Learning Machine Learning with Kaggle Challenges

(1) Introduction

Qiyang Hu
IDRE

About this series

- Not a comprehensive course
    - No derivation of theories
    - Not covering every ML field
    - Not a complete guide for library (sklearn, tensorflow)
    - Not pursuing an award-level Kaggle ranking
- Instead, we will
    - Give descriptive review (avoid math!)
    - Touch selected topics
    - Combine with slides and demos
- Expectations:
    - For beginners: get a general idea, lower the starting barrier
    - For experts: overview the knowledge structure, seek the collaborations

Syllabus of the series

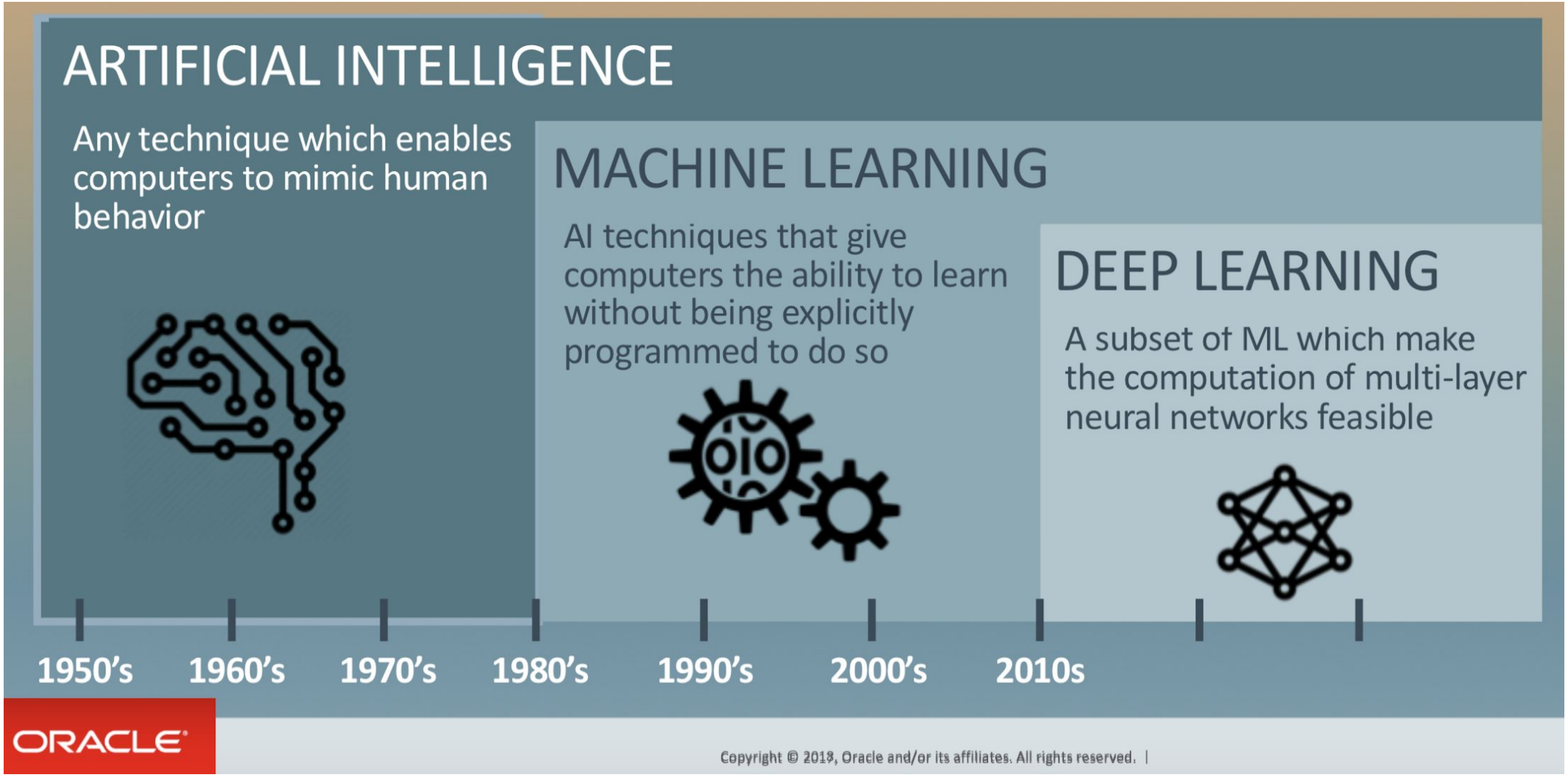
1. Introduction to Machine Learning (Oct 24)
2. Classification (Oct 31)
    - General techniques and Scikit Learn
3. Deep learning (1) (Nov 7)
    - General Deep learning and Tensorflow 2.0
    - Convolutional Neural Networks
4. Deep learning (2) (Nov 14)
    - Data augmentation
    - Save/load models
    - Transfer learning
5. Deep learning (3) RNNs (*TBD*)
6. Reinforcement Learning — PPO (*TBD*)

