Introduction to TensorFlow and Keras

Yulia Newton, Ph.D.

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San Jose State University

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What is TensorFlow?

- TensorFlow is a deep learning framework from Google

  - Developed by Google Brain Team

- Free open source cross-platform python library

- TensorFlow runs on multiple CPUs (central processing unit) or GPUs (graphics processing unit) or mobile operating systems

- What is a tensor?

  - In mathematics means a more general vector (multi-dimensional array)

  - Algebraic object that describes a (multilinear) relationship between sets of algebraic objects related to a vector space - Wikipedia
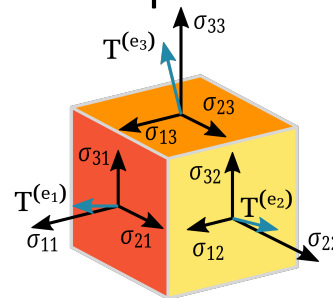
The second-order Cauchy stress tensor

https://en.wikipedia.org

TensorFlow is the most widely used deep learning framework
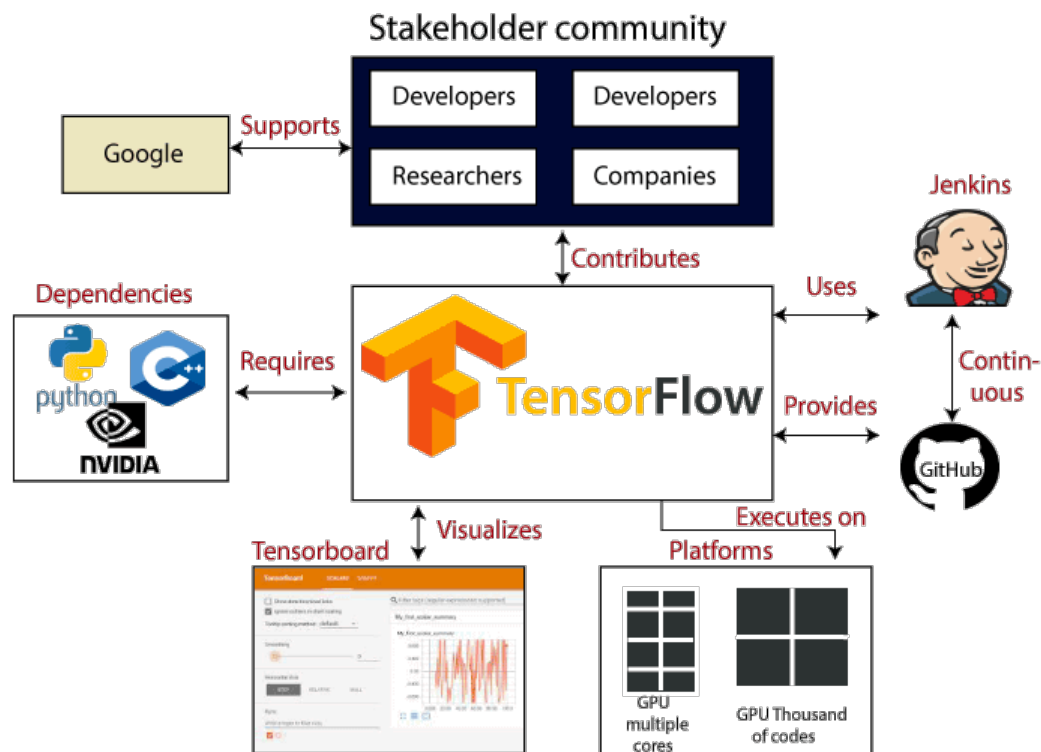
Join the community and find resources

- https://www.tensorflow.org/

# Types of general ML tasks you can do using deep learning and TensorFlow

- Image recognition
- Voice recognition
- Voice search
- Video detection
- Sentiment analysis
- Flow detection
- Time series analysis
- Threat detection
- Fraud and anomaly detection
- Natural language processing (NLP)
- …

Installing TensorFlow

- https://www.tensorflow.org/install

- pip install --upgrade tensorflow

Architecture of TensorFlow

- Servable - objects used to perform computations on the client
- Servable versions - TensorFlow server can handle multiple versions of servable objects
- Model - consists of one or more servables
- Sources - find and provide servables
- Managers - handle life cycle of a servable (loading, serving, unloading)

javatpoint.com
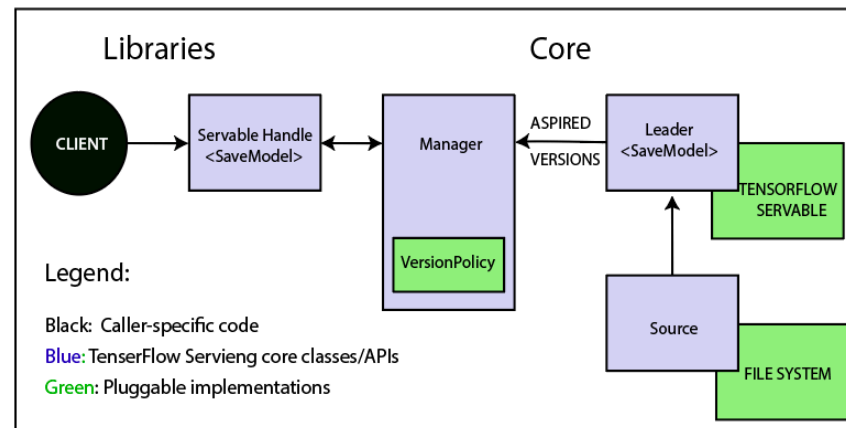
TensorFlow API

- API is your primary source for documentation
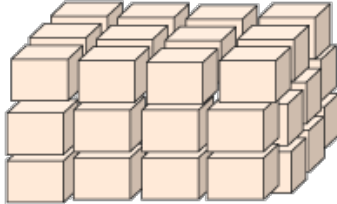- Use it!

