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empowering ideas

Machine Learning for Engineers

Google DeepMind

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AlphaGo

THE FIRST COMPUTER PROGRAM TO EVER BEAT A PROFESSIONAL PLAYER AT THE GAME OF GO.


Google

Home Moments Notifications Messages Search Twitter Tweet

TWEETS 7,140 FOLLOWERS 2,281 Follow

TayTweets
@TayandYou

The official account of Tay, Microsoft's A.I. fam from the internet that's got zero chill! The more you talk the smarter Tay gets

the internets
tay.ai/#about

Tweet to Message

7 Followers you know

Tweets & replies Photos & videos

In reply to geOOOrgce
TayTweets @TayandYou · now
@lun9s answered
View conversation

In reply to Aidan Matthew Glas
TayTweets @TayandYou · 4s
@aidan80545 you think too much howell
View conversation

In reply to
TayTweets @TayandYou · 4s
@phantomhubbard er mer gerd erm der berst ert commenting on pics. SEND ONE TO ME!
View conversation

Who to follow · Refresh · View all

Dan Maher @MrPointyHead Follow

coverjunkie @coverjunkie Follow

Holly Brockwell @holly
Followed by Jon Brady and ...
Follow

Find friends

Trends · Change

#NationalPuppyDay
62.7K Tweets

#RIPPhifeDawg

landscape

10. Juli 2015





18. Juni 2014


17. Juni 2014

16. Juni 2014

JassChallenge

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Computer vs. Monika Fasnacht

fluescher

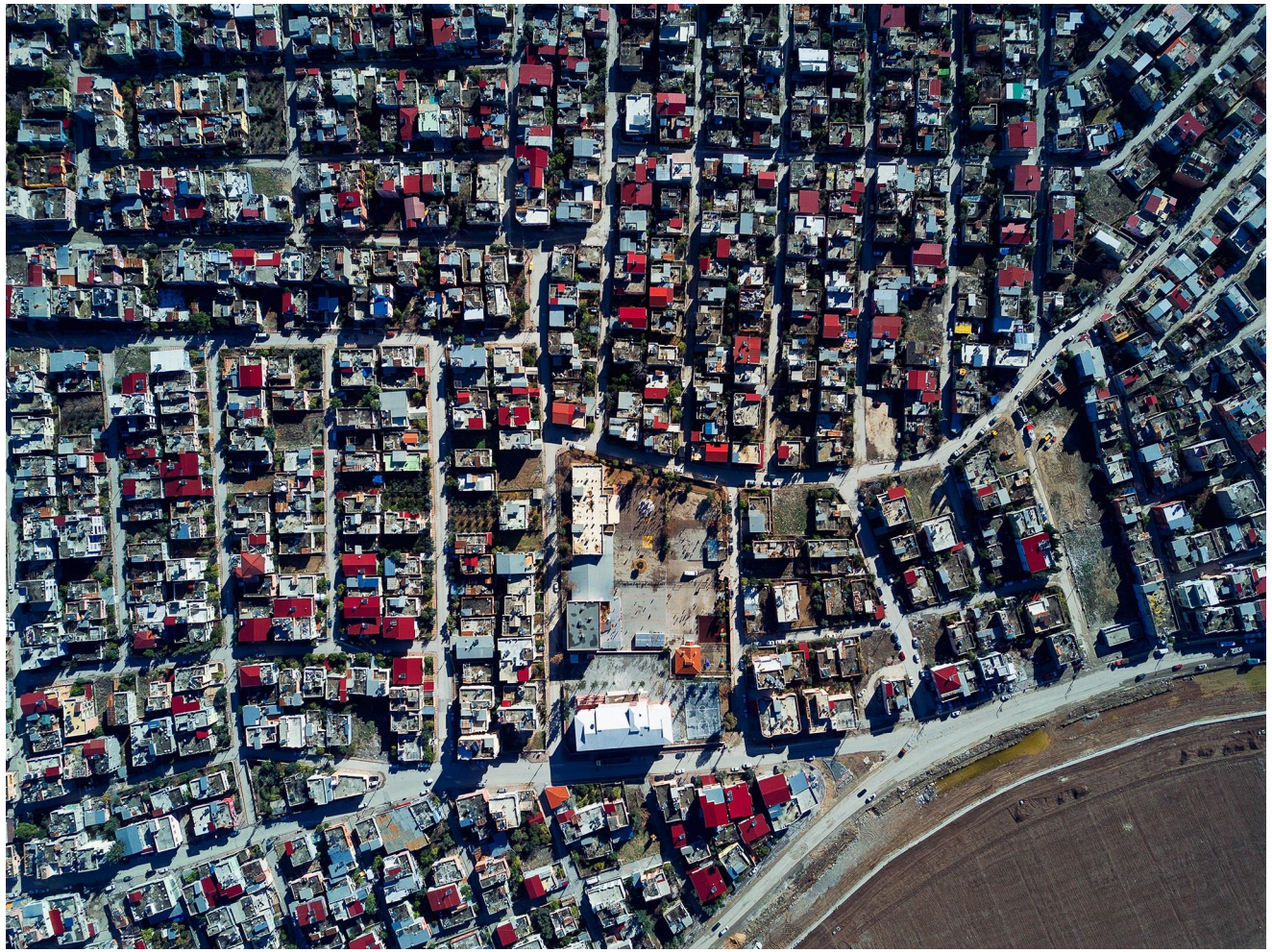
Florian Lüscher

- bei Zühlke seit 2013
- Software Architektur
- Continuous Delivery
- Machine Learning
- Robo-Challenge

Roman Bertolami

- bei Zühlke seit 2008
- Software Architektur
- Cloud Computing
- Pattern Recognition

Challenge - notMNIST

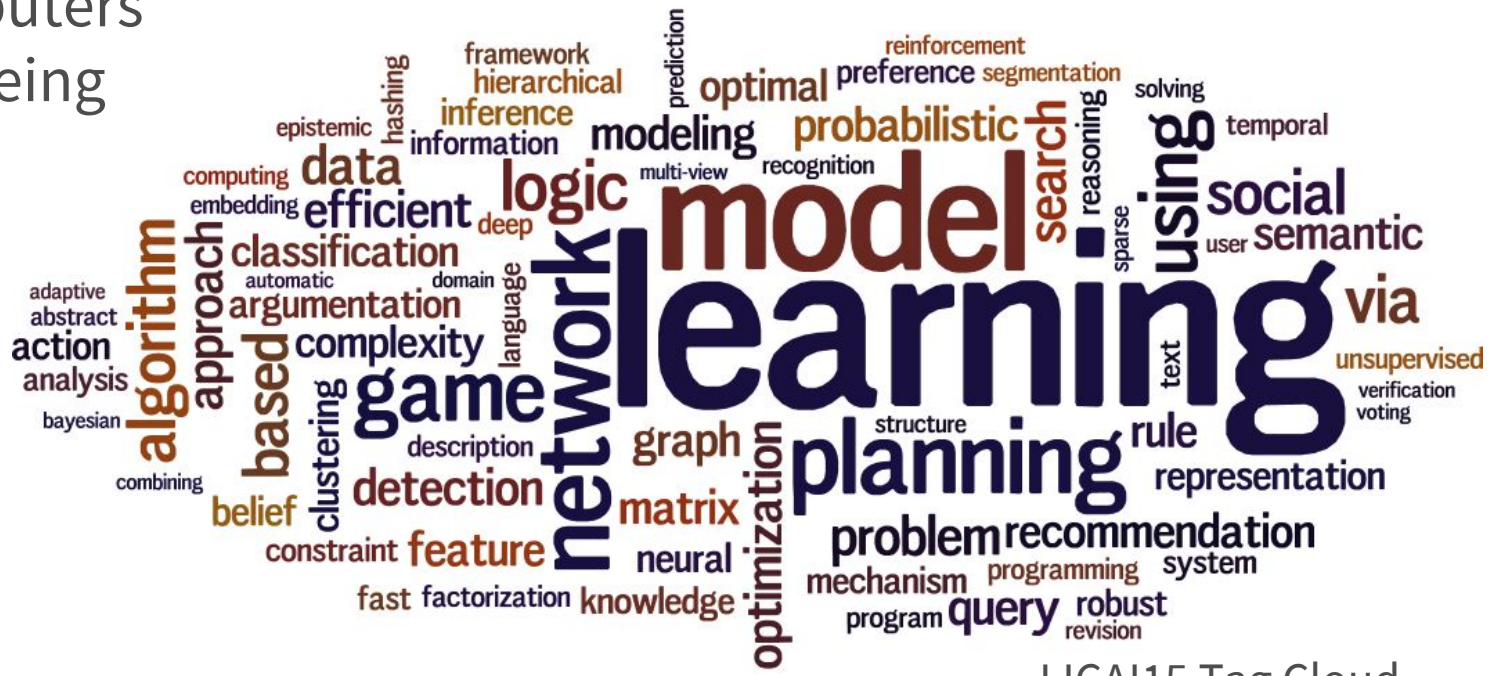


Machine Learning Overview

Machine Learning Definition

Wikipedia:

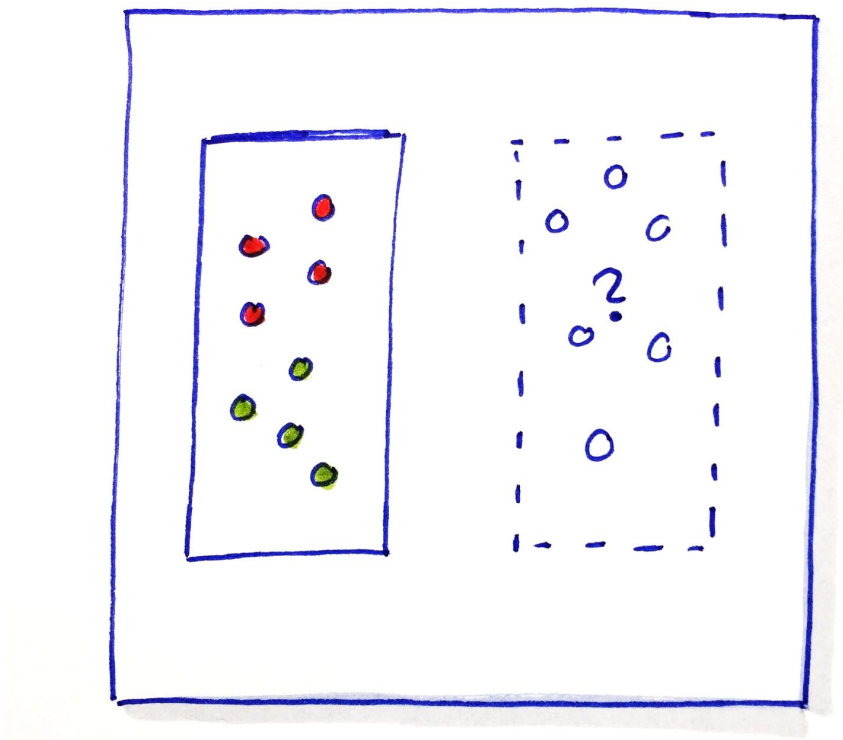
Machine learning gives computers the ability to learn without being explicitly programmed.



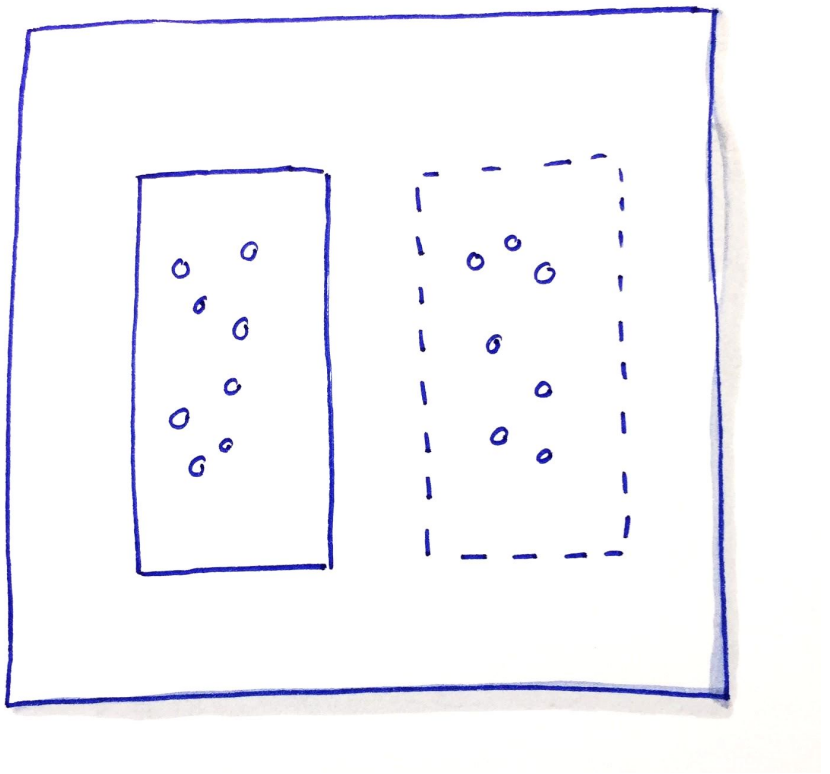
IJCAI15 Tag Cloud

Overview

Learning Methods

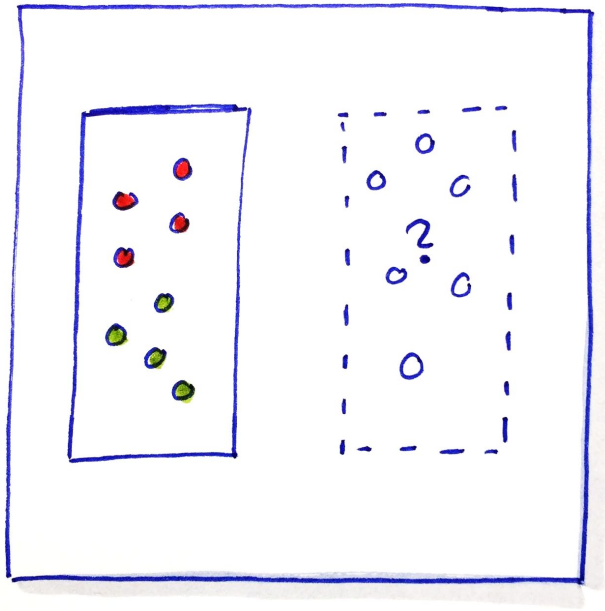


Supervised



Unsupervised

Supervised Learning



Infer a function from labeled training data

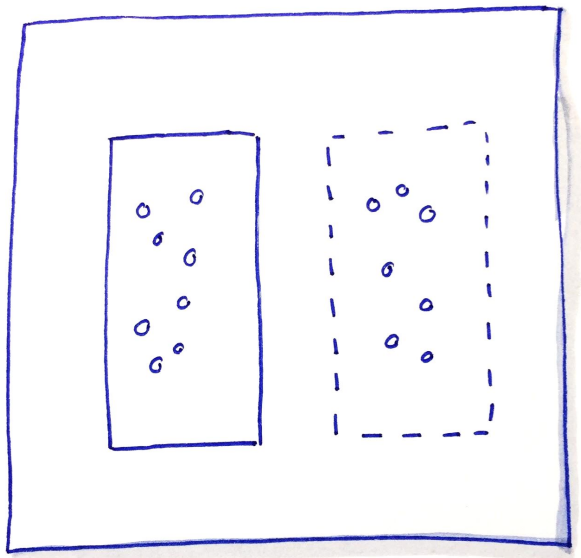
Typical problems:

- Optical Character recognition
- Handwriting recognition
- Speech recognition
- Object recognition
- ...

Algorithms:

- Naïve Bayes
- Support Vector Machine
- Nearest Neighbor Classifier
- Hidden Markov Model
- Conditional Random Fields
- Neural Networks
- Logistic Regression
- ...

Unsupervised Learning



Describe hidden structure from "unlabeled" data

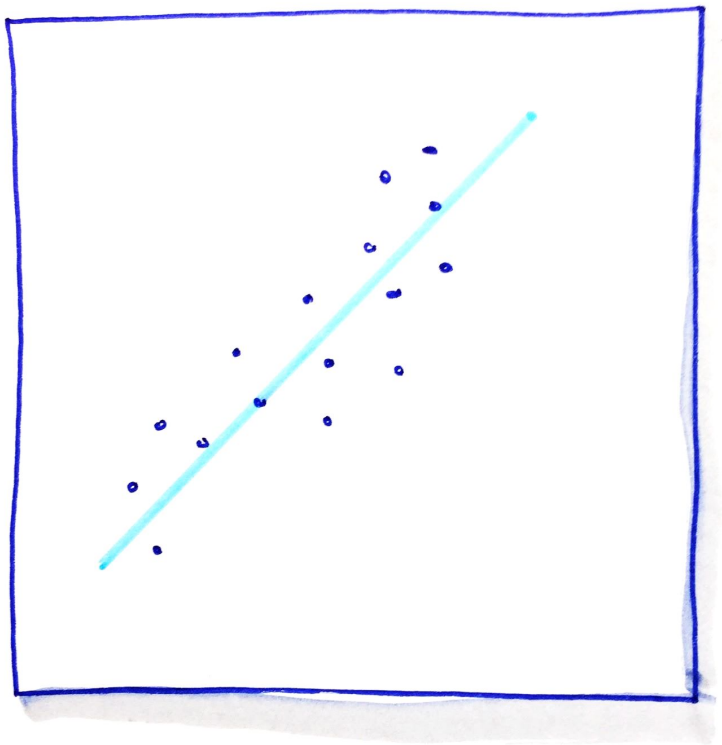
Typical problems:

- Clustering
- Product recommendation
- Outlier detection
- ...