The Series's Github Repo

https://github.com/huqy/idre_learning_machine_learning

Learning Resources

- Google Machine Learning Crash Course
- Andrew Ng’s Machine learning
  - Coursera or Youtube
- Aurélien Géron’s Book:
  - “Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems” 2nd Edition
- Coding Tensorflow:
  - Youtube and Udacity
- Prakashan’s Machine Learning/Deep Learning Session
  - Notes on Google Sites



ARTIFICIAL INTELLIGENCE

Any technique which enables computers to mimic human behavior

MACHINE LEARNING

AI techniques that give computers the ability to learn without being explicitly programmed to do so

DEEP LEARNING

A subset of ML which make the computation of multi-layer neural networks feasible

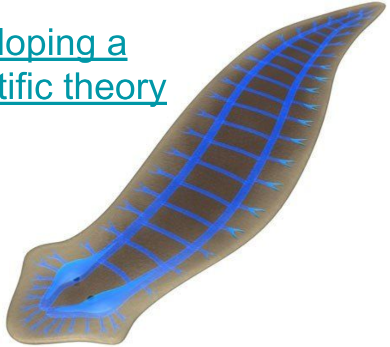
Some Amazing Machine Learning Achievements

AlphaGo ZERO

Lip Read

CycleGAN

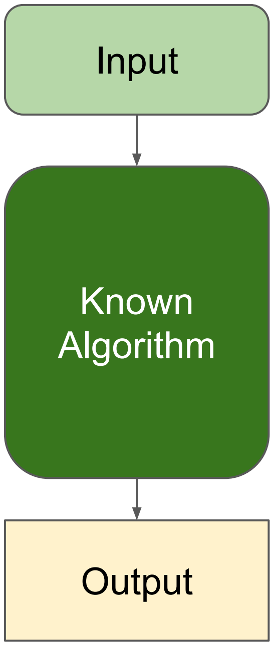
[Developing a scientific theory]



[Passing 8th grade Sci Exam]

What is Machine Learning?

