MLCC Study Jam

Rajkot Edition

Hello!

I AM Pratik Parmar

And I am here to bore you with Machine Learning.

Where to find course content?

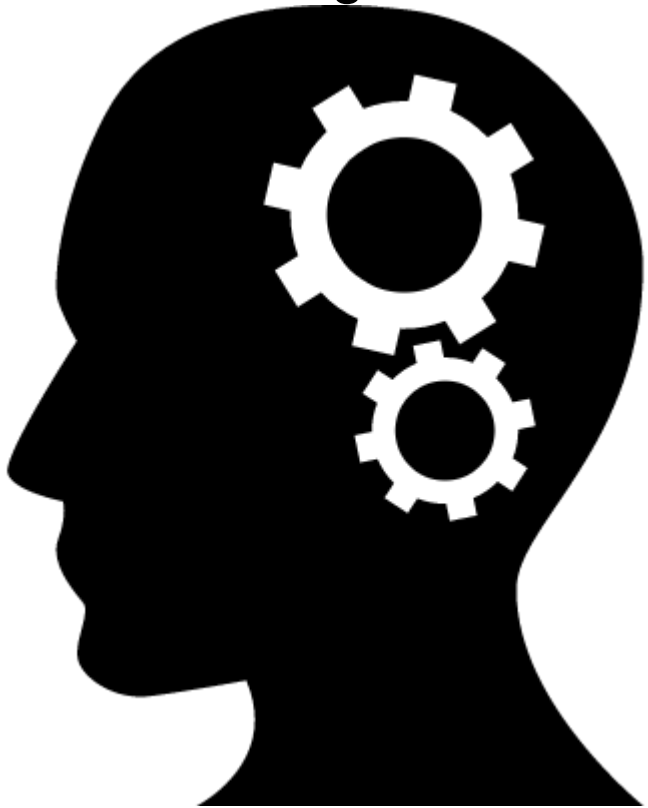
http://g.co/mledu/studyjams-IN

Google Colab

What is Machine Learning actually?

Logic

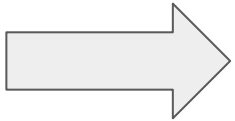
Input



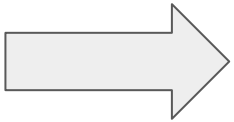
Output

To minimize the difference between predicted output and actual output.

Input



$$f(x)$$



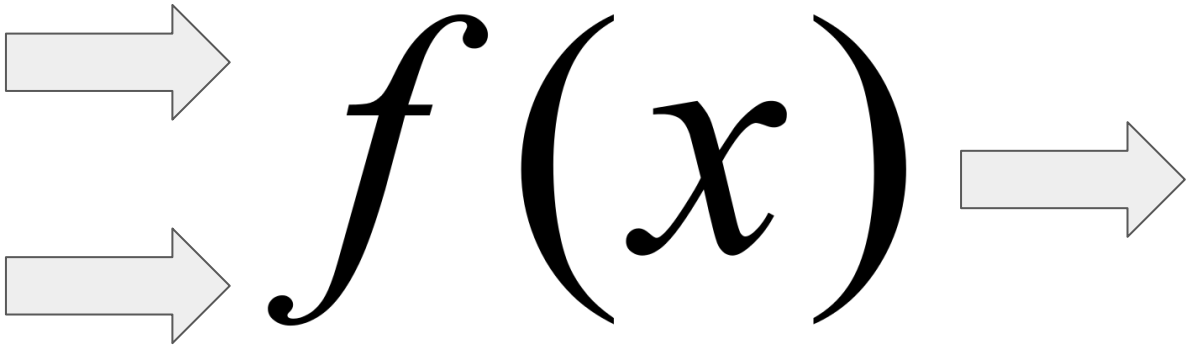
Output

Trained mathematical function

To minimize the difference between predicted output and actual output.

Old Input

Old Output



Learn parameters of the function

Trained mathematical function

What do experts say about ML / DS / AI ?

“The sexy job in the next 10 years will be statisticians. People think I’m joking, but who would’ve guessed that computer engineers would’ve been the sexy job of the 1990s?” - Hal Varian(Chief economist, Google)

“The world is one big data problem.” - Andrew McAfee(associate director of the Center for Digital Business at the MIT Sloan School of Management)

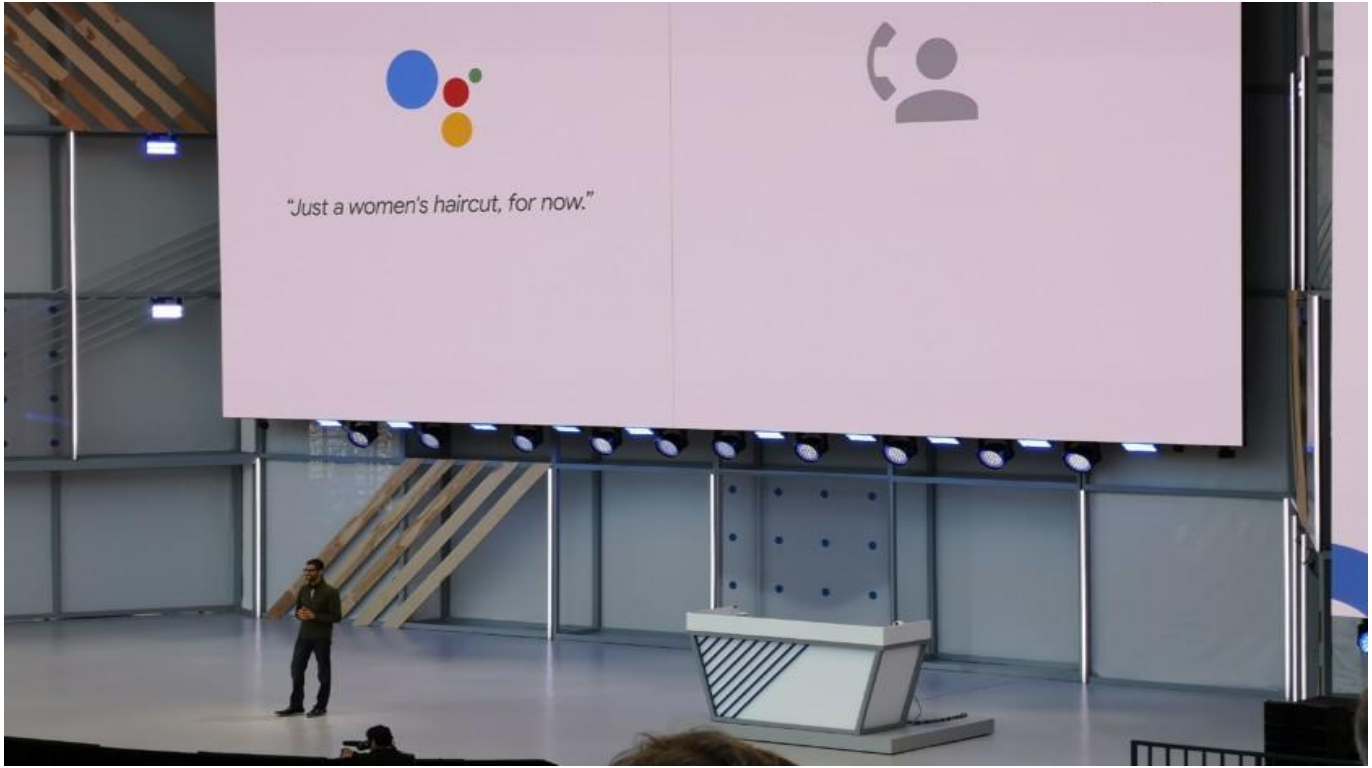
“Data is the Next Intel Inside.” Tim O’Reilly

“Data is the sword of the 21st century, those who wield it the samurai.” -Jonathan Rosenberg

“A year spent in artificial intelligence is enough to make one believe in God.” -Alan Perlis