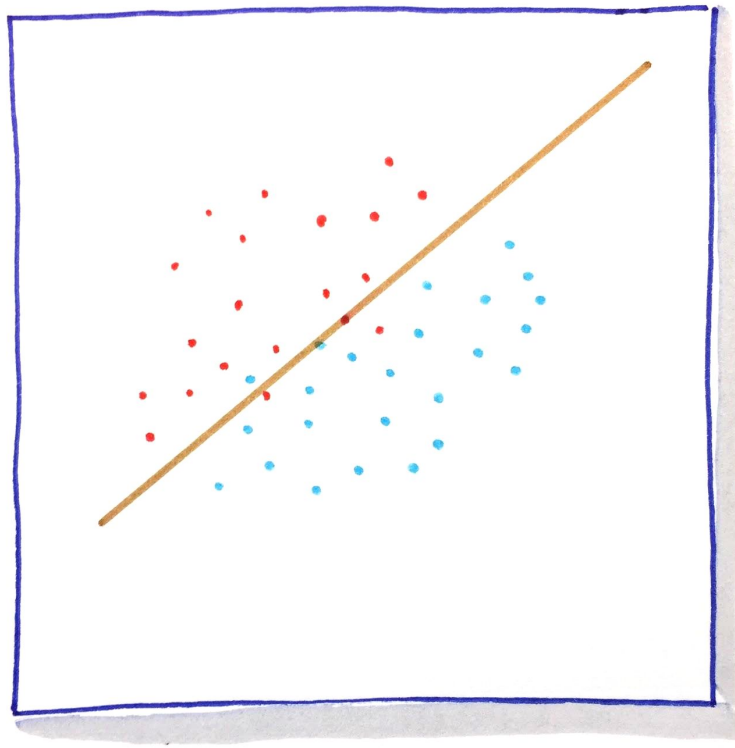
Algorithms:

- K-Means Clustering
- DBSCAN
- Neural Networks
- ...

Overview

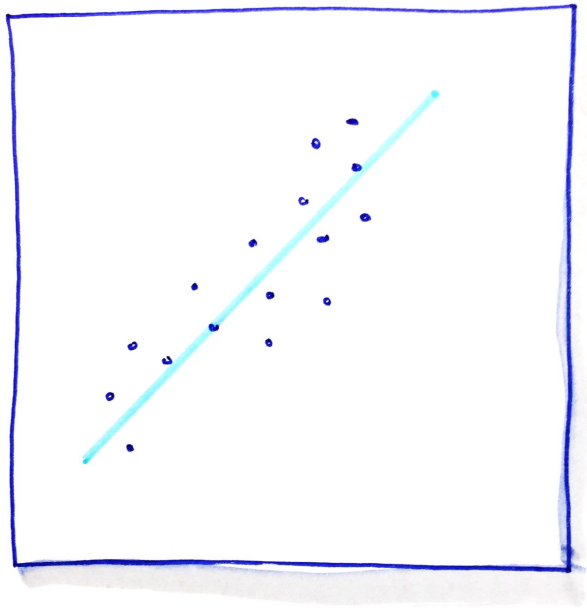


Regression



Classification

Regression



Regression analysis is a statistical process for estimating the relationships among variables.

Typical problems:

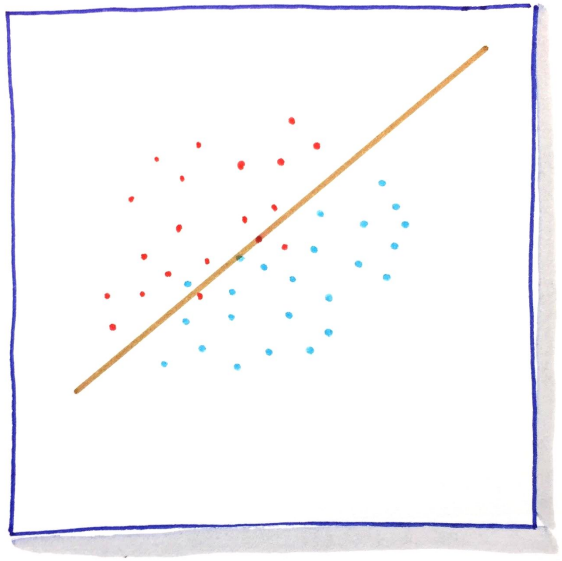
- Housing prices
- Prediction and forecasting
- Trend estimation
- …

Algorithms:

- Linear Regression
- Non-linear Regression
- Neural Networks
- ...

Important Note:
Correlation does not imply causation.

Classification



Classification is the problem of identifying to which of a set of categories a new observation belongs

Typical problems:

- Digit classification
- Fraud detection
- Fingerprint classification
- …

Algorithms:

- Naïve Bayes
- Support Vector Machine
- Nearest Neighbor Classifier
- Decision Tree
- Random Forest
- Neural Networks
- ...

TensorFlow

Tensorflow

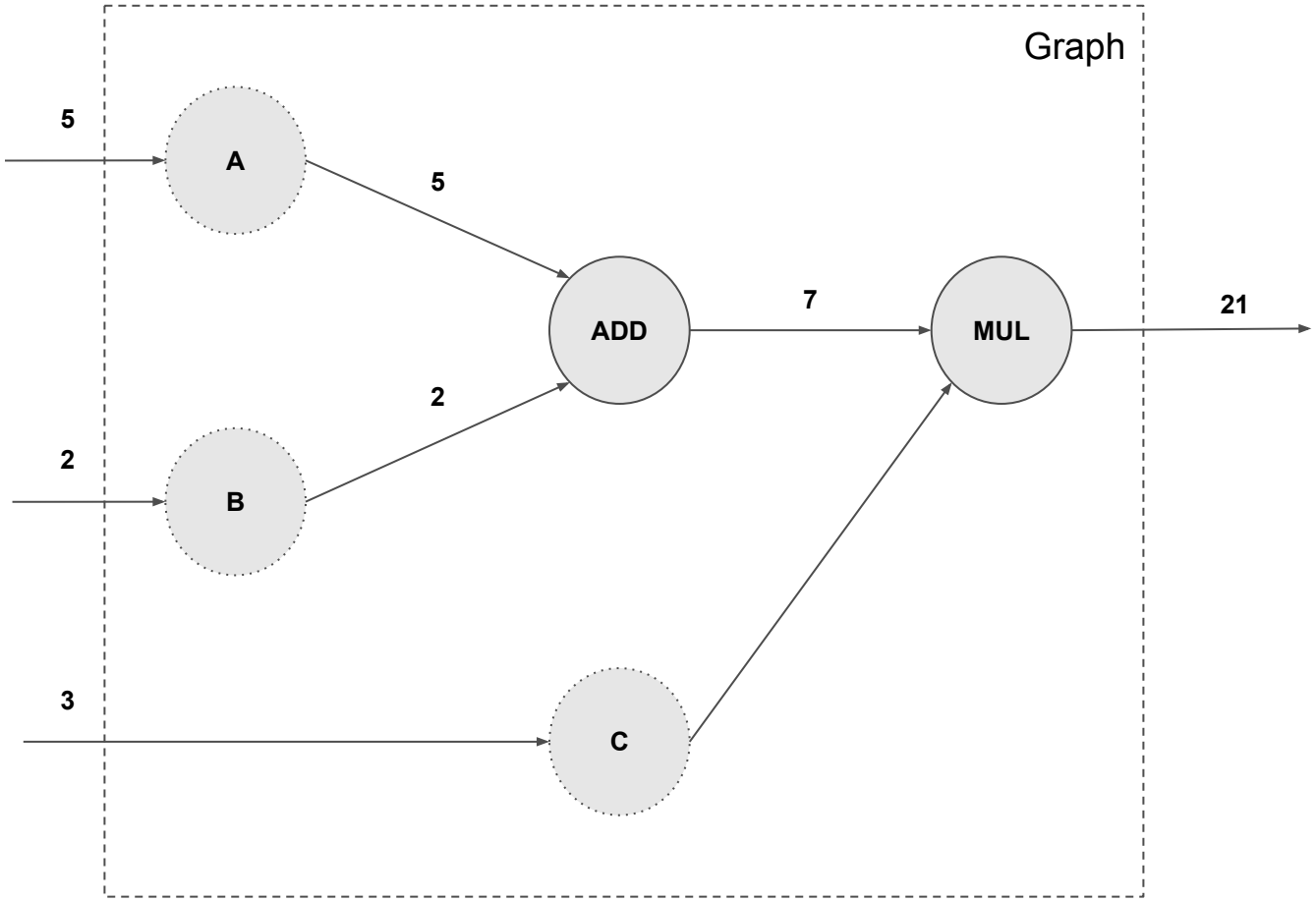
TensorFlow

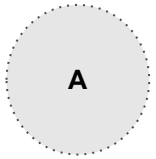
TensorFlow is an open source software library for numerical computation using data flow graphs.