Traditional Programming

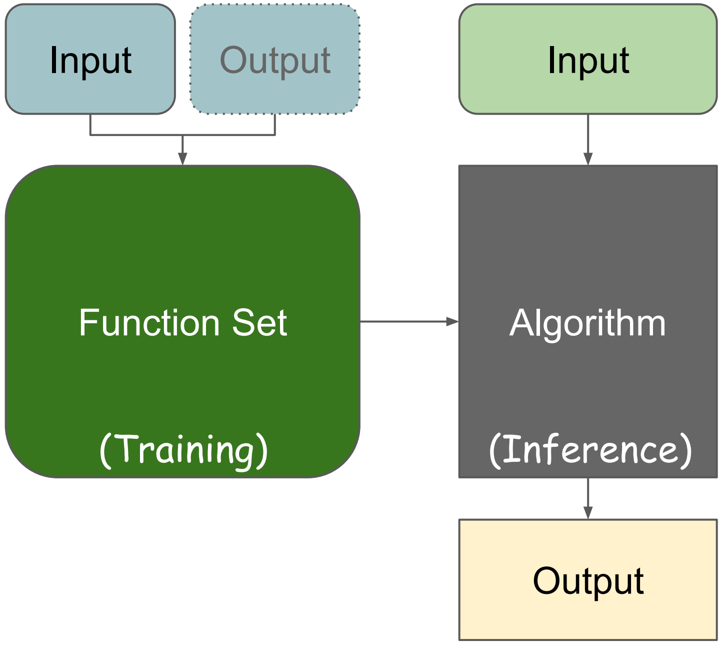


Input

Known Algorithm

Output

Machine Learning



Input

Output

Function Set

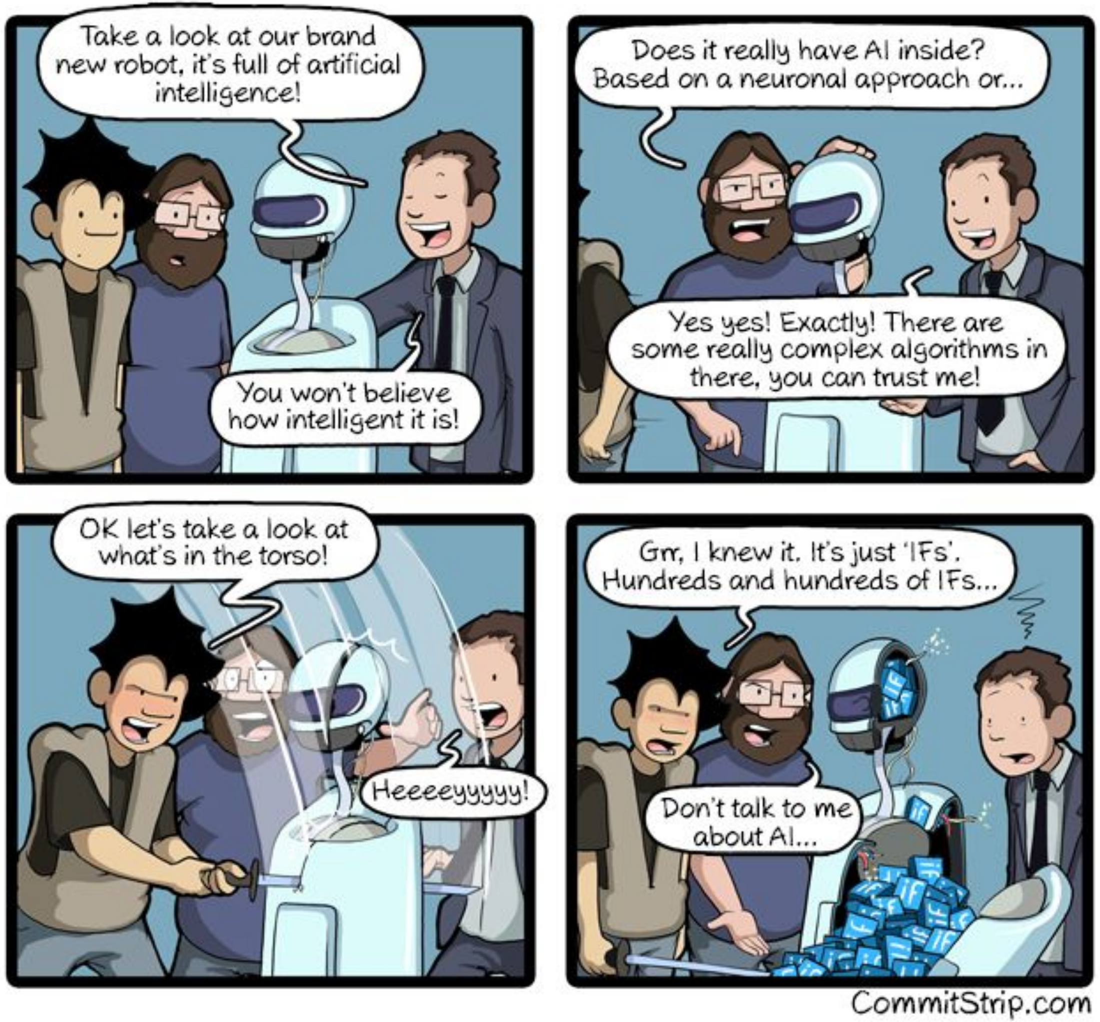
(Training)

Input

Algorithm

(Inference)

Output


Take a look at our brand new robot, it's full of artificial intelligence!
You won't believe how intelligent it is!
Does it really have AI inside? Based on a neuronal approach or...
Yes yes! Exactly! There are some really complex algorithms in there, you can trust me!
OK let's take a look at what's in the torso!
Heeeeyyyyy!
Grr, I knew it. It's just 'IFs'. Hundreds and hundreds of IFs...
Don't talk to me about AI...
IF
CommitStrip.com

Hard-coded AI vs. Deep Learning AI

Key Terminology in Machine Learning

- Datasets:
  - Label: a desired output (e.g. house price)
  - Feature: a known input (e.g. address, condition, household income, etc)

