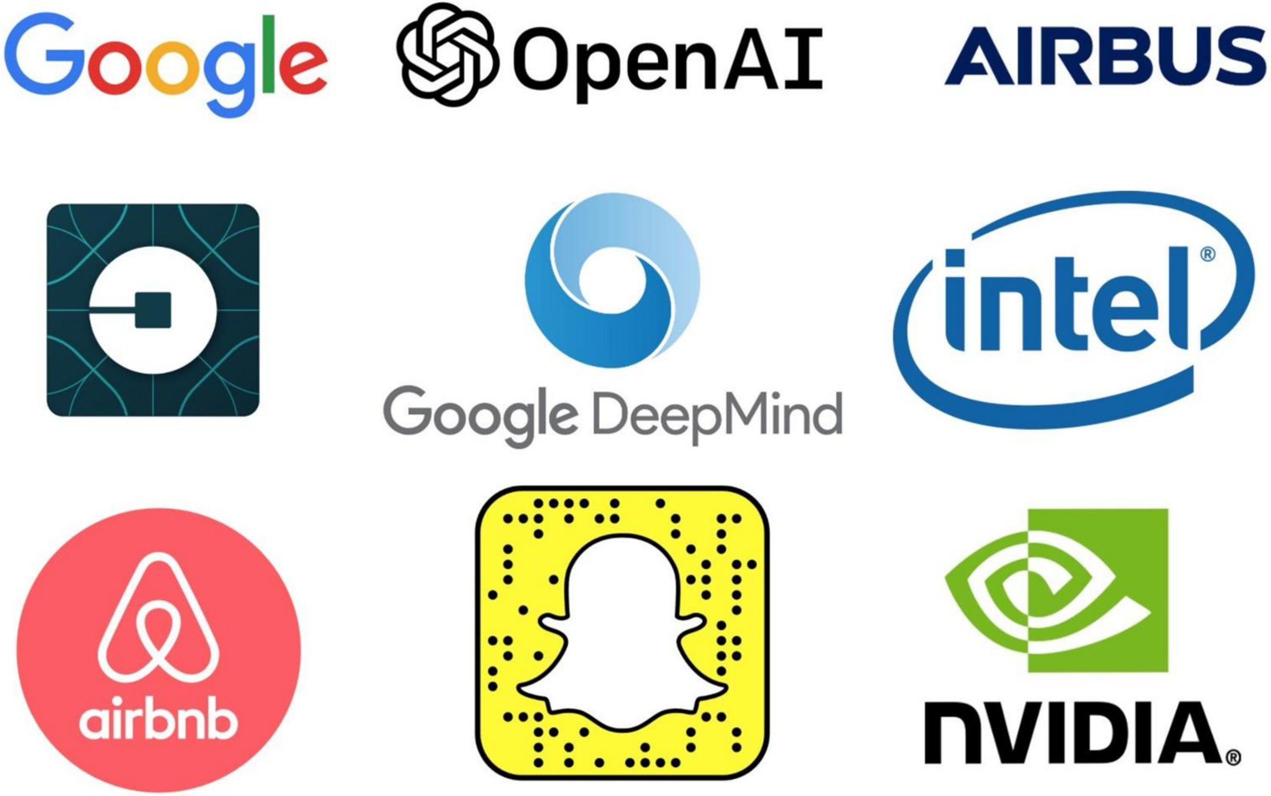
Deep Learning libraries/frameworks as per popularity(Source : Google)