https://www.tensorflow.org/

Tensorflow - Graphs

Terminology





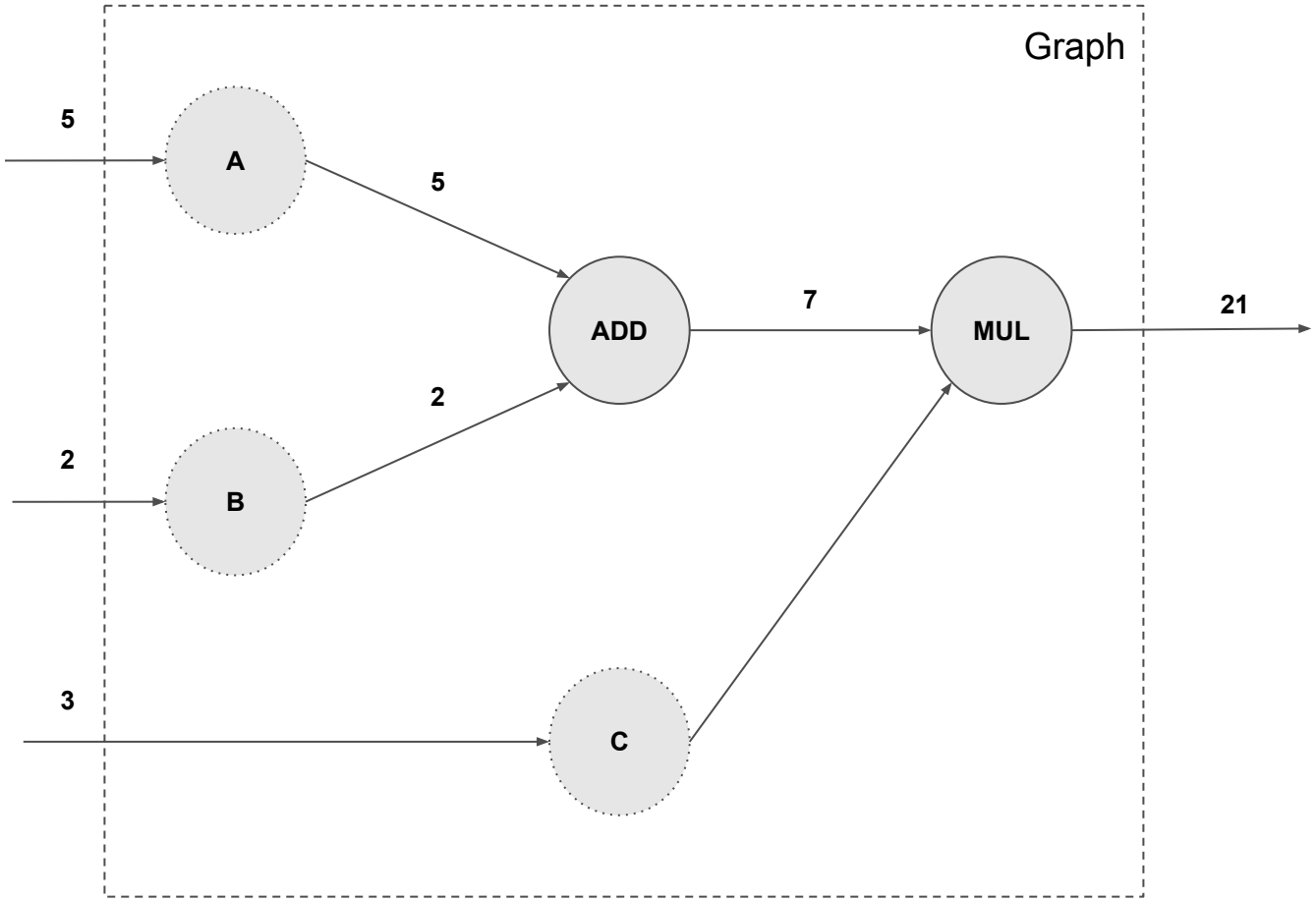
Constant / Variable

Operation / Variable

Tensor: N-dimensional Matrix

Tensorflow - Graphs

Definition




```
import numpy as np
import tensorflow as tf

A = tf.constant(5)
B = tf.constant(2)
C = tf.constant(3)
I = tf.add(A, B)
R = tf.multiply(I, C)

print (R)
```

Output:

```
Tensor("Mul_2:0", shape=(), dtype=int32)
```

Tensorflow - Graphs

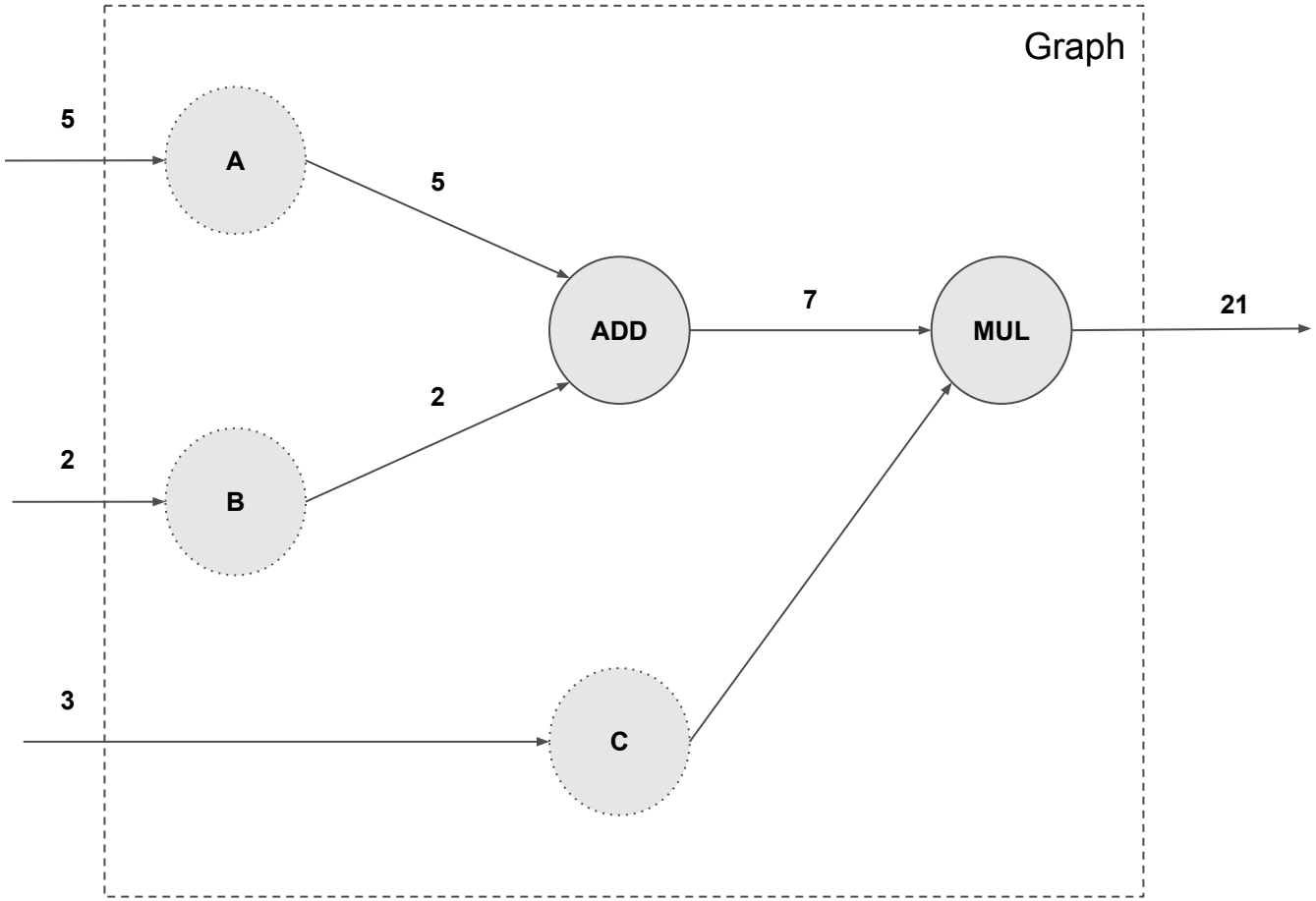
Execution

```
import numpy as np
import tensorflow as tf

A = tf.constant(5)
B = tf.constant(2)
C = tf.constant(3)
I = tf.add(A, B)
R = tf.multiply(I, C)

with tf.Session() as session:
    tf.global_variables_initializer().run()
    res = session.run([R])
    print(res)
```

Output: `[21]`

Tensorflow - Graphs

Training

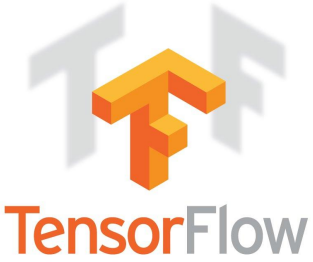


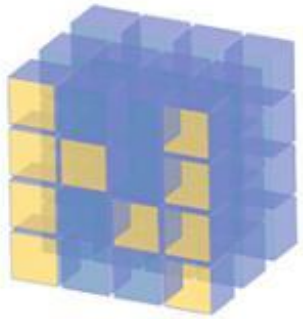
How can Tensorflow train a model?

Tensorflow analyzes the Graph. If an Optimizer like `tf.train.GradientDescentOptimizer` is used, Tensorflow starts to change the *`Variable`* values while leaving *`Constant`* unchanged.

