Learning Machine Learning with Kaggle Challenges

(1) Introduction

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IDRE

About this series

- Not a complete course
  - No comprehensive derivation of machine learning theories
  - Not covering every field of machine learning
  - Not a complete guide for library (sklear, tensorflow) usages
  - Not pursuing an award-level ranking for Kaggle Challenges
- On the contrary
  - Mostly giving descriptive review (avoid math!)
  - Touching several selected topics
  - Combining with slides and demos
- Expectations:
  - For beginners: get a general idea, flatten the steep learning curve
  - For experts: overview the knowledge structure, seek the collaborations

The series needs your feedback!

Survey link: https://forms.gle/4PcfPCapZGTpKWcK6

Syllabus of the series

1. Introduction to Machine Learning
2. Classification
   - General machine learning and Scikit Learn
3. Deep learning (1)
   - General Deep learning and Tensorflow 2.0
   - Convolutional Neural Networks (CNNs)
4. Deep learning (2)
   - Data augmentation
   - Save/load models
   - Transfer learning
5. Deep learning (3) RNNs (optional)
6. Reinforcement Learning (PPO) (optional)

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
  - 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

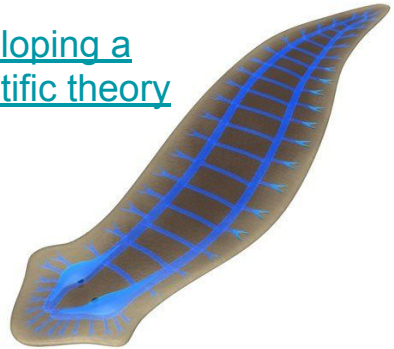
1950's 1960's 1970's 1980's 1990's 2000's 2010s