# Why TensorFlow?

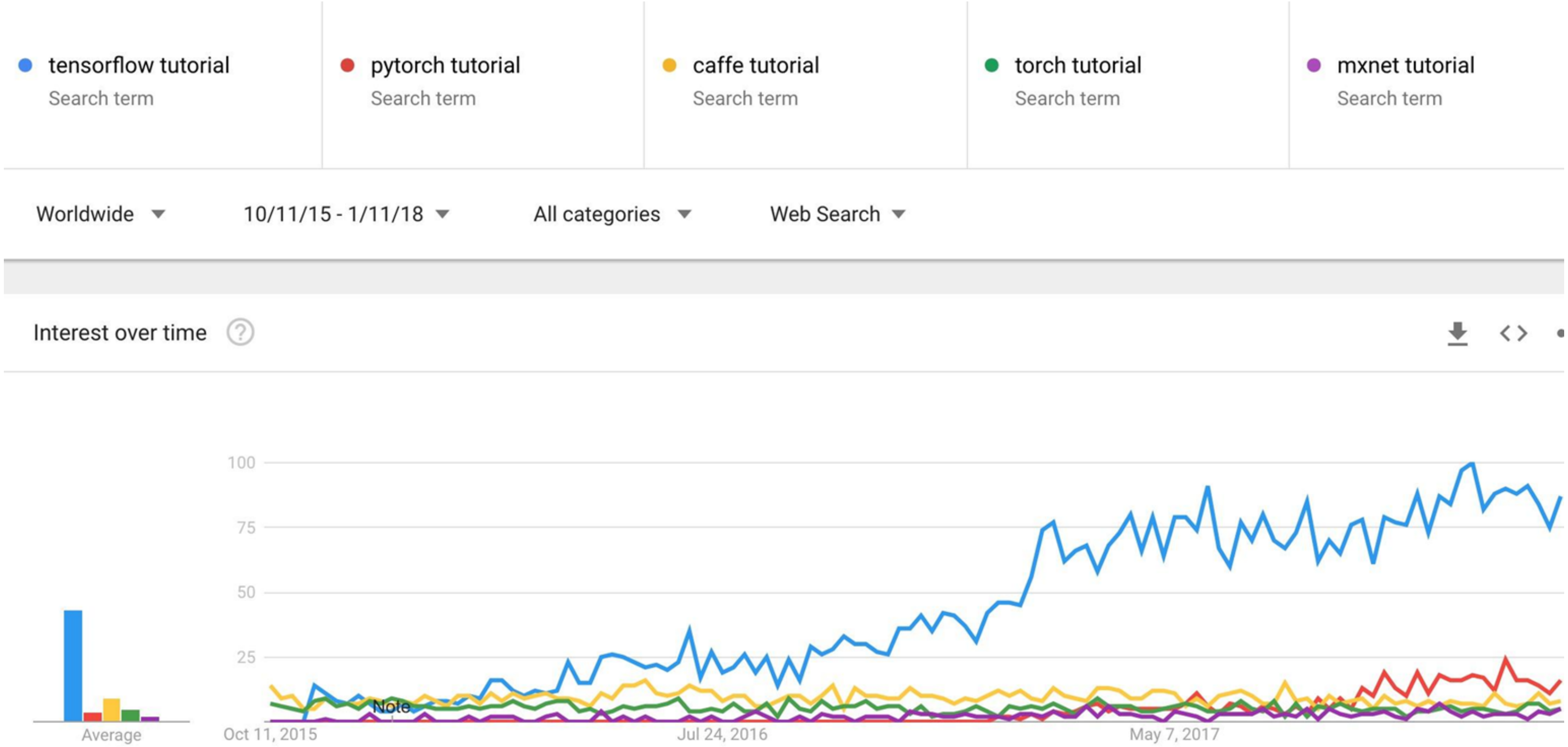
- Flexibility + Scalability
- Popularity



# Companies using TensorFlow



# Demand for tutorials on TensorFlow



● tensorflow tutorial
Search term

● pytorch tutorial
Search term

● caffe tutorial
Search term

● torch tutorial
Search term

● mxnet tutorial
Search term

Worldwide ▼ 10/11/15 - 1/11/18 ▼ All categories ▼ Web Search ▼

Interest over time

# Resources

- The official documentations
- TensorFlow’s official sample models
- Books
  - Aurélien Géron’s Hands-On Machine Learning with Scikit-Learn and TensorFlow (O’Reilly, March 2017)
  - François Chollet’s Deep Learning with Python (Manning Publications, November 2017)
  - Nishant Shukla’s Machine Learning with TensorFlow (Manning Publications, January 2018)
  - Lieder et al.’s Learning TensorFlow A Guide to Building Deep Learning Systems (O’Reilly, August 2017)

# Build TensorFlow environment

- Build through pip
- Build through Conda distribution(Easiest Way)
- Next show the steps to build through Conda

# Build TensorFlow environment

- Install Anaconda
- Install necessary packages
- Install TensorFlow
- First TensorFlow program

# What’s a tensor?

An n-dimensional array

0-d tensor: scalar (number)