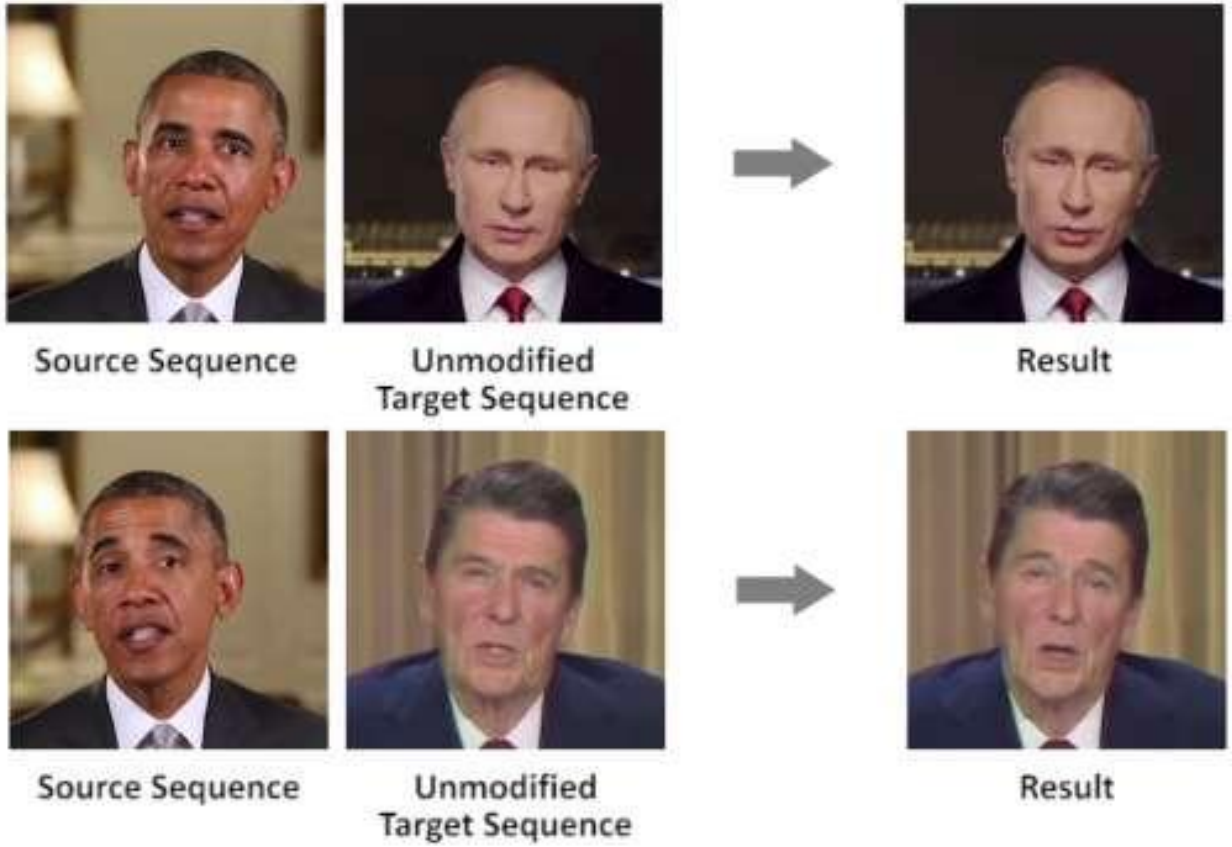
“Data science can get you high without cannabis, drunk without alcohol and tripped up without the coke”- The Honorable Speaker

Shocking IT NEWS last year?



Google Duplex?

OpenAI's 'Dota 2' bots taking on pro teams ?


Source Sequence
Unmodified Target Sequence
Result
Source Sequence
Unmodified Target Sequence
Result

Deep Fake ?


PART 1
DEEP FAKES
Good or Bad??

Why is AI all the rage only NOW?

- More Data
- More Computing Power
- Cloud as the Platform
- Commoditization of Deep Learning (e.g. Tensorflow, PyTorch)
- Specialized hardware for Deep Learning (CPUs <- GPUs <- TPUs)
- Automation of ML (e.g. MIT's Data Science Machine & Google's AutoML)

Is Machine Learning for everyone?

Machine Learning is
Already Affecting Your World

Google

Translate

Turn off instant translation

English | Korean | Spanish | Detect language

Korean | Chinese (Traditional) | English | Translate

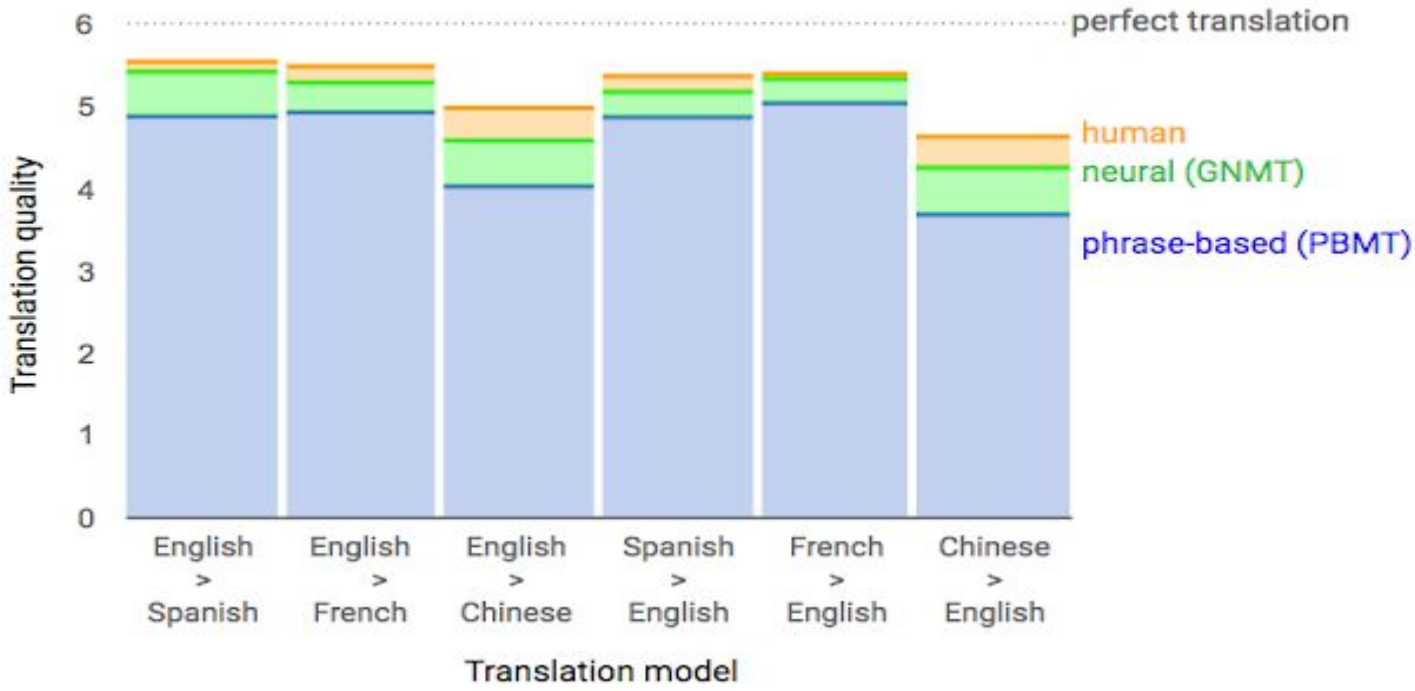
If you want to build a ship, don’t drum up people together to collect wood and don't assign them tasks and work, but rather teach them to long for the endless immensity of the sea.