- Model: relationship between input & output
  - Parameter: to be learned from data, e.g. weight, coefficients
    - Weight: a coefficient for a feature in linear model
    - Bias: an intercept or offset from an origin
  - Hyperparameter: often set by heuristics, e.g. learning rate, depth of trees, batch, epoch.
  - Batch: a subset from the division of training datasets
  - Epoch: all data in training sets has had an opportunity to update the internal model parameters

Complete Glossary

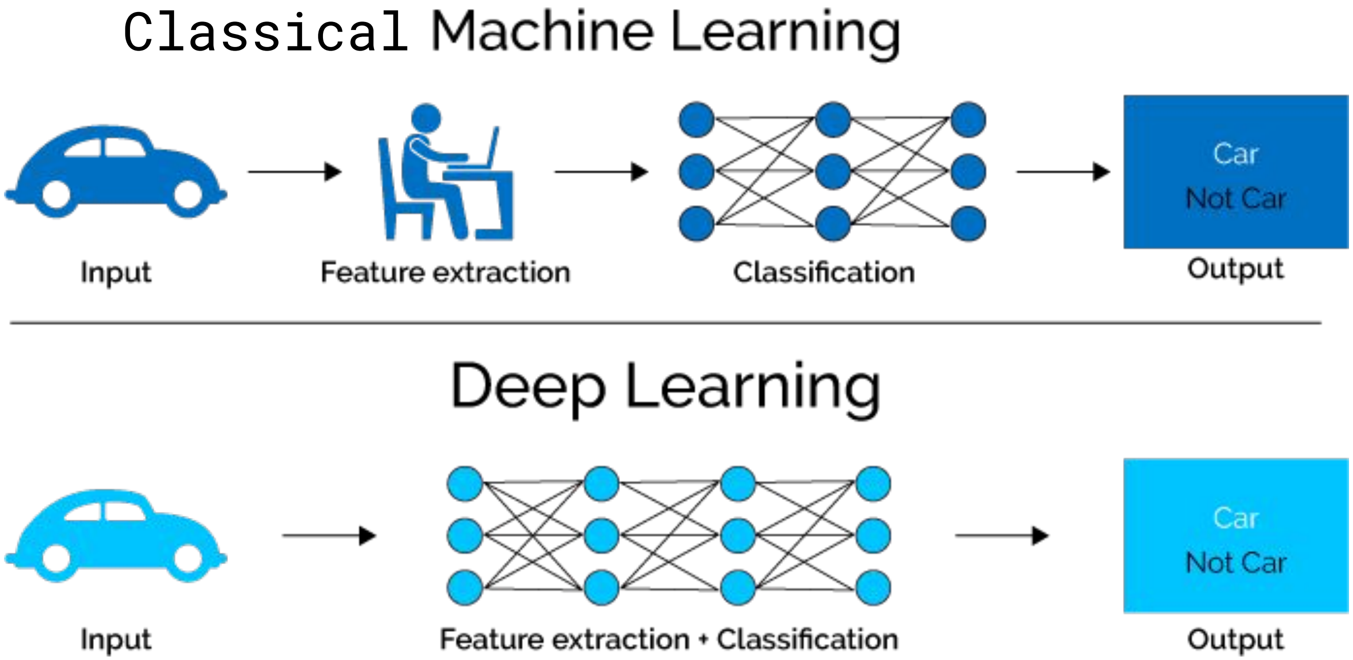
A lot of “Learning”s to learn

- Supervised Learning (data with labels)
  - Regression
  - Classification (SVM, Decision Tree, K-NN, **Deep Learning**)
- Unsupervised Learning (data without labels) (PCA, Clustering, Factor Analysis)
- Semi-supervised Learning (data with partial labels)
- Reinforcement Learning (reward rules to get data) (PPO, Deep Q-learning)
- Inverse reinforcement learning (no rules & no labels)
- Transfer Learning (data with unrelated labels)

  (zero-shot learning, one-shot learning, few-shot learning, etc.)