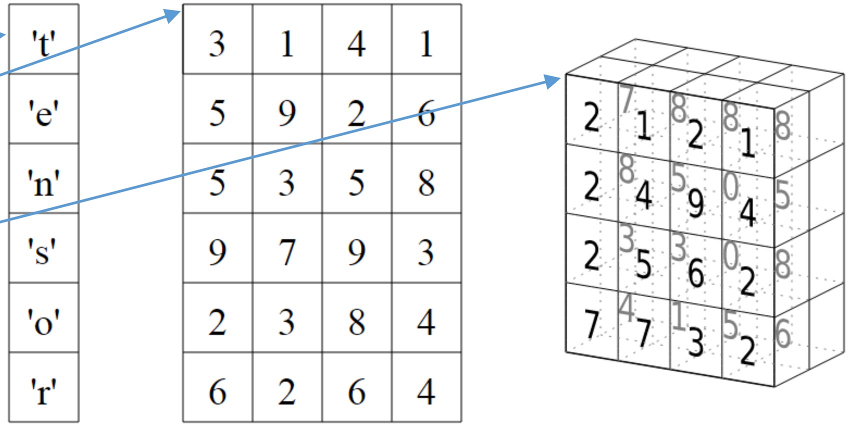
1-d tensor: vector

2-d tensor: matrix

3-d tensor: cube

and so on

tensor



| |
|---|
| 't' |
| 'e' |
| 'n' |
| 's' |
| 'o' |
| 'r' |

tensor of dimensions [6]
(vector of dimension 6)

| | | | |
|---|---|---|---|
| 3 | 1 | 4 | 1 |
| 5 | 9 | 2 | 6 |
| 5 | 3 | 5 | 8 |
| 9 | 7 | 9 | 3 |
| 2 | 3 | 8 | 4 |
| 6 | 2 | 6 | 4 |

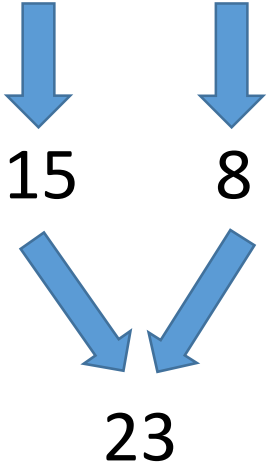
tensor of dimensions [6,4]
(matrix 6 by 4)

tensor of dimensions [4,4,2]

# Data Flow Graphs

Step 1: Assemble a graph

Calculate: 5x3 + (5+3) = ?