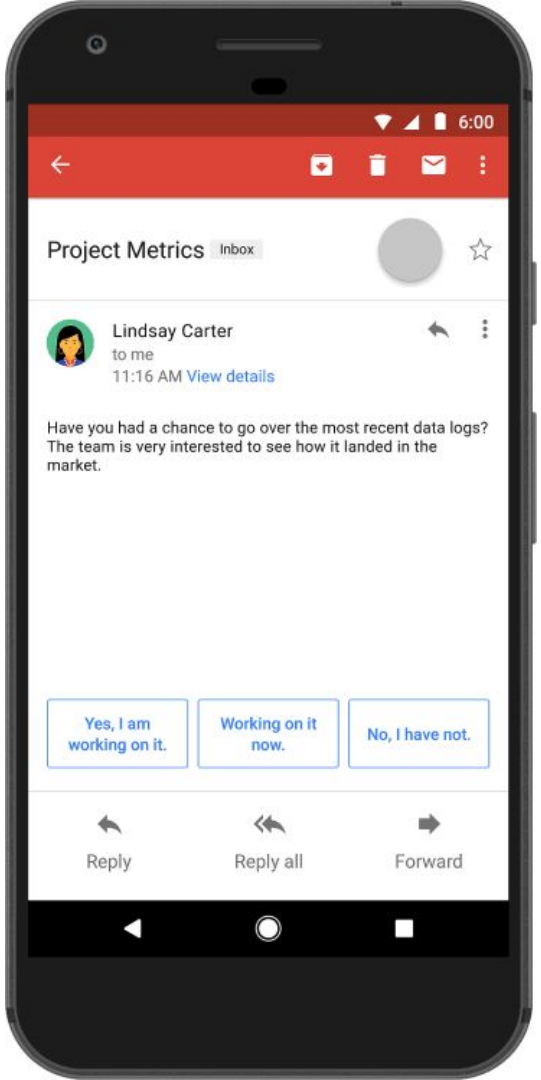
180/5000

如果要建造一艘船，不要一起鼓勵人們收集木材，不要分配任務和工作，而應該教他們漫長的海洋無限遠。

Suggest an edit

Rúguǒ yào jiànzào yī sōu chuán, bùyào yīqǐ gǔlì rénmen shōují mùcái, bùyào fēnpèi rènwù hé gōngzuò, ér yīnggāi jiào tāmen màncháng dì hǎiyáng wúxiàn yuǎn.


perfect translation
human
neural (GNMT)
phrase-based (PBMT)
Translation quality
6
5
4
3
2
1
0
English > Spanish
English > French
English > Chinese
Spanish > English
French > English
Chinese > English
Translation model


6:00
Project Metrics
Inbox
Lindsay Carter
to me
11:16 AM View details
Have you had a chance to go over the most recent data logs? The team is very interested to see how it landed in the market.
Yes, I am working on it.
Working on it now.
No, I have not.
Reply
Reply all
Forward


MACHINE LEARNING
MACHINE LEARNING EVERYWHERE!
memegenerator.net

This is cool but how we can develop such applications?

Why do we don't study Machine Learning ?

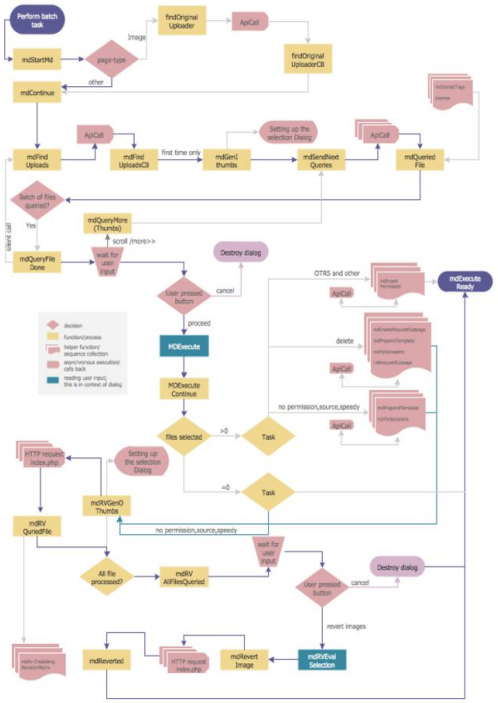
- Excuse 1: **Algebra** - Machine Learning is a lot about math and that's where a lot of people give up. Not just algebra, calculus is also a demon for us!

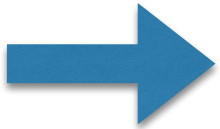
- Excuse 2: **Really tedious syllabus** - A proper machine learning track can take three years; ranging from math and programming to specific applications and tools. A standard data science specialization takes almost three years. You maybe don't want to do college again!

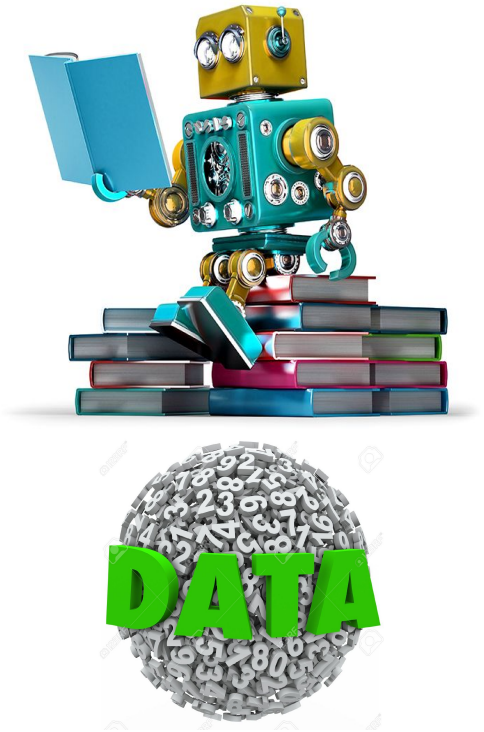
- Excuse 3: **Openness to newcomer** - Machine Learning has been traditionally thought as a field demanding excellent command over math and code. This is just a small rumor.

Linear algebra waiting for you to start learning ML

Rule based programming VS Data driven learning



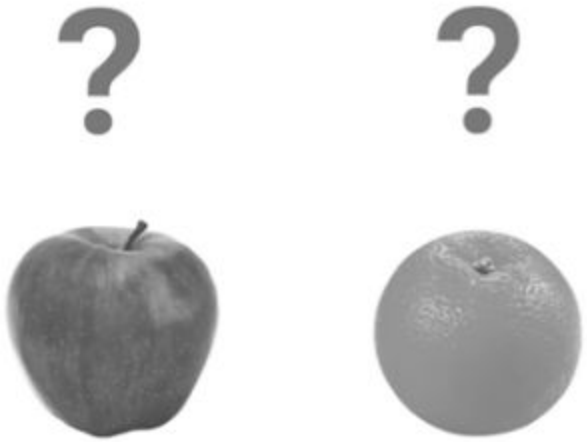




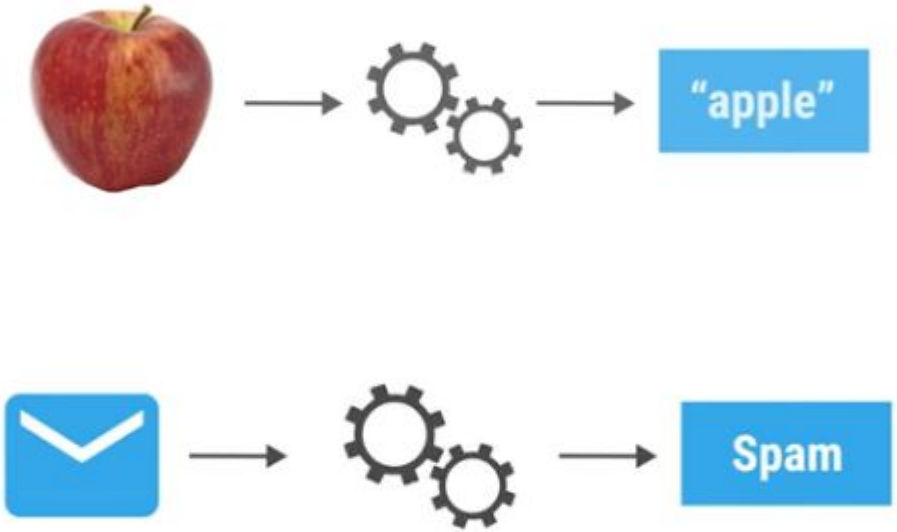
Machine learning is learning from example and experience.