  ⇒ Continuous learning
  ⇒ Meta Learning (MAML, LSTM)

Classical Machine Learning vs. Deep Learning



Source: https://www.xenonstack.com/blog/log-analytics-deep-machine-learning/

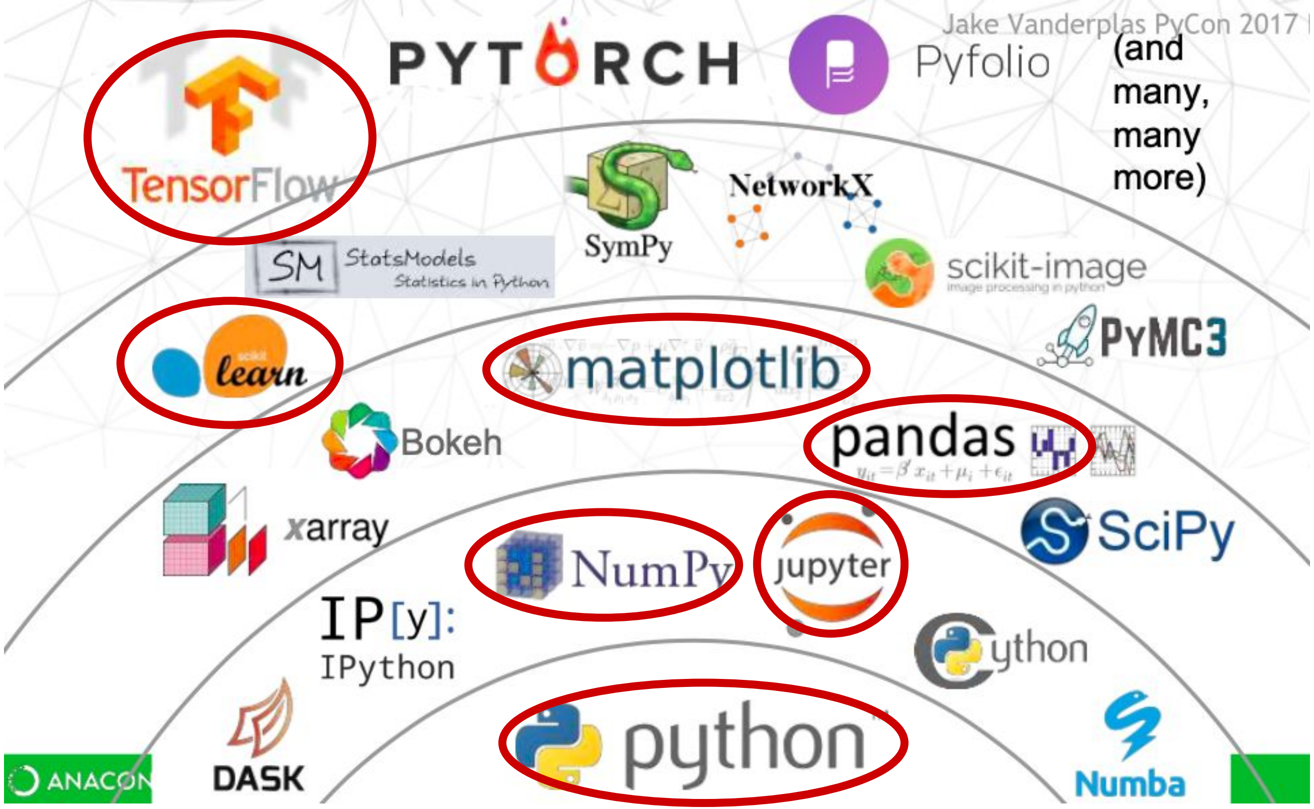
Machine Learning vs. Statistics

- Commons: same/interchangeable concepts & techniques:

Machine Learning	**Statistics**
Learning	Fitting
Supervised Learning	Regression/Classification
Unsupervised Learning	Clustering/Density Estimation

- Differences: source
  - Prediction vs. Explanation
  - Forward vs. Rearward Looking
  - Big vs. Small Data
  - Many vs. Few Variables