Some Amazing Machine Learning Achievements

AlphaGo

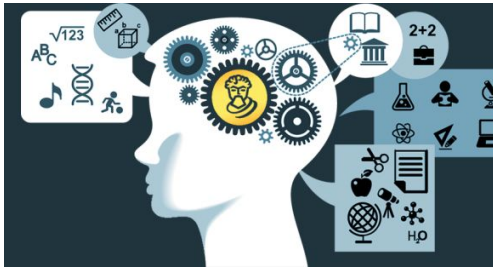
Lip Read

Developing a scientific theory

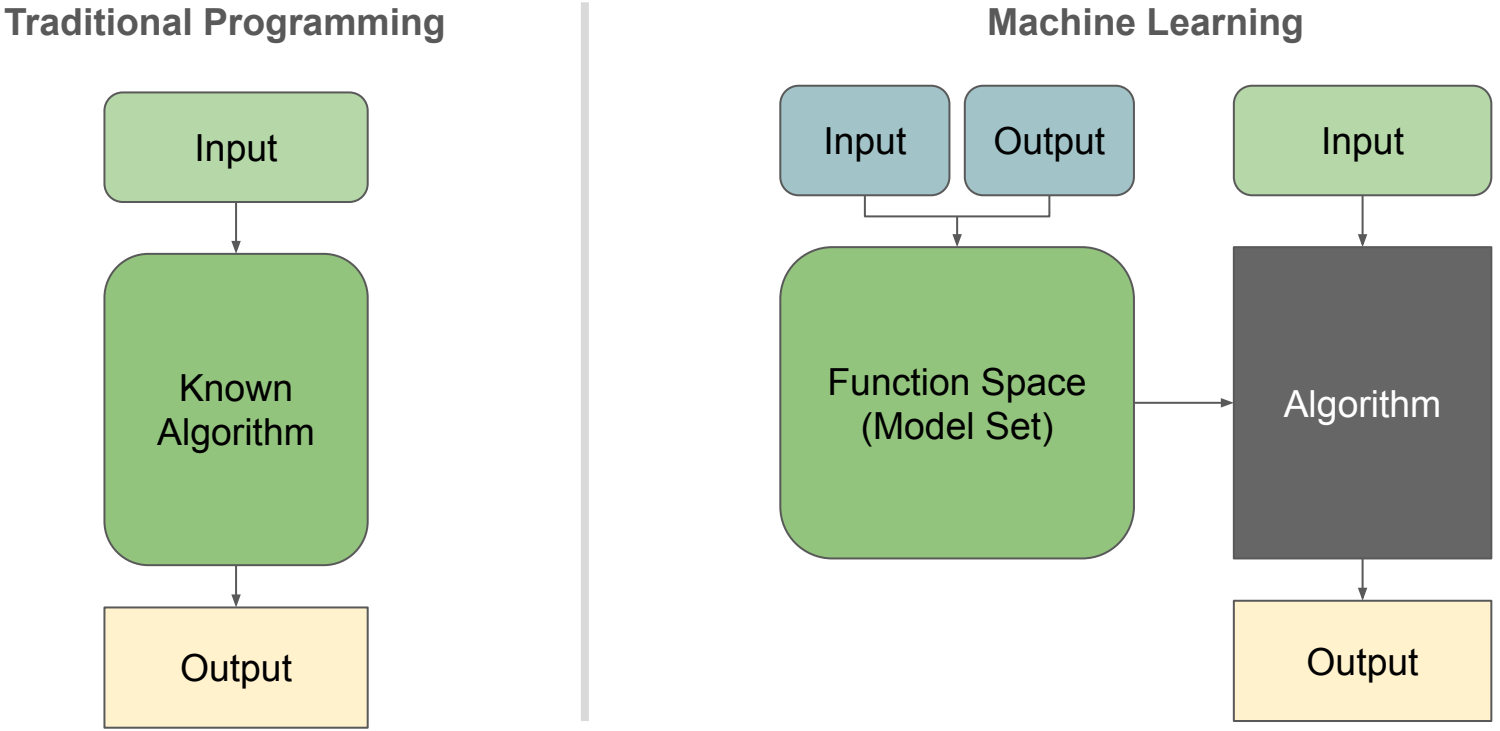


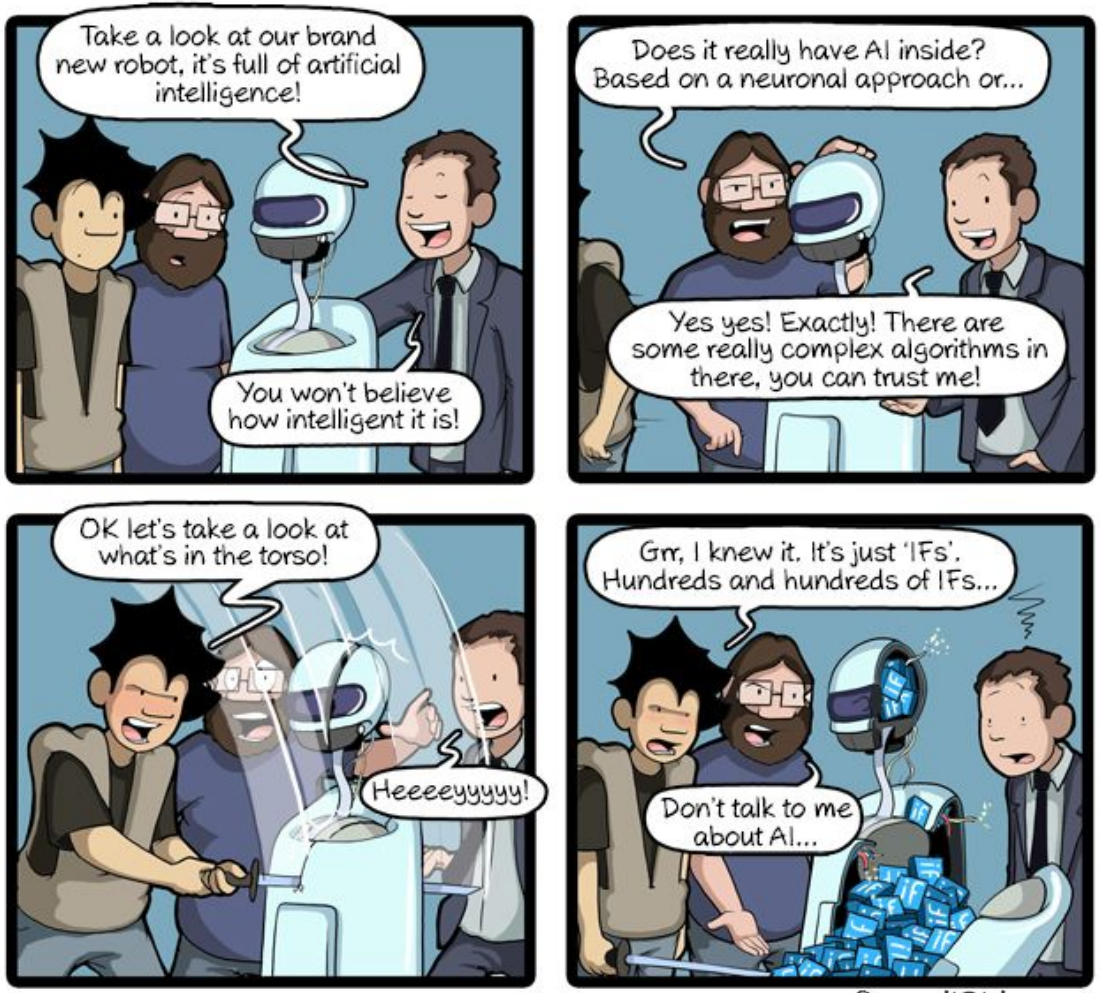
GAN

Passing 8th grade Sci Exam

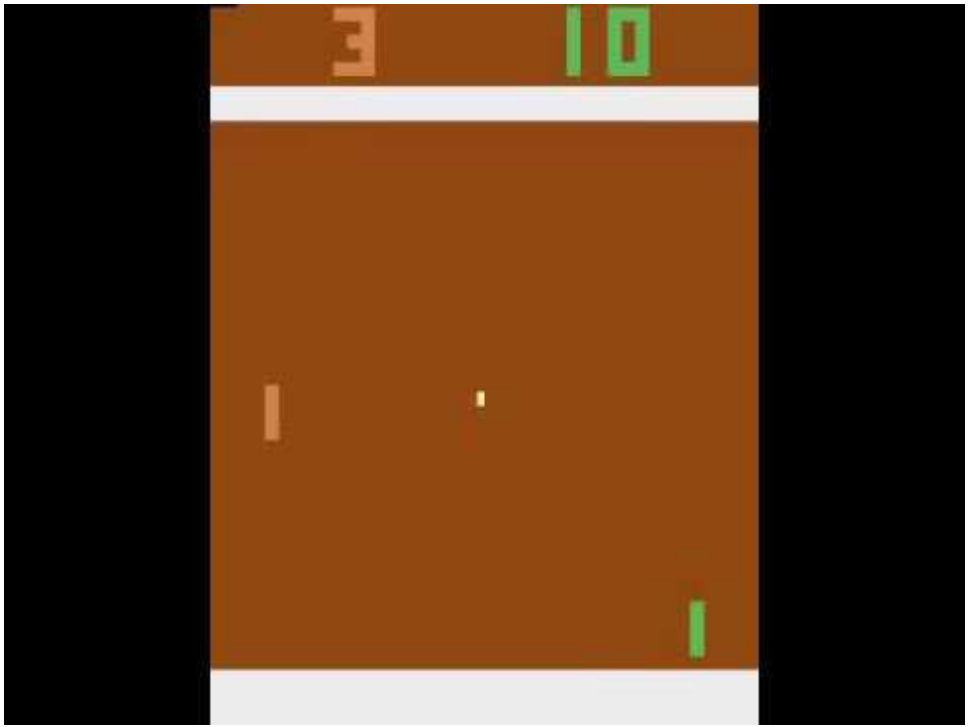


What is Machine Learning?




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...
CommitStrip.com

Hard-coded AI vs. Deep Learning AI



Key Terminology in Machine Learning

- Datasets:
  - Label: a desired output
  - Feature: a known input

- 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

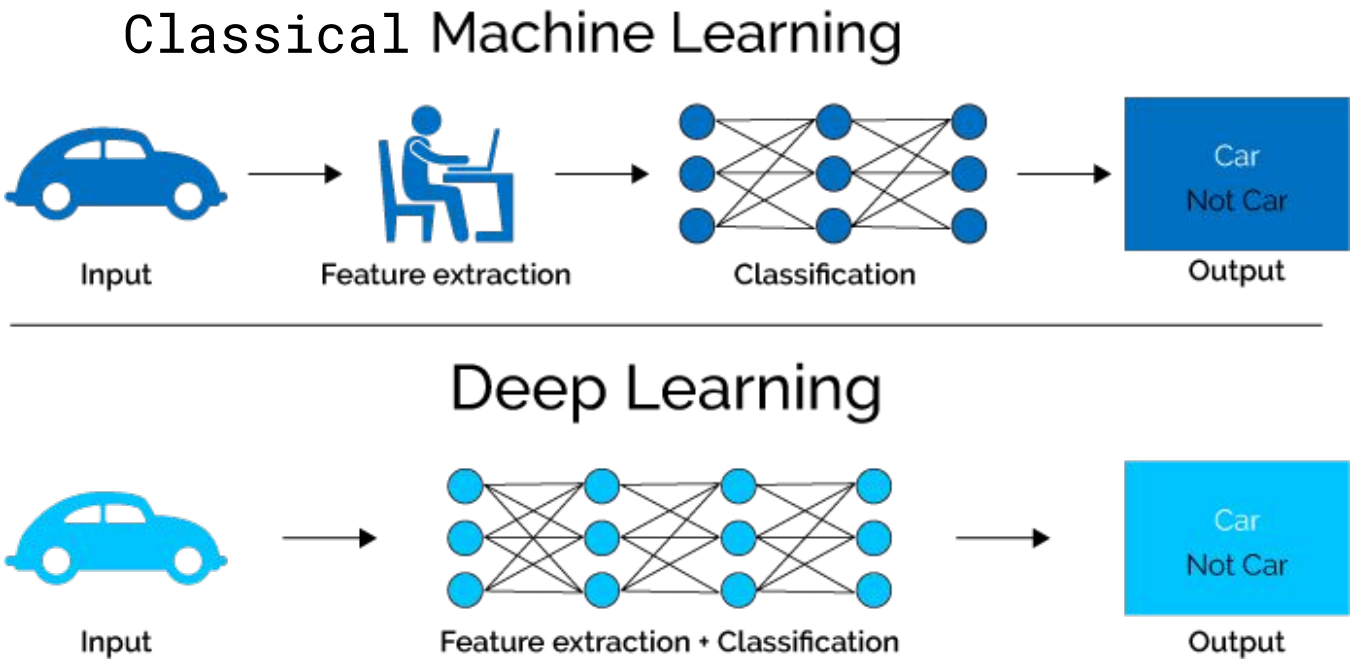
- Supervised Learning (data with labels)
  - Regression
  - Classification (SVM, Decision Tree, K-NN, **Deep Learning**)
- Unsupervised Learning (data without labels) (PCA, Clustering, Factor Analysis)
- Semi-supervised Learning (data with partial labels)
- Reinforcement Learning (reward rules to get 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/