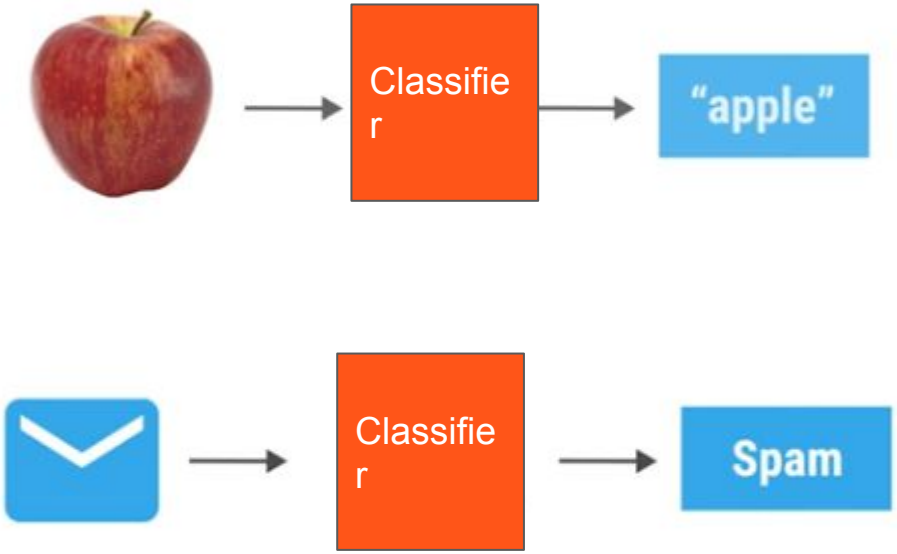
-Josh Gordon


“apple”



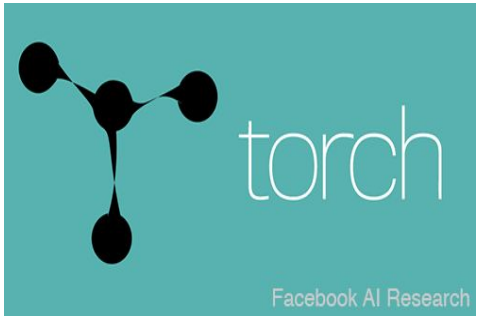
```
def detect_colors(image):
    # lots of code

def detect_edges(image):
    # lots of code

def analyze_shapes(image):
    # lots of code

def guess_texture(image):
    # lots of code

def define_fruit():
    # lots of code

def handle_probability():
    # lots of code
```


"apple"
Spam


Classifie
r
"apple"
Classifie
r
Spam


Collect Training Data
Train Classifier
Make Predictions

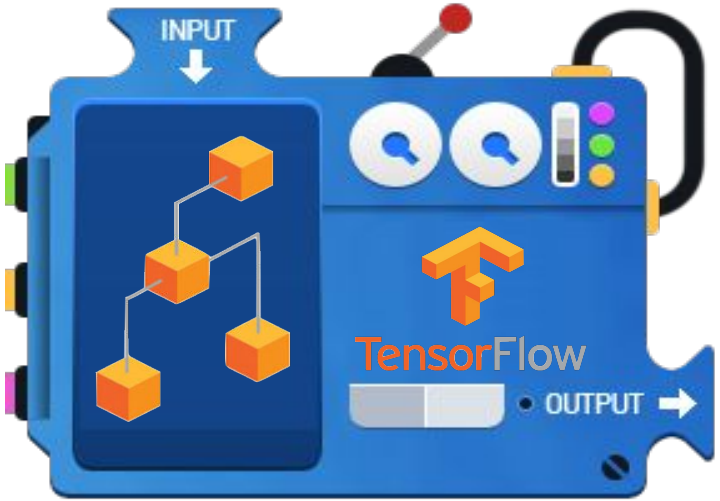
Machine Learning Frameworks



- TensorFlow™ is an open source library for numerical computation using data flow graphs.
- Python! (It's just front end actually)

TensorFlow Mechanics

2 feed data and run graph (operation)
sess.run (op)



1 Build graph using TensorFlow operations

3 update variables in the graph (and return values)

WWW.MATHWAREHOUSE.COM

Stuff except the real part !

- Extracting data or in some cases, **useful data** from a source.

E.g. Extracting the address of every person from a **leaked Aadhar database**

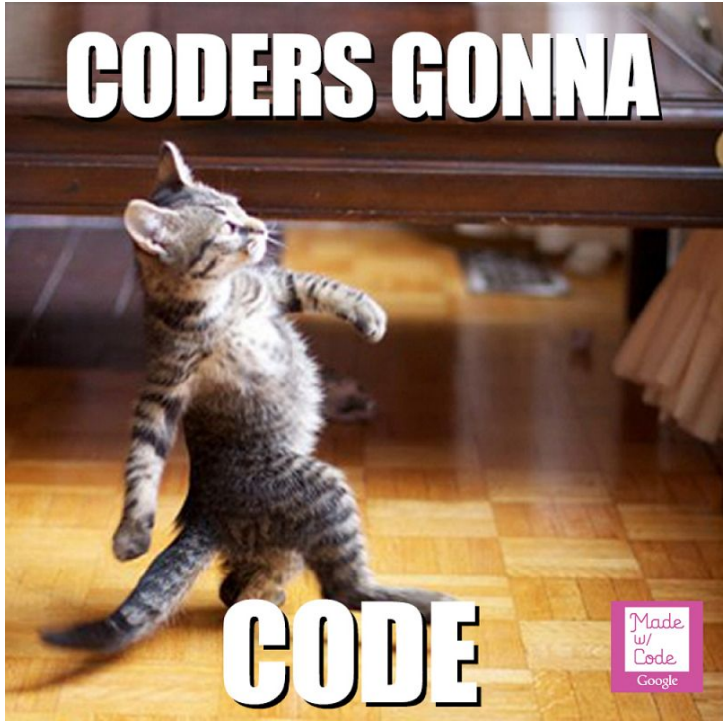
- Visualizing the data in form of graphs or charts

E.g. Drawing a histogram to prove young adults live mostly nearby a party place

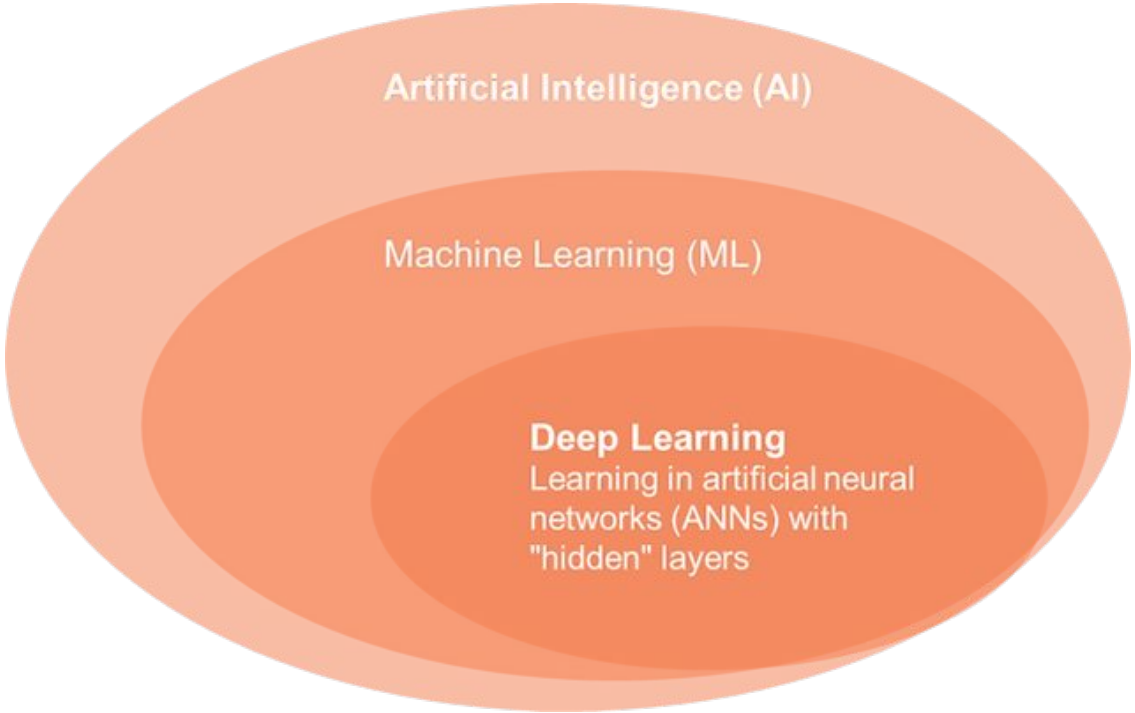
- Manipulating the data to achieve desired results