15

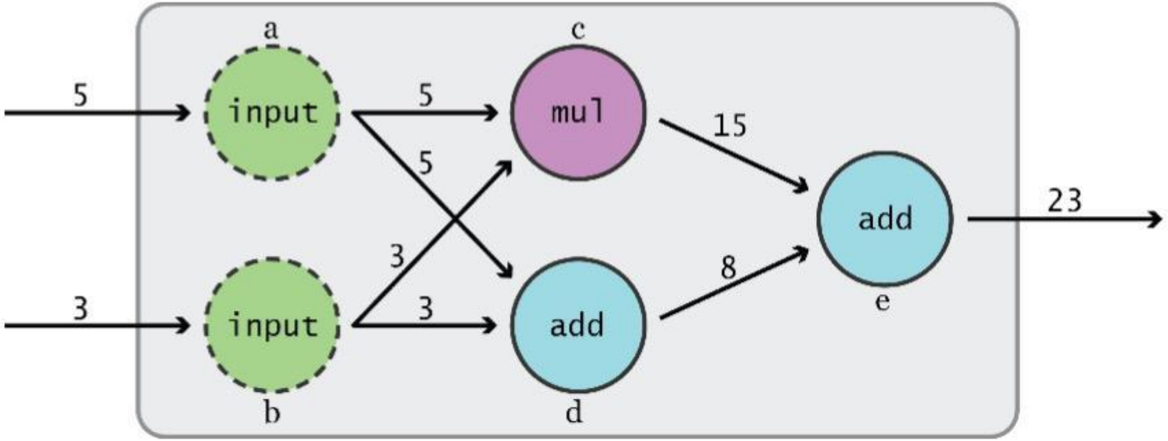
8

23

# Data Flow Graphs

TensorFlow separates definition of computations from their execution

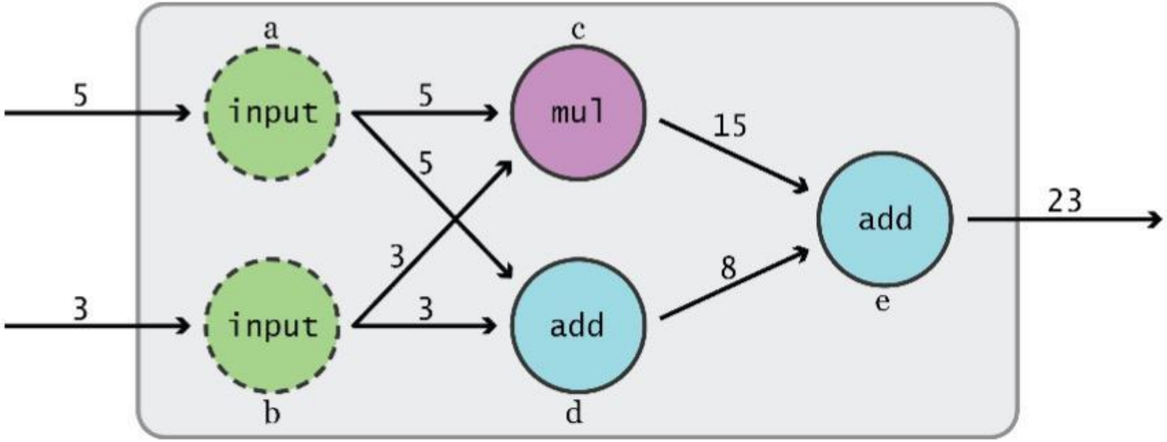
5x3 + (5+3)



Graph from *TensorFlow for Machine Intelligence*

# Data Flow Graphs

Step 2: use a session to execute operations in the graph.



Graph from *TensorFlow for Machine Intelligence*

# Data Flow Graphs

x = 2

y = 3

output_1 = x * (x + y)

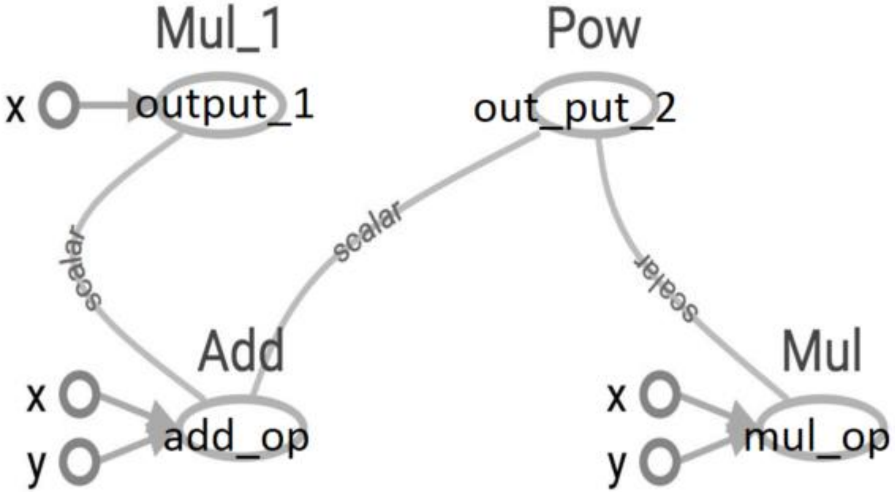
output_2 = (x+y)$^{(x*y)}$

add_op = x + y

mul_op = x * y

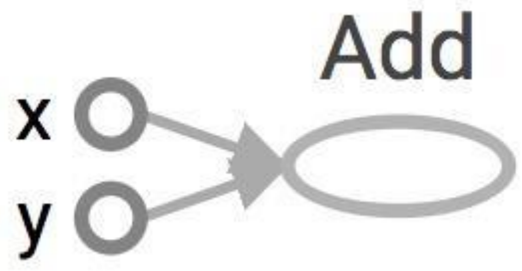
output_1 = x * add_op

output_2 = add_op$^{mul\_op}$



# Data Flow Graphs

import tensorflow as tf
Nodes: operators, variables, and constants
Edges: tensors