Python Scientific Ecosystem



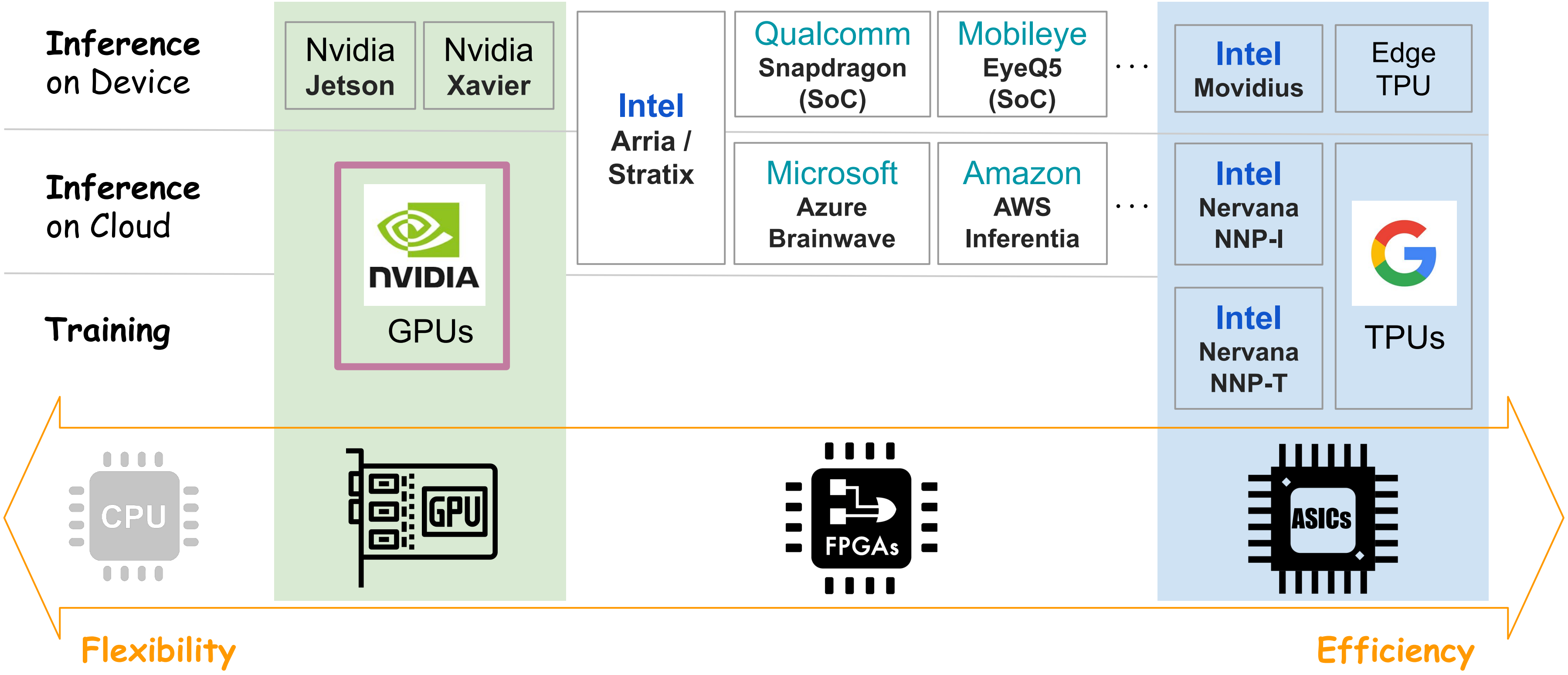
(and many, many more)

What is kaggle ?

- An online platform and community for data scientists and machine learner
    - 1,000,000+ registered users in 194 countries in 2017
    - Founded in 2010, acquired by Google in 2017
    - Hosts 19K+ of datasets and 200K+ code snippets
    - Offers a cloud-based workbench with computational resources
    - Famous for the competitions with high rewards (accessible to anyone)

- Kaggle competitions (active list)
    - Featured: full-scale, commercially-purposed, offering high prizes (e.g. from Lyft, Zillow…)
    - Research: experimental, usually no prizes (e.g. from Google, wikipedia, …)
    - Get-started: tutorialized, easiest (e.g. Titanic)
    - Playground: “for fun” (e.g. Dogs-vs-Cats)
    - Other types: for recruitment, annual...

Machine Learning hardwares (AI Chips)



Inference on Device

Inference on Cloud

Training

Nvidia Jetson

Nvidia Xavier

NVIDIA GPUs

Intel Arria / Stratix

Qualcomm Snapdragon (SoC)

Mobileye EyeQ5 (SoC)

. . .

Microsoft Azure Brainwave

Amazon AWS Inferentia

. . .