E.g. Demanding the Corporation to build a party place for drawing more income from young adults

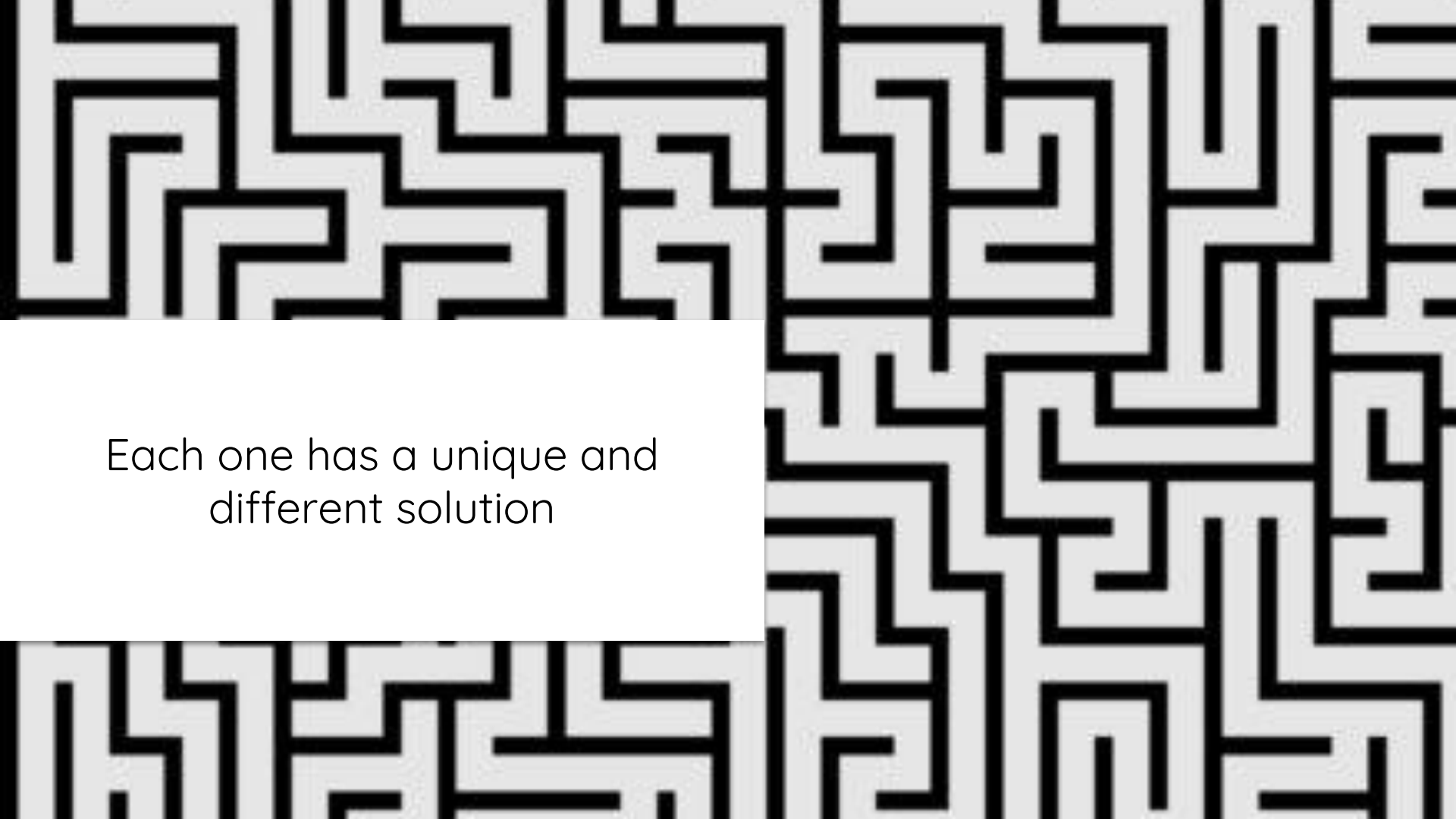
Give some space because...



Artificial Intelligence, Machine Learning and Deep Learning




Machine Learning is a Maze


Each one has a unique and
different solution

Machine Learning in Python

- Raw Data collection
  - BeautifulSoup library
- Data Preprocessing and Cleanup
  - Pandas library
- Data Visualization
  - Matplotlib and Seaborn library
- ML Modeling
  - Tensorflow
- Deployment
  - Tensorflow Serving

What is (supervised) machine learning ?

ML system learn

how to combine input

to produce useful predictions

on never-before-seen data

Terminology: Labels

- **Label** is the true thing we're predicting: *y*
  - The *y* variable in basic linear regression
  - The label could be the future price of wheat, the kind of animal shown in a picture, the meaning of an audio clip, or just about anything.

Terminology: Features

- A **feature** is an input variable—the x variable in simple linear regression.

$$x_1, x_2, \ldots x_N$$

  - The *y* variable in basic linear regression
  - The label could be the future price of wheat, the kind of animal shown in a picture, the meaning of an audio clip, or just about anything.

Terminology: Features

- In the spam detector example, the features could include the following:
  - words in the email text
  - sender's address
  - time of day the email was sent
  - email contains the phrase "one weird trick."

Terminology: Example, Labeled example and unlabeled data

- Example is a particular instance of data, *x*
- Labeled example, has {features, label} : (x, y)
  - Used to train the model
  - In our spam detector example, the labeled examples would be individual emails that users have explicitly marked as "spam" or "not spam."
- Unlabeled example has {features, ?} : (x, ?)
  - Used for making predictions on new data

Labeled Example

housingMedianAge (feature)	totalRooms (feature)	totalBedrooms (feature)	medianHouseValue (label)
15	5612	1283	66900
19	7650	1901	80100
17	720	174	85700
14	1501	337	73400
20	1454	326	65500

Unlabeled Example

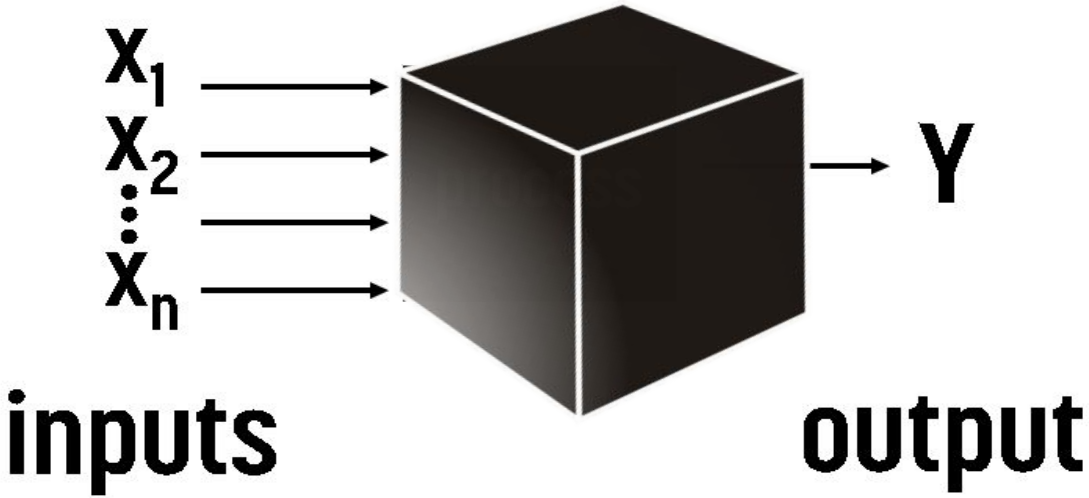
housingMedianAge (feature)	totalRooms (feature)	totalBedrooms (feature)
42	1686	361
34	1226	180
33	1077	271

Once we've trained our model with labeled examples, we use that model to predict the label on unlabeled examples. In the spam detector, unlabeled examples are new emails that humans haven't yet labeled.

