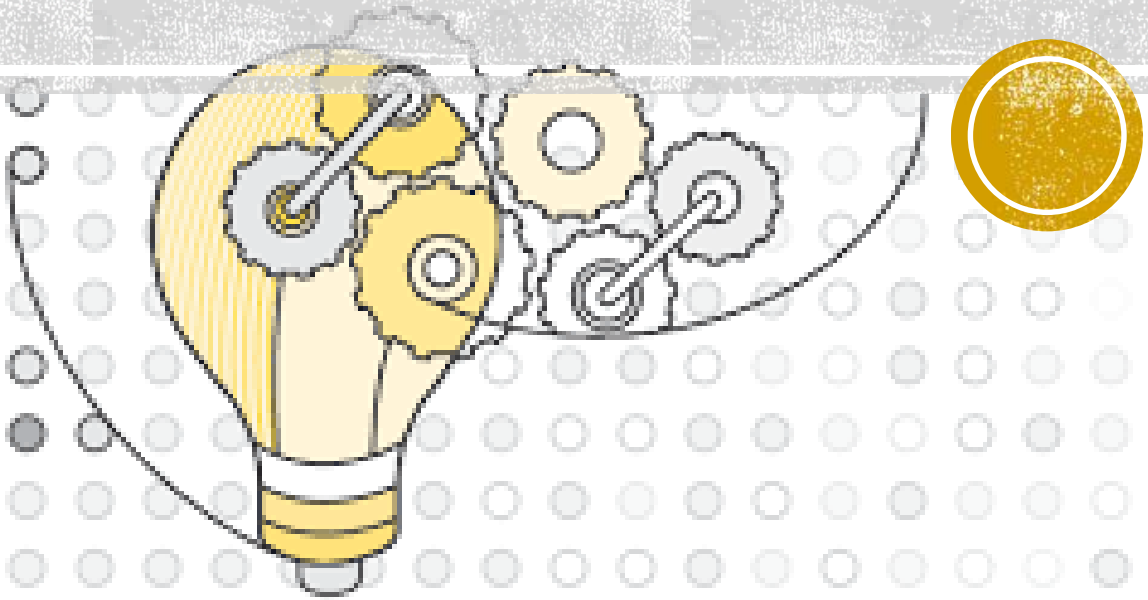
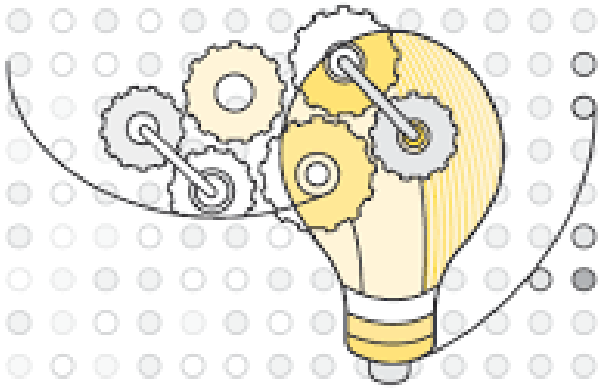
INTRODUCTION



PEOPLE



WHO ARE WE?

Prof. Shaowei Lin
Instructor
Weeks 1-7

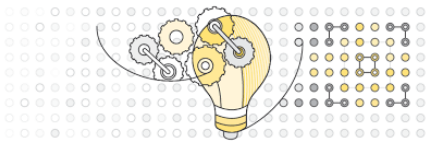
Prof. Lu Wei
Instructor
Weeks 8-14

Teaching Assistants

Zhang Yan
Mon PM, Thu AM

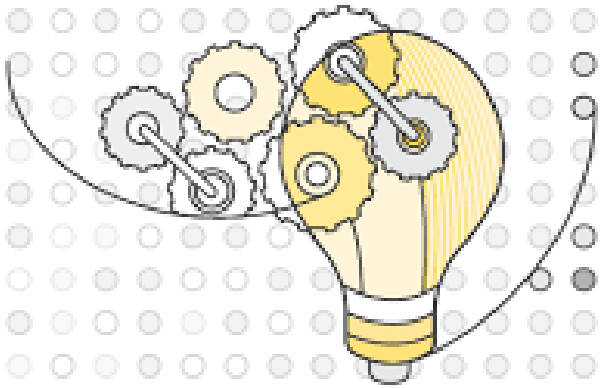
Gary Phua
Mon AM, Thu PM

Allan Jie
Mon AM, Thu PM



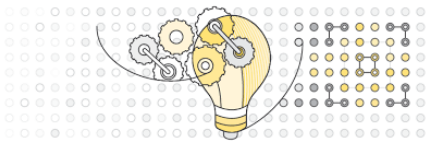
WHO ARE YOU?