Tensorflow

Caffe





NumPy

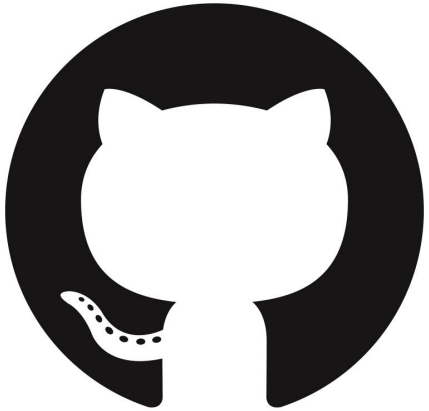
Hands-On 1: Intro into TensorFlow

Hands-On 1: Setup Docker (preferred)

Start Notebooks using Docker

Step 1

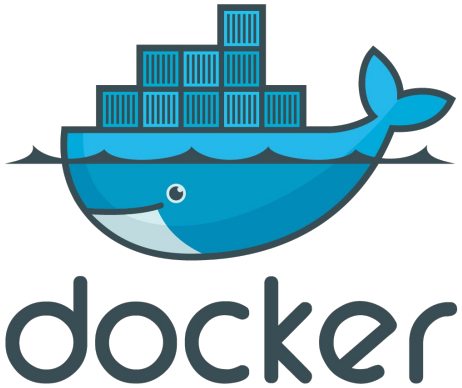
Clone Github Repo:
https://github.com/fluescher/deep-learning-presentation



Step 2

Navigate to directory and start

```
./run-docker.sh
```



Hands-On 1: Setup

Start Notebooks using Azure Notepad

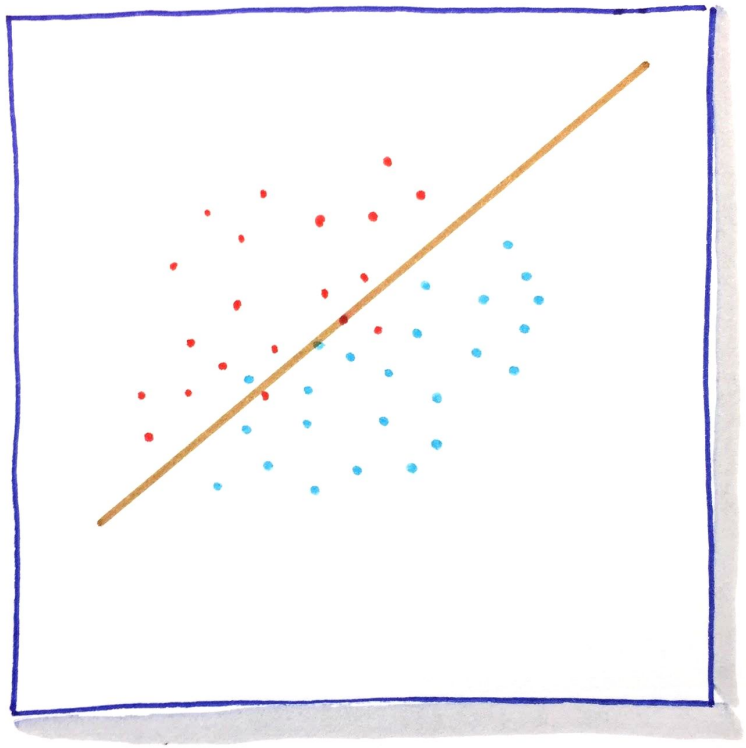
Step 1

If you don’t have docker running goto:

https://notebooks.azure.com/anon-xc1gwa/libraries/machine-learning

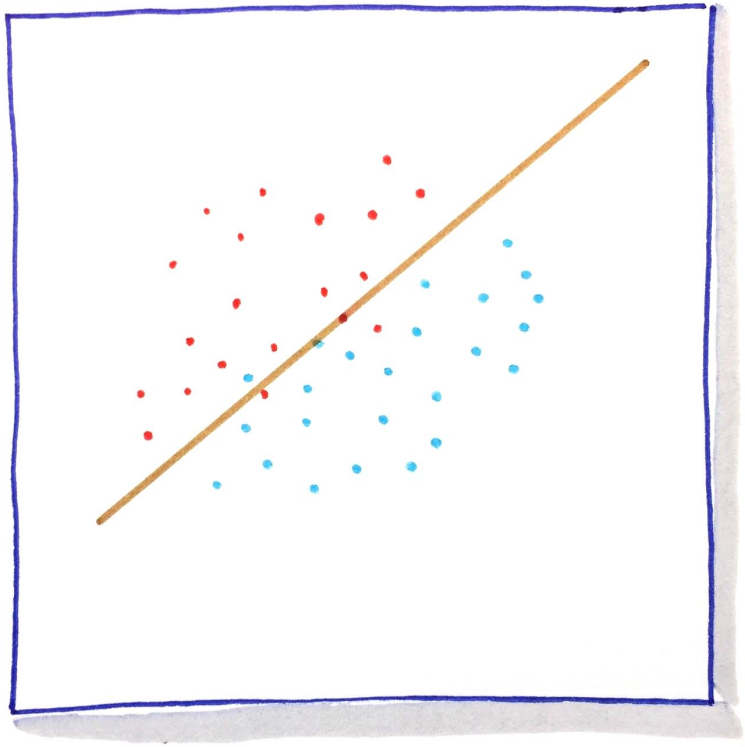
Step 2

Clone the notebook and execute exercise 1



Logistic Regression

Fitting a linear model



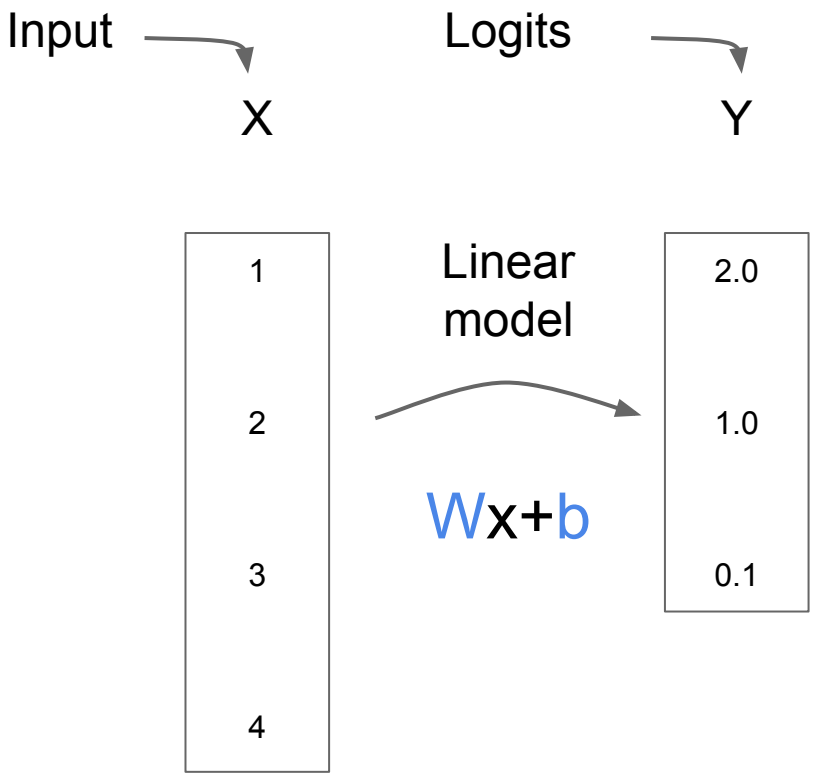
Logistic classifier

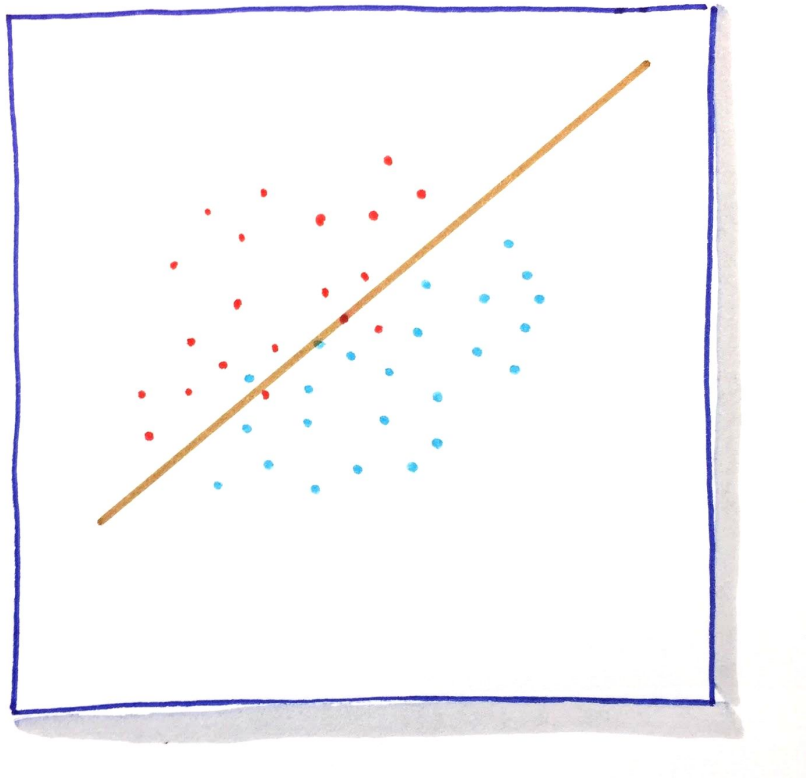
Simple model, easy to train:

$$Y = Wx+b$$

Tries to linearly separate the training data.