Models

- A model defines the relationship between features and label.
  - For example, a spam detection model might associate certain features strongly with "spam".
- Training : Creating or learning the model
  - That is, you show the model labeled examples and enable the model to gradually learn the relationships between features and label.
- Inference: Applying the trained model to unlabeled examples.
  - That is, you use the trained model to make useful predictions (y'). For example, during inference, you can predict medianHouseValue for new unlabeled examples or spam or not spam in spam detection

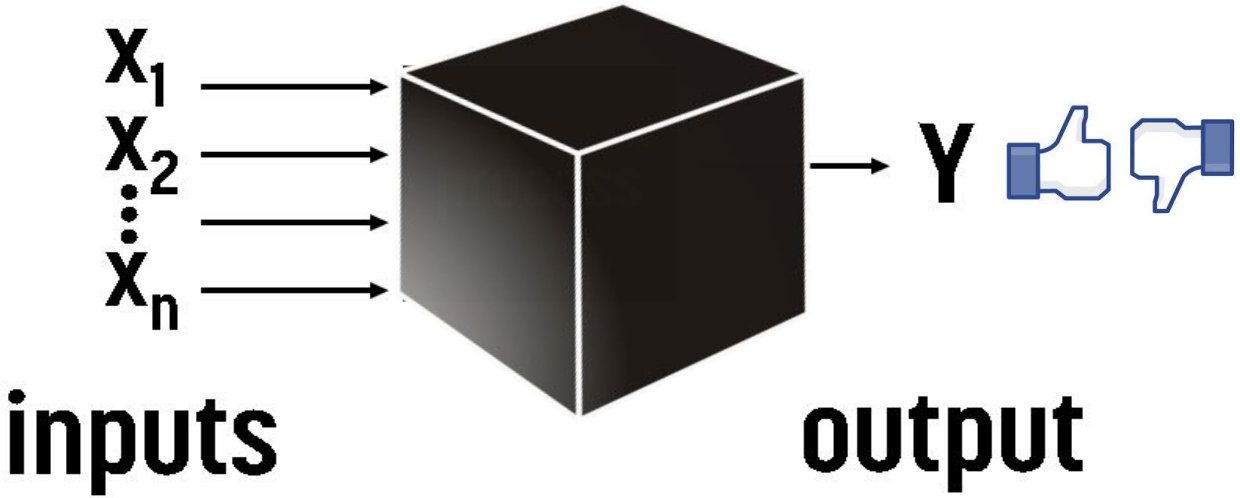
Regression



Regression

- Predicts continuous values. For example,
  - What is the value of a house in California?
  - What is the probability that a user will click on this ad?