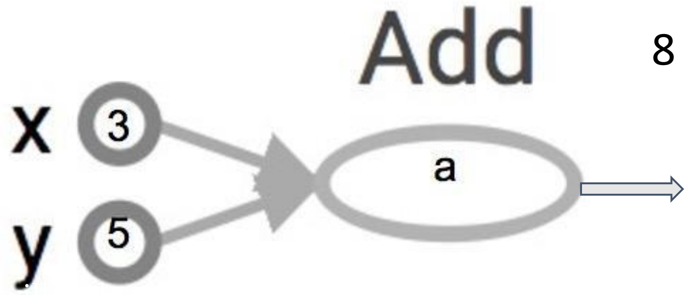
Visualized by TensorBoard

# How 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

>> 8

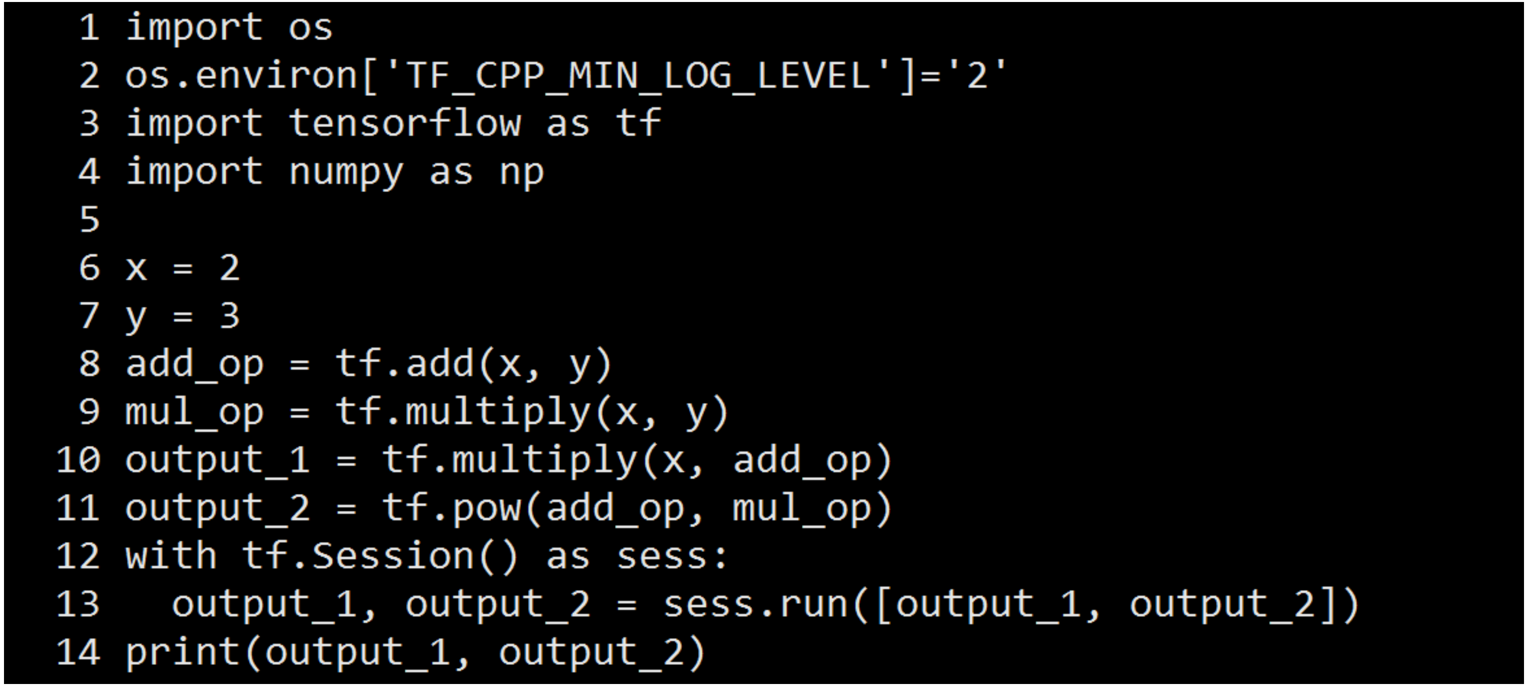


# tf.Session()

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

Session will also allocate memory to store the current values of variables.

# Data Flow Graphs



```python
import os
os.environ['TF_CPP_MIN_LOG_LEVEL']='2'
import tensorflow as tf
import numpy as np

x = 2
y = 3
add_op = tf.add(x, y)
mul_op = tf.multiply(x, y)
output_1 = tf.multiply(x, add_op)
output_2 = tf.pow(add_op, mul_op)
with tf.Session() as sess:
  output_1, output_2 = sess.run([output_1, output_2])
print(output_1, output_2)
```

# TensorFlow for basic image process

# TensorFlow for liner regression

# TensorFlow for neural network

# CNN(Convolutional neural network)