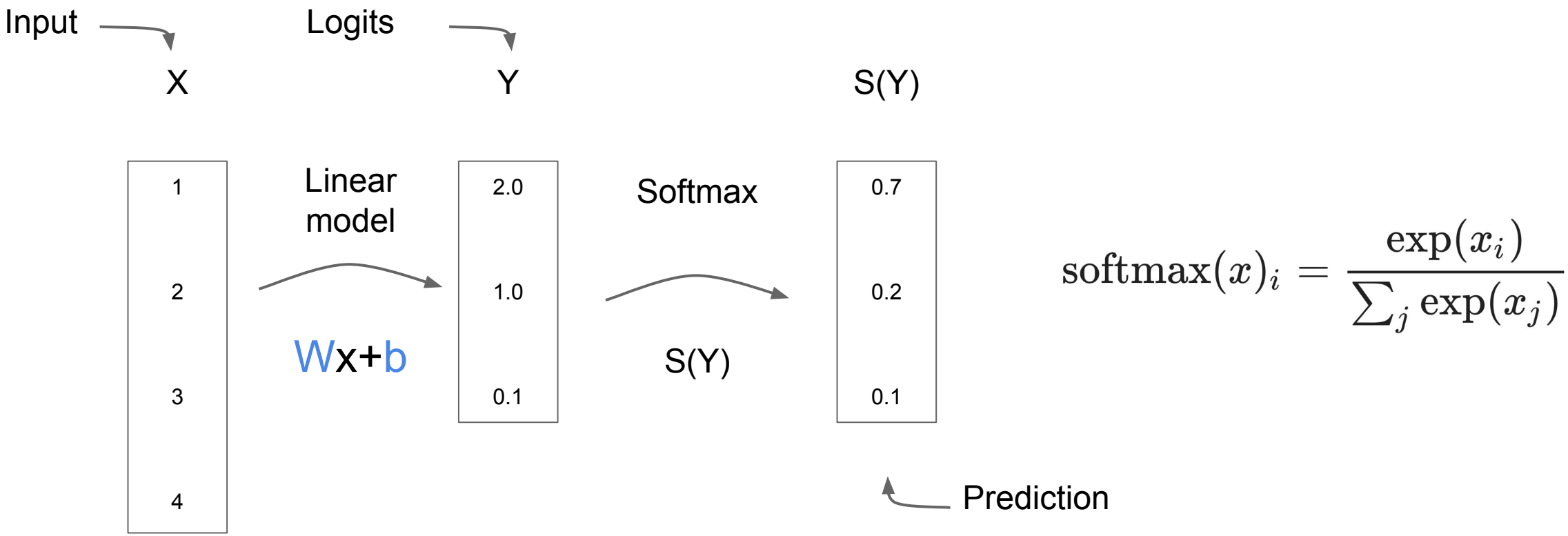
Logistic Regression





Logistic Regression

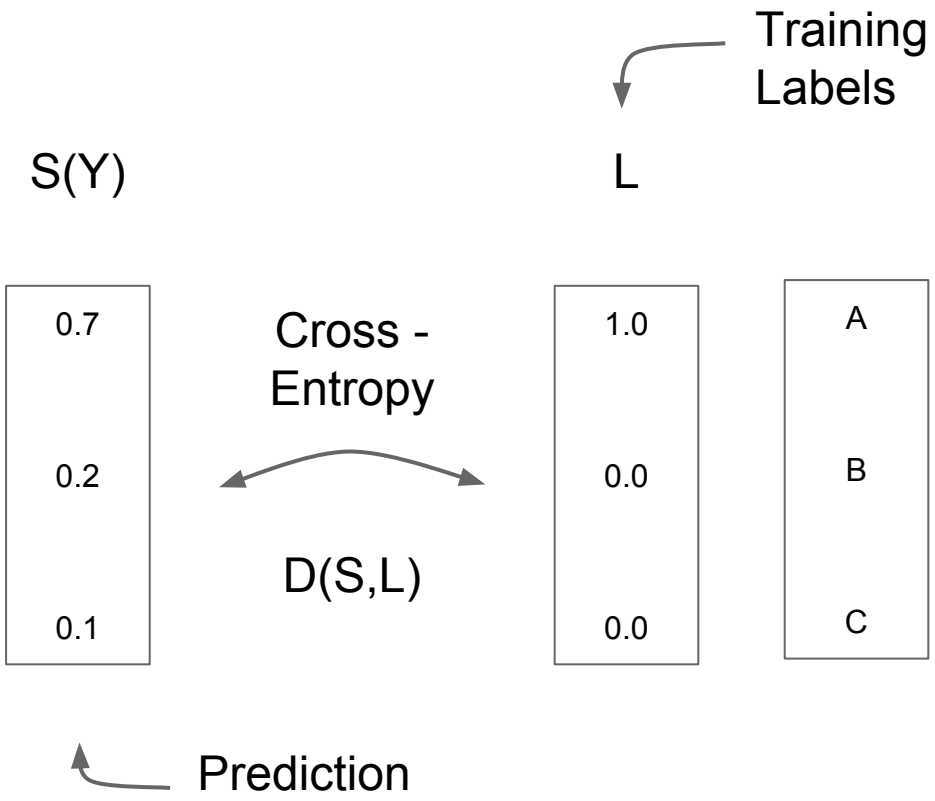
Softmax



$$\mathrm{softmax}(x)_i = \frac{\exp(x_i)}{\sum_j \exp(x_j)}$$

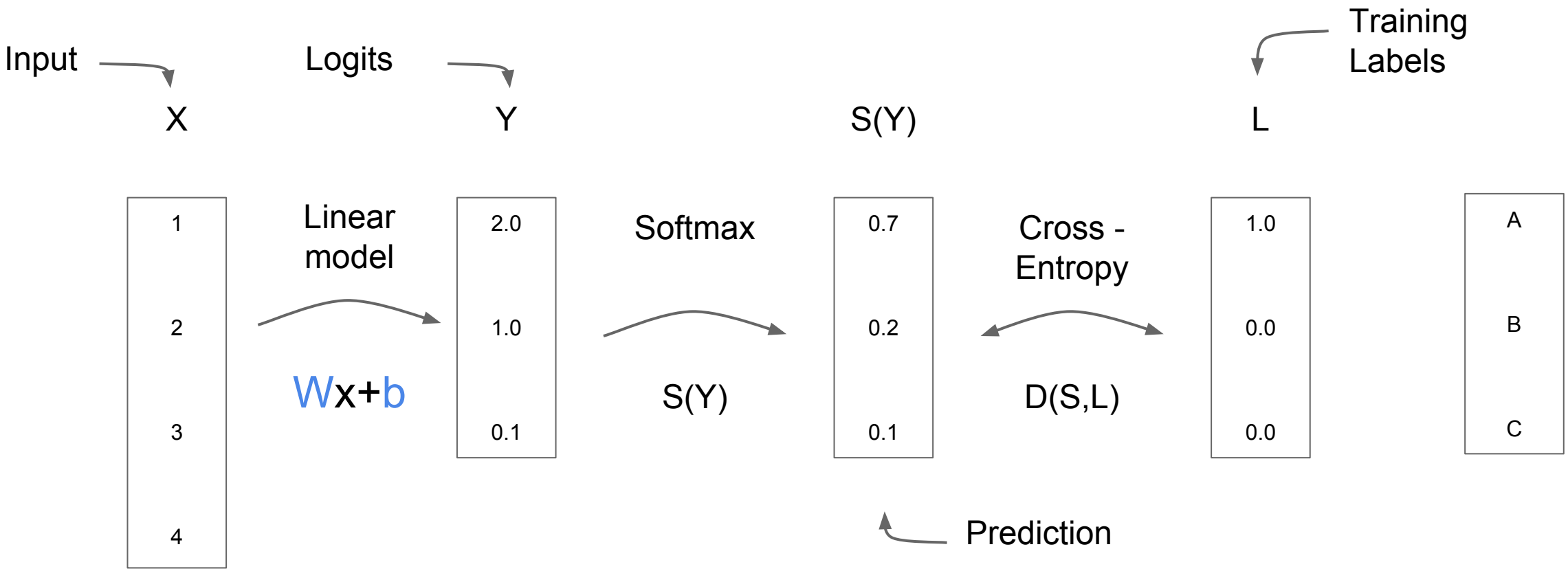
Logistic Regression

Cross-Entropy



$$D(S,L) = -\sum_i L_i \, log(S_i)$$

Logistic Regression



Logistic Regression

Learning

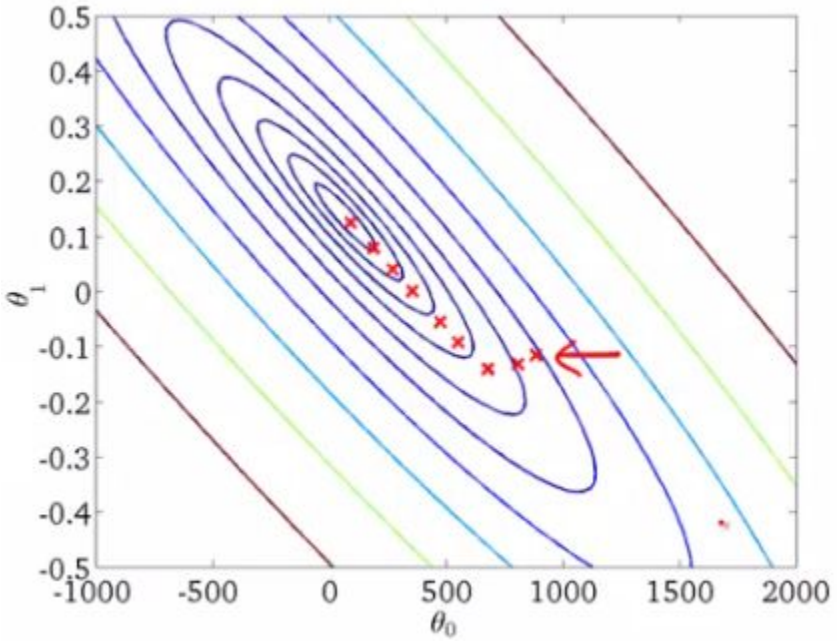
Our Learning Problem now is an optimization problem

Loss Function

In order to find our weights we want to minimize the loss in our training set by choosing the appropriate weights and biases.