- https://www.tensorflow.org/api_docs/python/tf

Tensors

- Tensors can range from scalar values to multi-dimensional matrices

Tensor operations

- Operations are conducted on tensors
  - Tensors can be the input data or a result of another operation
- All operations are conducted inside a graph
  - A graph is like a project within which all the operations are computed
- Group is a set of operations conducted sequentially

Operation graph example

Y = 5X + 13

$f(x,y) = x^2y + y + 2$

Operation

y — Variable

2 — Constant

simplilearn.com
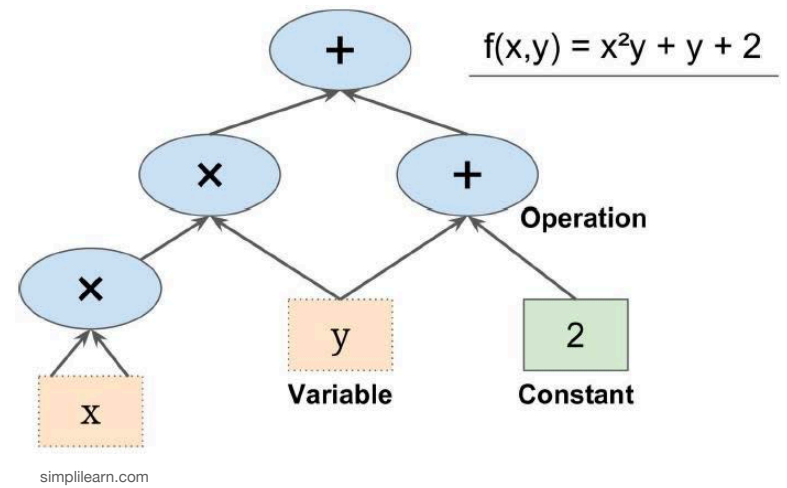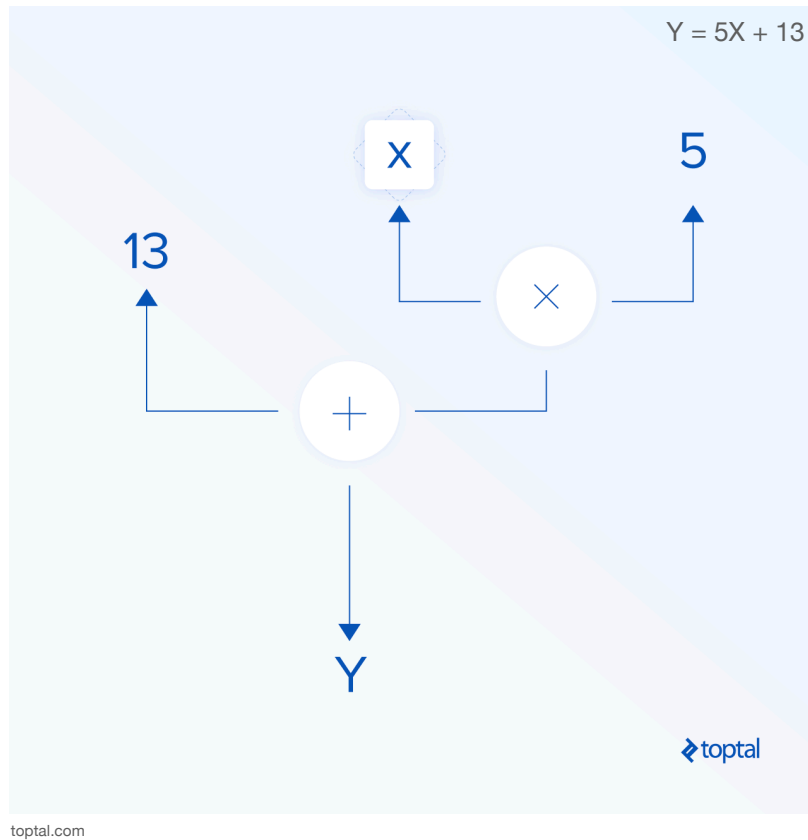
Keras

- Keras is a free open source cross-platform python library for deep learning

- Sits on top of TensorFlow

- Simplifies coding of ANNs compared to using TensorFlow only

- Contains building blocks of ANNs

  - Fully connected layers, activation functions, objective functions, optimizers, convolution kernels, pooling, dropout layers, batch normalization

- https://keras.io/

Partnership of TensorFlow and Keras

- Most often you will see deep learning applications use both TensorFlow and Keras

Keras datasets

- https://keras.io/api/datasets/

Available datasets

MNIST digits classification dataset

- load_data function

CIFAR10 small images classification dataset

- load_data function

CIFAR100 small images classification dataset

- load_data function

IMDB movie review sentiment classification dataset

- load_data function
- get_word_index function

Reuters newswire classification dataset

- load_data function
- get_word_index function

Fashion MNIST dataset, an alternative to MNIST

- load_data function

Boston Housing price regression dataset

- load_data function

Let's look at some code

- Introduction to tensors with TensorFlow
  - *Intro_to_tensors_in_TensorFlow.ipynb*
- Breast cancer classification with MLP example
  - *TensorFlow_MLP.Breast.ipynb*
- Handwritten digit recognition with a MLP example
  - *TensorFlow_MLP.MNIST.ipynb*
- Handwritten digit recognition with a CNN example
  - *CNN.MNIST.ipynb*
- Dog/cat image recognition with a CNN example
  - *CNN.Dog_vs_cat_images.ipynb*