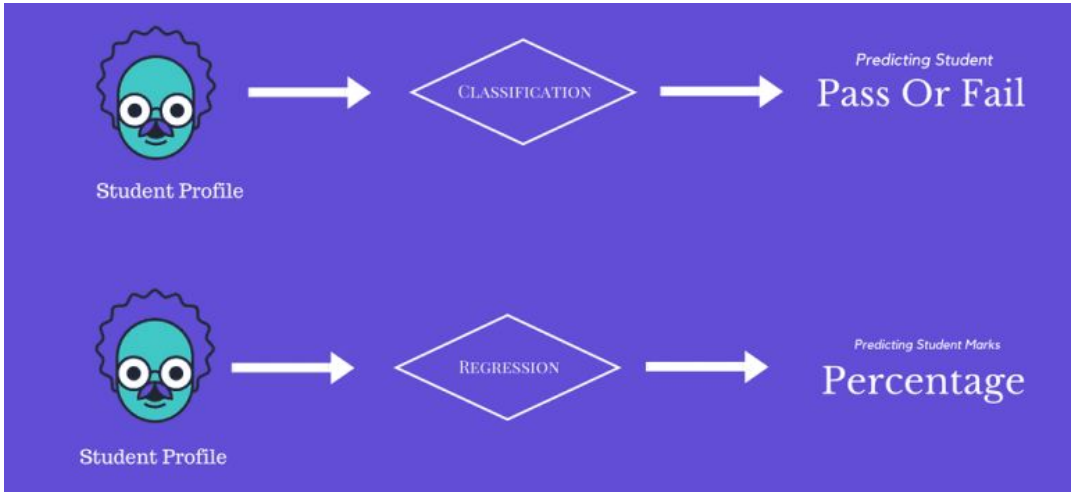
Classification



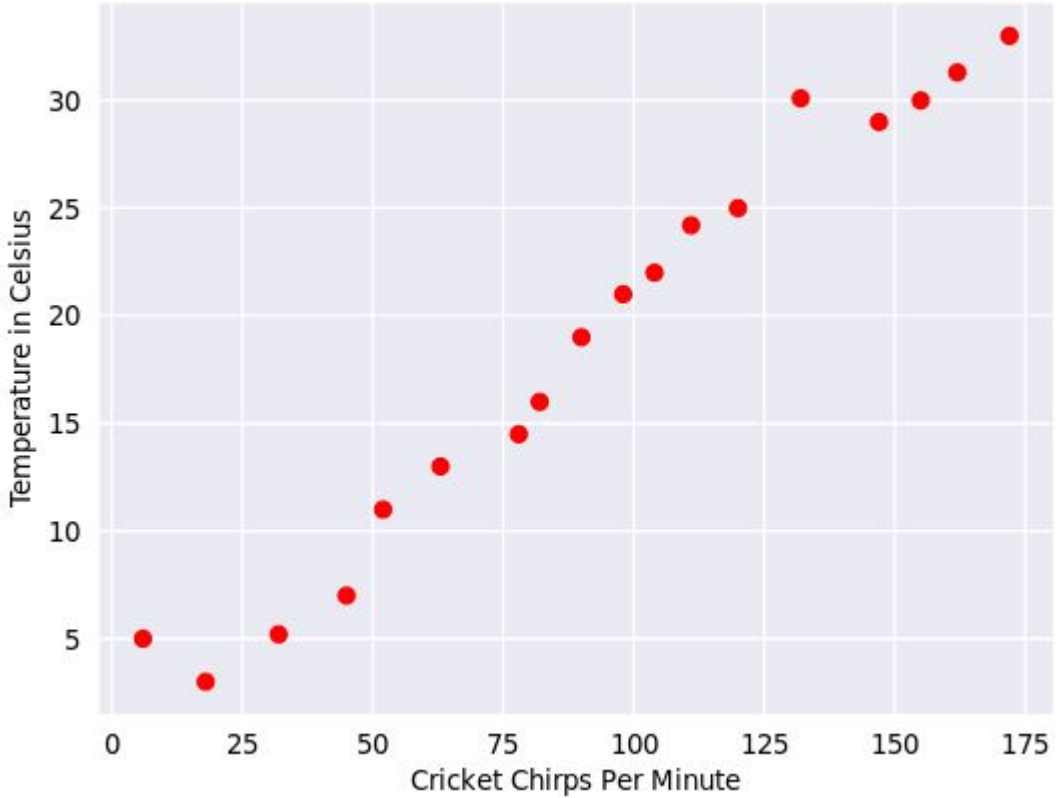
Classification

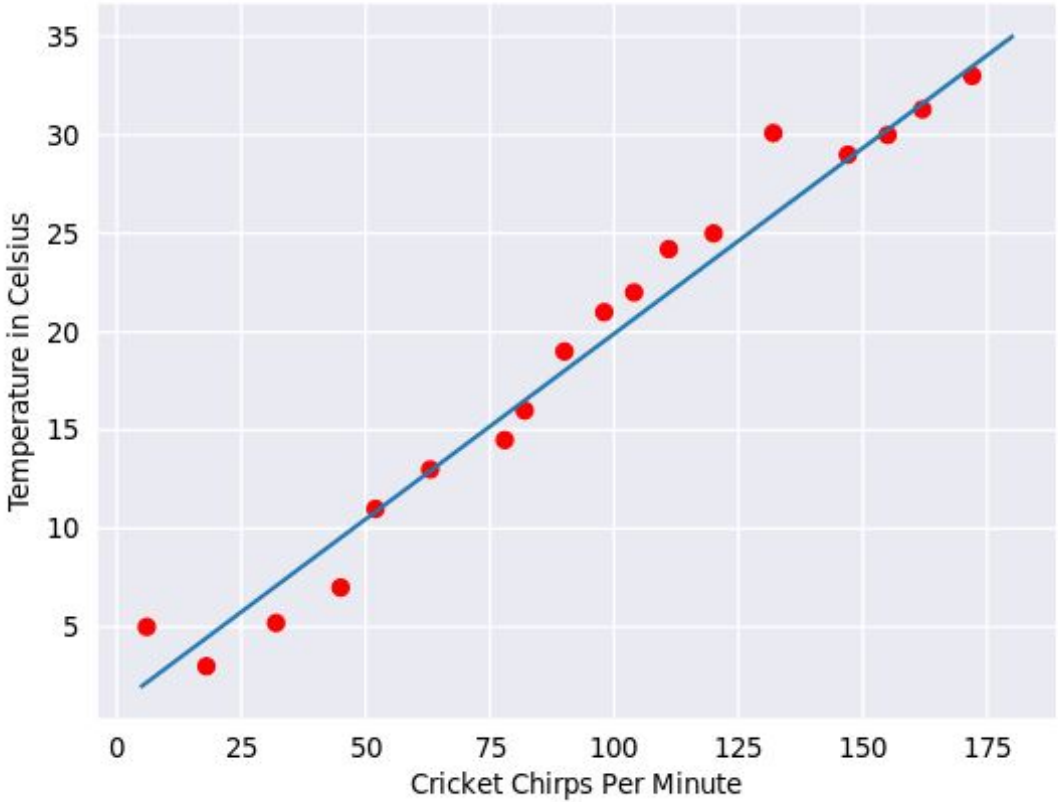
- Predicts discrete value. For example,
  - Is a given email message spam or not spam?
  - Is this an image of a dog, a cat, or a hamster?

Classification vs Regression



Linear Regression


Temperature in Celsius
30
25
20
15
10
5
0
25
50
75
100
125
150
175
Cricket Chirps Per Minute


Temperature in Celsius
35
30
25
20
15
10
5
0
25
50
75
100
125
150
175
Cricket Chirps Per Minute

Linear Regression

$$y = mx + b$$

- y is the temperature in Celsius—the value we're trying to predict.
- m is the slope of the line.
- x is the number of chirps per minute—the value of our input feature.
- b is the y-intercept.

By convention in machine learning,

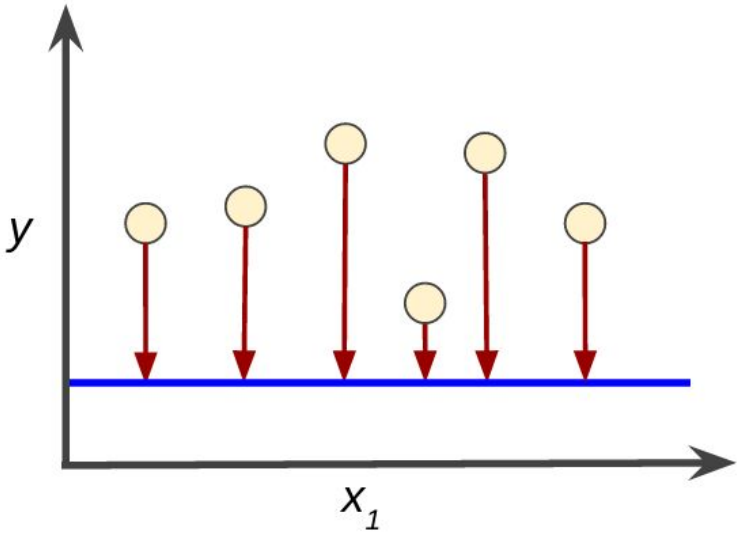
$$y' = b + w_1 x_1$$

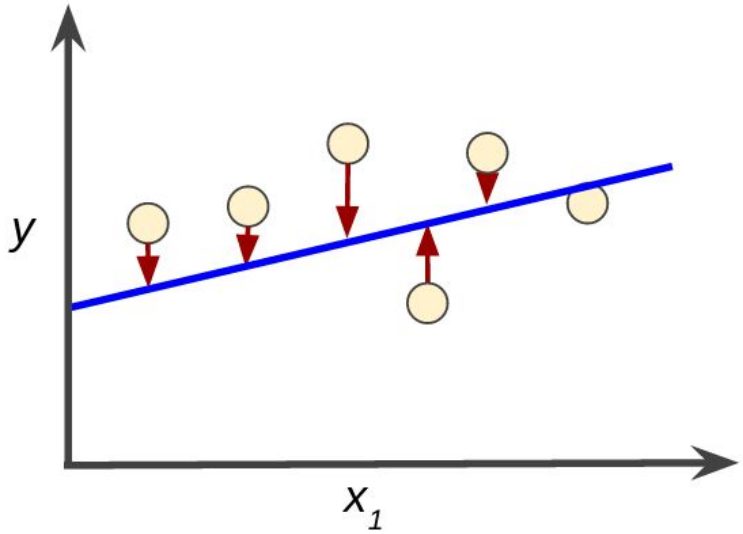
- y' is the predicted label (a desired output).
- b is the bias (the y-intercept), sometimes referred to as w0.
- w_1 is the weight of feature 1. Weight is the same concept as the "slope" m in the traditional equation of a line.
- x_1 is a feature (a known input).

- For more sophisticated models might reply on multiple features

$$y' = b + w_1 x_1 + w_2 x_2 + w_3 x_3$$

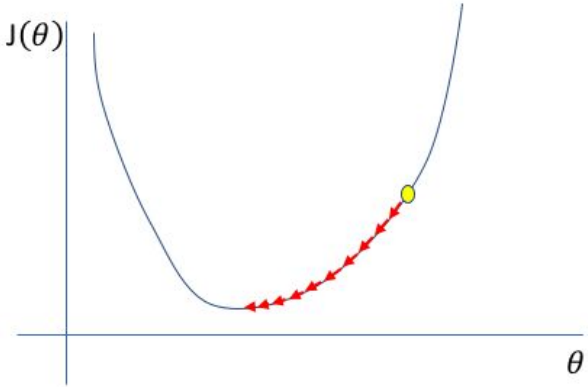
Loss





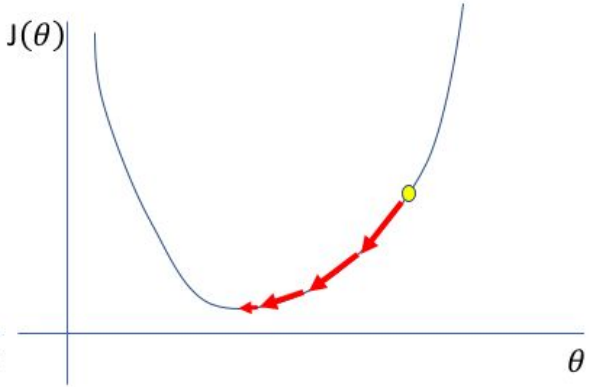
Learning Rate

Too low



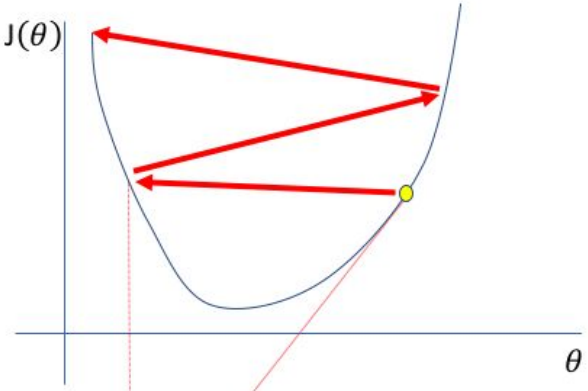
A small learning rate requires many updates before reaching the minimum point

Just right



The optimal learning rate swiftly reaches the minimum point

Too high



Too large of a learning rate causes drastic updates which lead to divergent behaviors