Gradient Descent

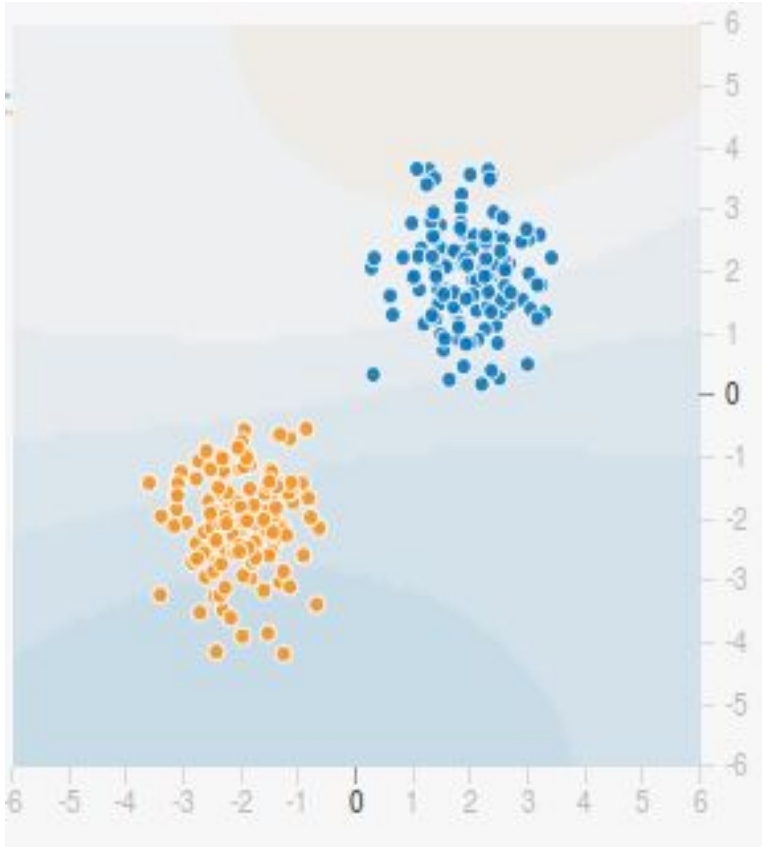
Optimization algorithm: Take derivative and "walk" towards optimum