Intel Movidius

Edge TPU

Intel Nervana NNP-I

Intel Nervana NNP-T

TPUs

Flexibility

Efficiency

Free GPU Computation Resources

- Google Colaboratory
    - A free Jupyter notebook env that requires no setup and runs entirely in the cloud.
    - Google Drive -> New -> More -> Google Colaboratory

- Kaggle
    - Kaggle.com -> Log in -> Kernel -> New Kernel

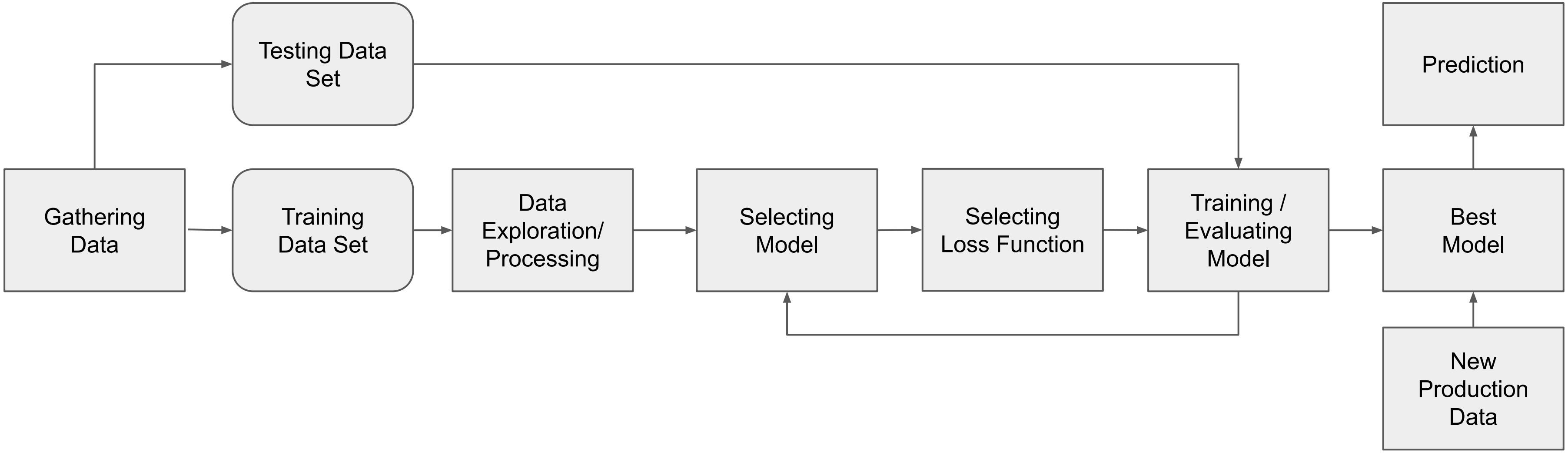
- Hoffman2
    - Download h2jupynb
    - chmod +x h2jupynb
    - ./h2jupynb -u [usrname] -t 8 -m 4 -s 8 -v anaconda3 -g yes
        - Info about GPU resource on H2

	Colab	Kaggle	Hoffman2
CPU Type	Intel Xeon 2.30GHz	Intel Xeon 2.30GHz	Intel Xeon 2.80GHz
Slots/Threads available	1 core / 2 threads	1 core / 2 threads	8 cores / no hyper-threads
RAM available	12 GB	18 GB	24 GB
Disk available	311 GB	626 GB	1 TB
GPU Type	Tesla T4 (2018)	Tesla P100 (2018)	Tesla P4 (2016)
GPU SP Floating-Point Perf	8.1 TFLOPs	10.6 TFLOPs	5.5 TFLOPs
GPU Memory	16 GB	16 GB	8 GB
Active Time Limit	8 hours	6 hours	24 hours

Before running the colab demos in this series

1. Register a Kaggle account
   a. Kaggle.com → "Register"
2. Create Kaggle API token and download json file
   a. Sign in → Your Profile → "My Account" → "Create New API Token"
3. Join the 2 competitions → "Join Competition"
   a. Titantic Challenge
   b. Dogs-vs-Cats Challenge
4. Get/run the colab files
   a. Git clone the github repo and copy to google drive
   b. Visit the github repo and open it directly (using chrome extension "Open in Colab")

Workflow for a machine learning project



Don’t forget to

- Sign in your info to the class
  - To get the email notifications

- Contact me for questions or discussions
  - huqy@idre.ucla.edu
  - Office: Math Sci #3330
  - Phone: 310-825-2011

- Fill out the survey for comments:
  - https://forms.gle/t3f8CztFQpeFFksy6