Squared Loss

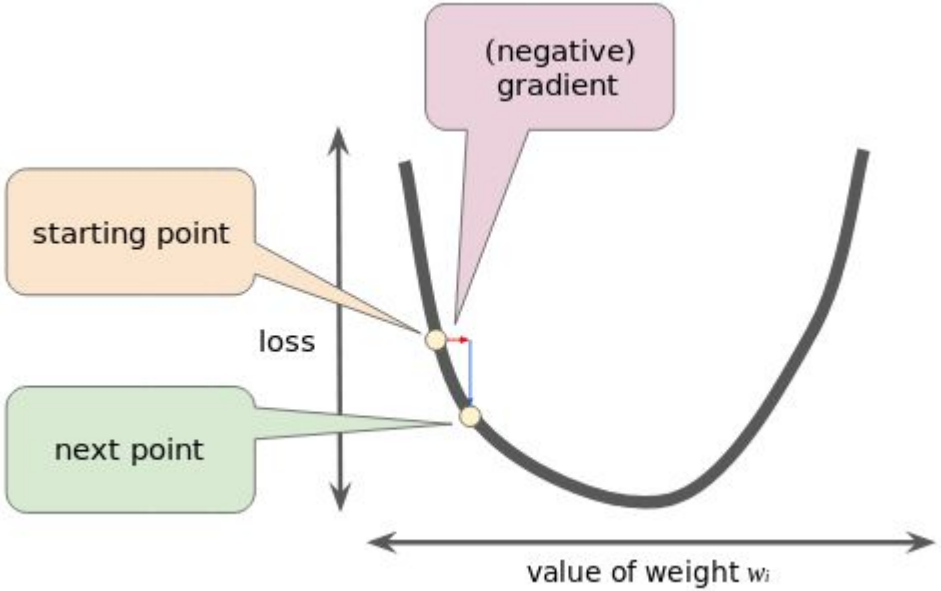
= the square of the difference between the label and the prediction
= (observation - prediction(x))^2
= (y - y')^2

$$MSE = \frac{1}{N} \sum_{(x,y) \in D} (y - prediction(x))^2$$

where:

- (x, y) is an example in which
  - x is the set of features (for example, chirps/minute, age, gender) that the model uses to make predictions.
  - y is the example's label (for example, temperature).
- $prediction(x)$ is a function of the weights and bias in combination with the set of features x.
- D is a data set containing many labeled examples, which are (x, y) pairs.
- N is the number of examples in D.

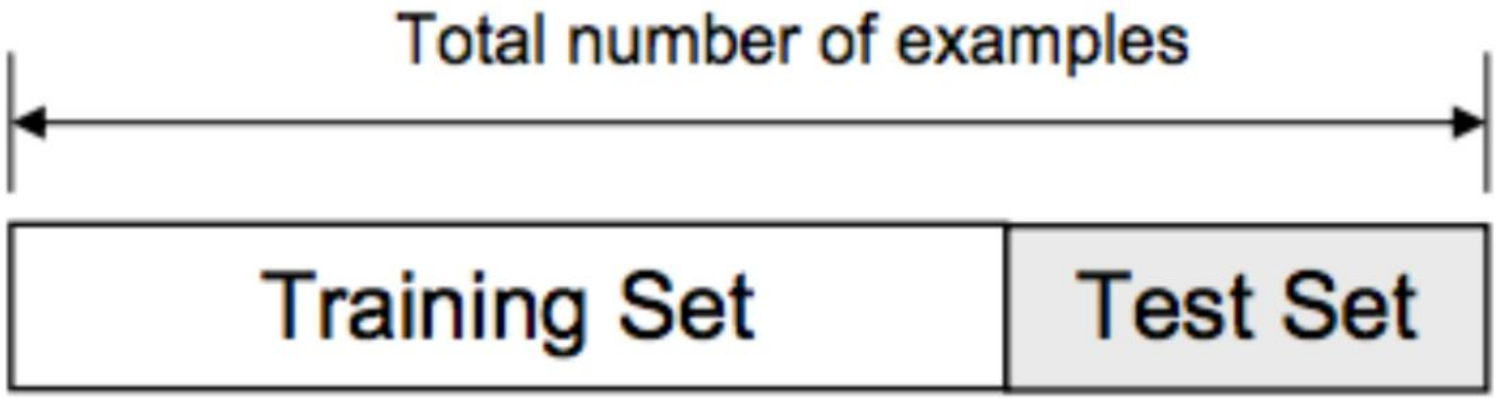
Reducing the loss



Reducing the loss

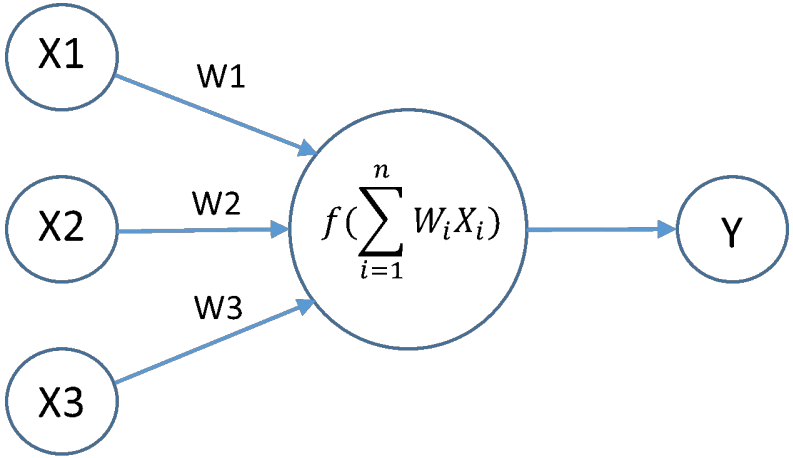
Exercise: http://tiny.cc/mlccloss

Training and Test Sets: Splitting Data

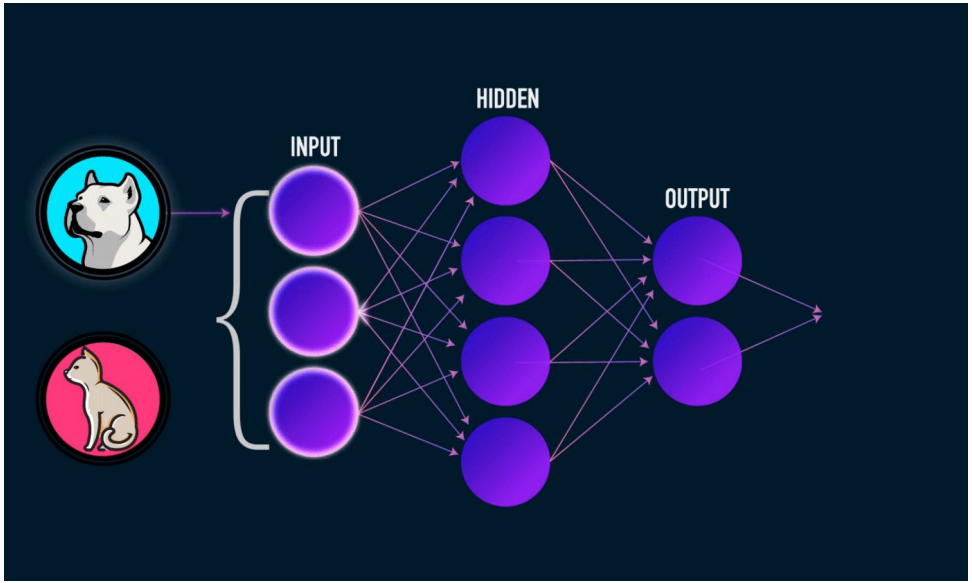


Time to implement Linear Regression

Neural Networks



Neural Networks



You can be this...

Need help? Call 100

- Shoot us a mail
- Ask during weekly hangout
- Create issue on Tensorflow Github repo
- Machine Learning subreddit
- Tensorflow channel on Youtube

What's next

- Machine Learning Courses
  - Shri Shri Shri Andrew Ng's machine learning course- Say no more! https://www.coursera.org/learn/machine-learning
  - Deep Learning: https://www.udacity.com/course/deep-learning-nanodegree-foundation--nd101
  - Stanford's Intro to TensorFlow Course: https://web.stanford.edu/class/cs20si/
  - MIT's Intro to Deep Learning Course: introtodeeplearning.com

What's next

- Tensorflow
  - Visit the TensorFlow homepage to get started! https://www.tensorflow.org/
  - Check out these talks from the TensorFlow Developer Summit: https://youtu.be/RUougpQ6cMo

What's next

- Google Cloud ML
  - ML Engine - https://cloud.google.com/ml-engine/
  - Machine Learning APIs (Image recognition, voice recognition, translation) - https://cloud.google.com/products/machine-learning/

NO QUESTIONS PLEASE 👽

May the math be with you !