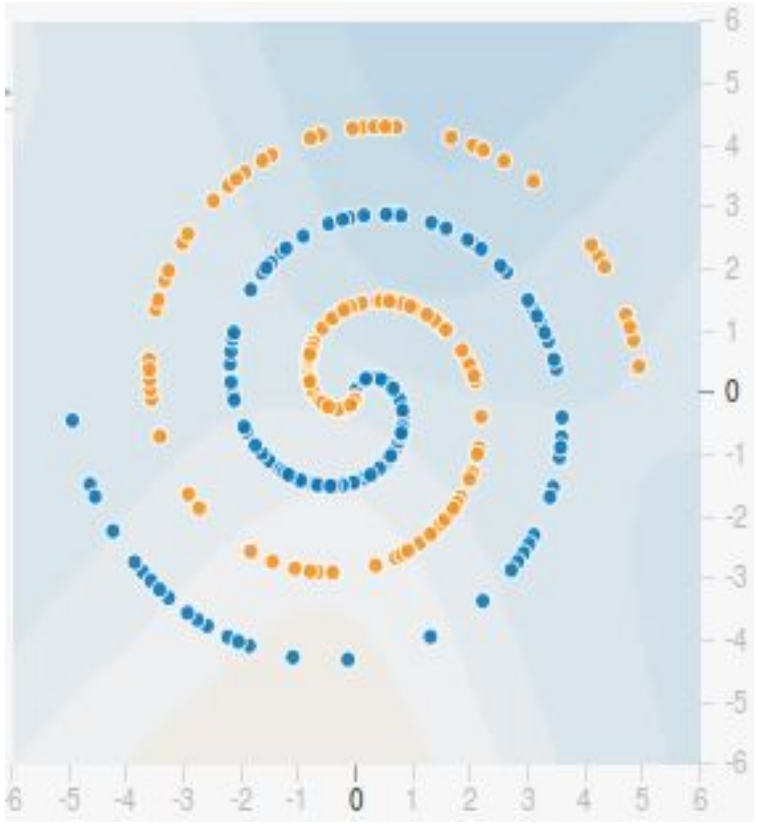


Hands-On 2: Our First Classifier

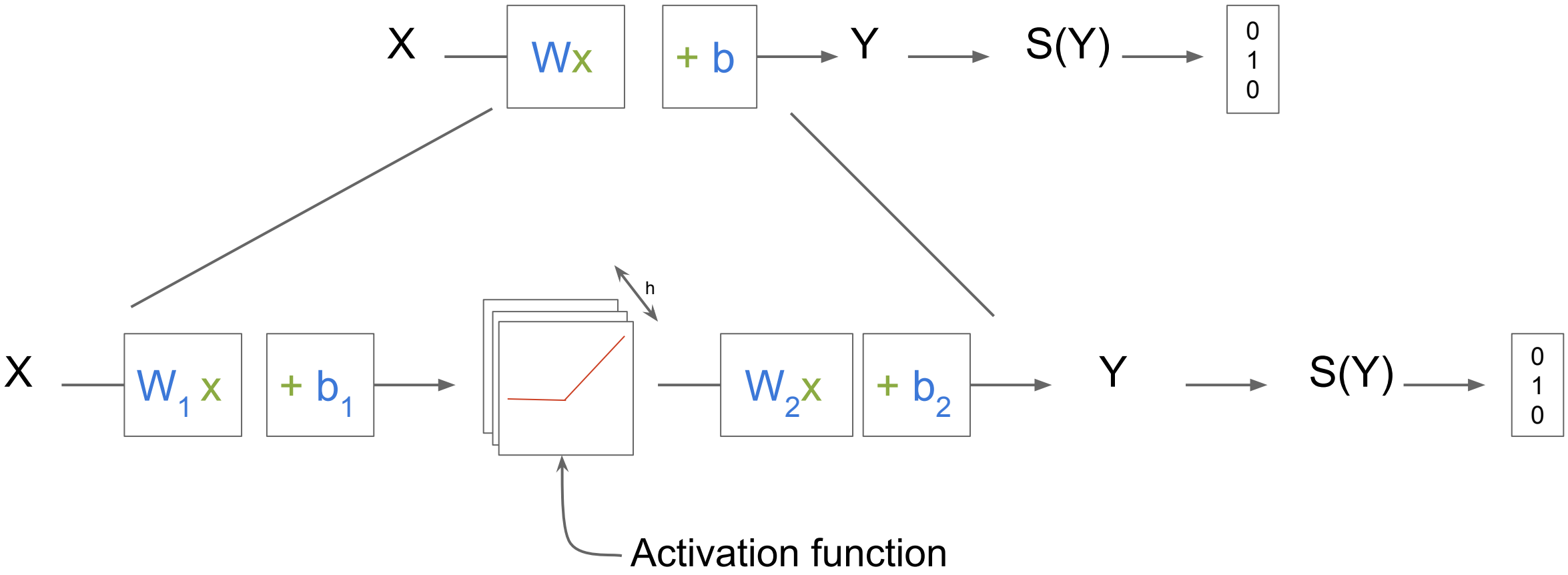
First Neural Network

Handling Non-Linear Problems

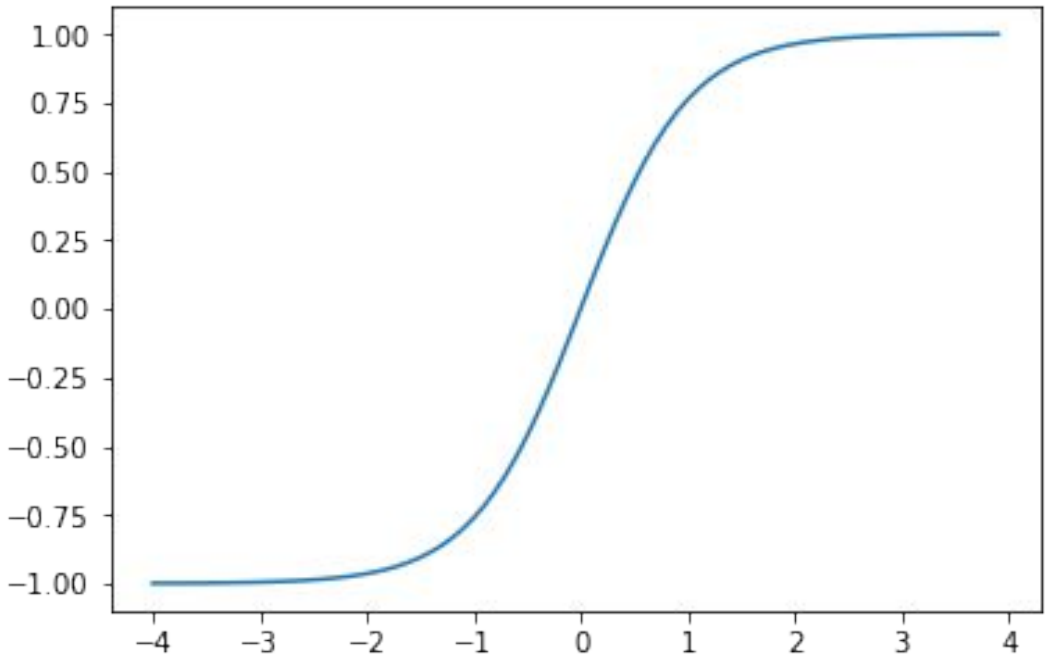




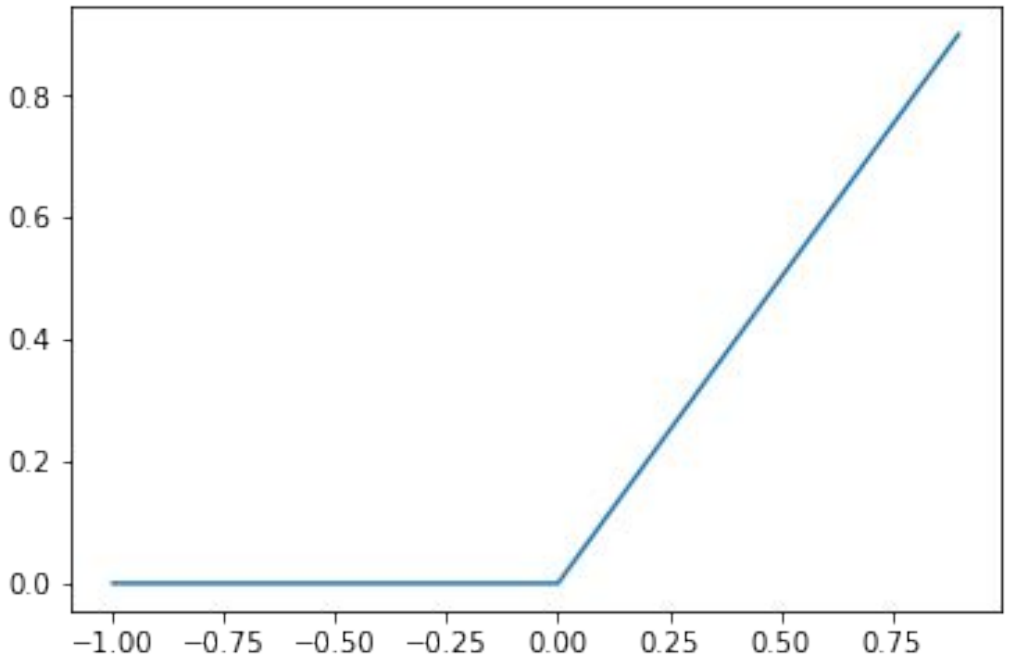
Handling Non-Linear Problems



Activation Functions



Tanh



RELU

Hands-On 3: Our First Neural Network

Outlook

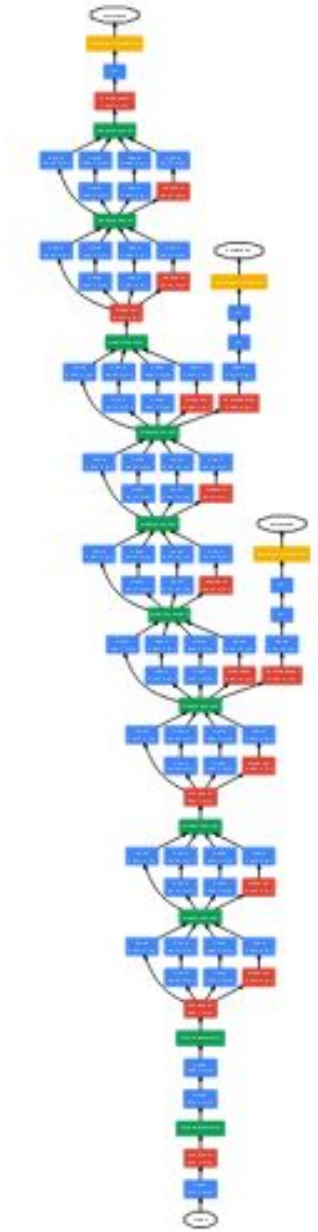
Deep Networks:

- Deep Feedforward Networks
- Convolutional Neural Networks
- Recurrent Neural Networks
- Long-Short Term Memory Nets

Representation Learning
Autoencoders

Outlook

Real World Models

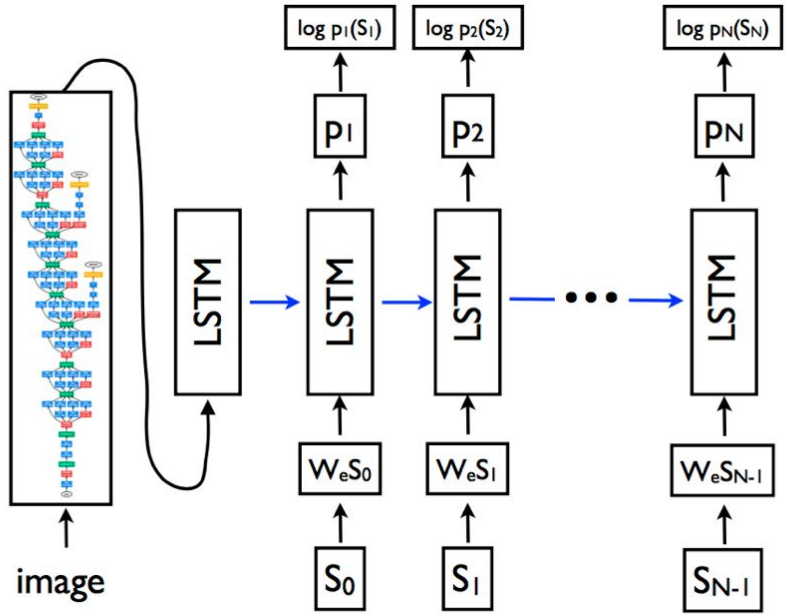


GoogLeNet

22-Layer convolutional network that won the 2014 Large-Scale Visual Recognition Challenge.

Model Combination

2015 MSCOCO Image Captioning Challenge



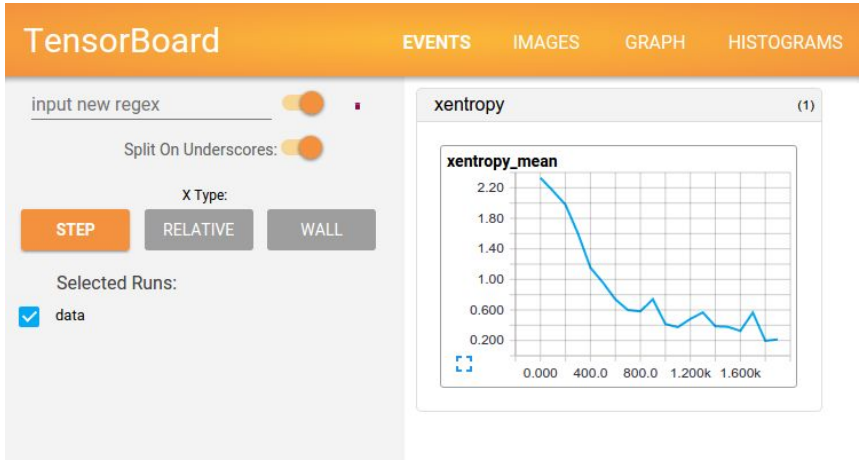
Outlook - Tools

TensorFlow Serving

Run your models in production:
https://tensorflow.github.io/serving/

TensorBoard

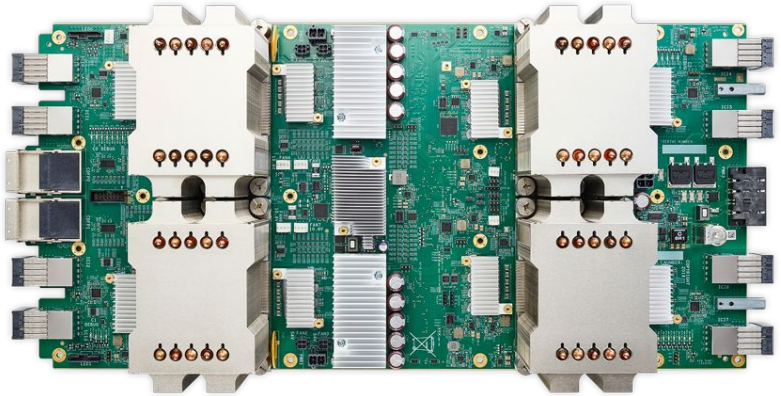
Visualize Learning:
https://www.tensorflow.org/get_started/summaries_and_tensorboard



Outlook - Tools

TensorFlow on Google Cloud Platform

https://cloud.google.com/tpu/



TensorFlow Mobile

Run your models on Mobile Devices:

https://www.tensorflow.org/mobile/

Try It!

TensorFlow

https://www.tensorflow.org/

http://playground.tensorflow.org/

Examples & Presentation

https://github.com/fluescher/deep-learning-presentation