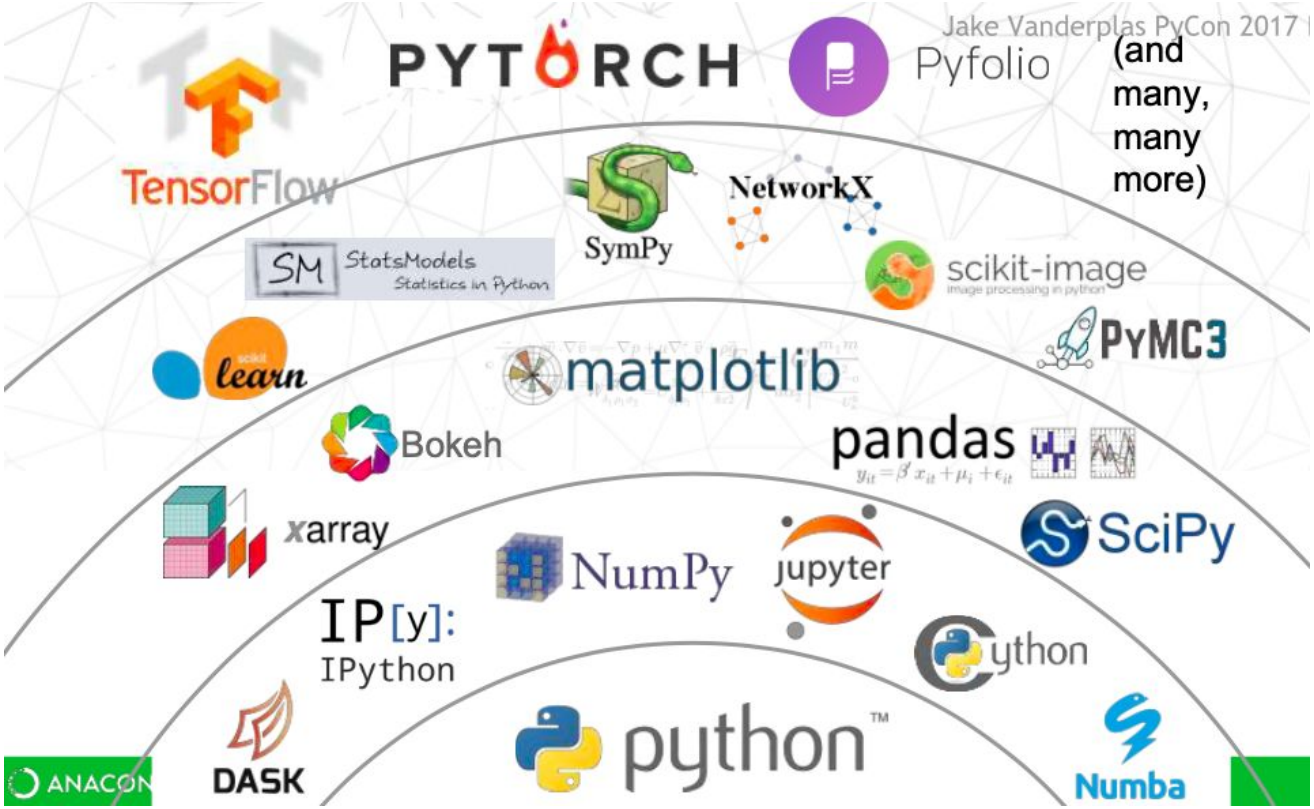
Classical Machine Learning vs. Statistics

- 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



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...

Available Free GPU Computation Resources

- Google Colaboratory
  - 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 w/o hyp-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
Training 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.

Workflow for a machine learning project