CLASS



COURSE INFORMATION

- Office Hours
- Lessons
- Prerequisites
- Assessment
- Schedule
- Textbooks
- Syllabus
- Software
- Project
- Homework
- eDimension
- Observers

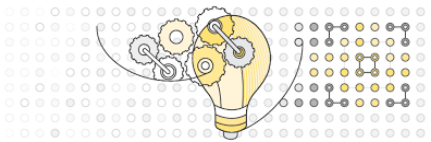


COURSE GOALS

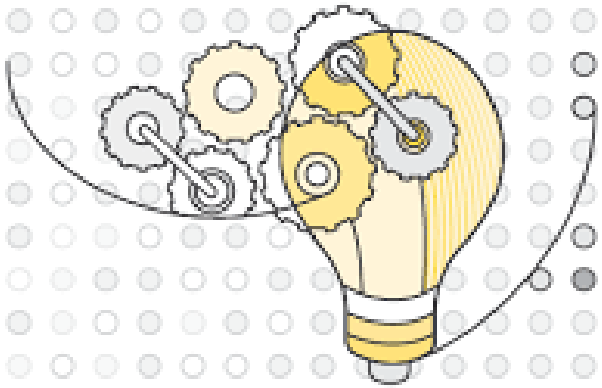
1. Curious to discover more
2. Confident of doing it yourself
3. Contemplative of the theory
4. Cautious of the dangers

ACKNOWLEDGEMENTS

- MIT 6.036 Introduction to Machine Learning
- SUTD 50.007 Machine Learning (Alex Binder)
- Stanford CS229 Machine Learning



MACHINES

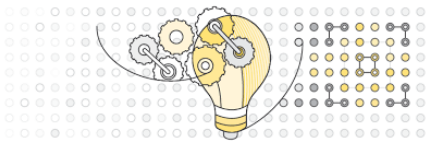


WHAT IS MACHINE LEARNING?

Hard-Coded

Trained

Giving computers the ability to learn without being explicitly programmed
– Arthur Samuel (1959)



WHAT IS MACHINE LEARNING?

Task

Performance

Experience

Algorithms that improve their performance
at some task with experience
– Tom Mitchell (1998)

TYPES OF MACHINE LEARNING

Supervised Learning

TYPES OF MACHINE LEARNING

Unsupervised Learning

TYPES OF MACHINE LEARNING

Reinforcement Learning

TYPES OF MACHINE LEARNING

Transfer Learning

SUPERVISED LEARNING

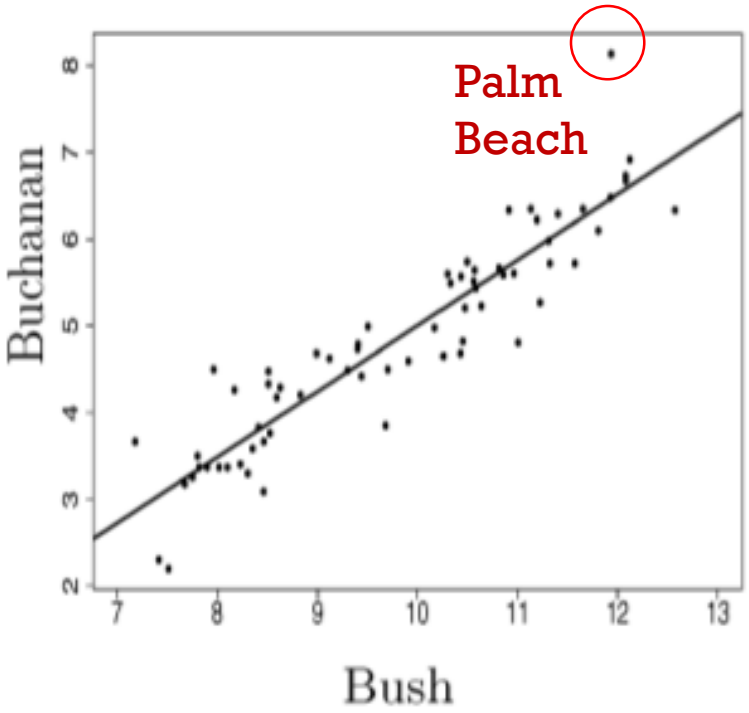
Learning a function

$y = f(x)$

$x \in \mathbb{R}$

$y \in \mathbb{R}$

Regression (Linear)



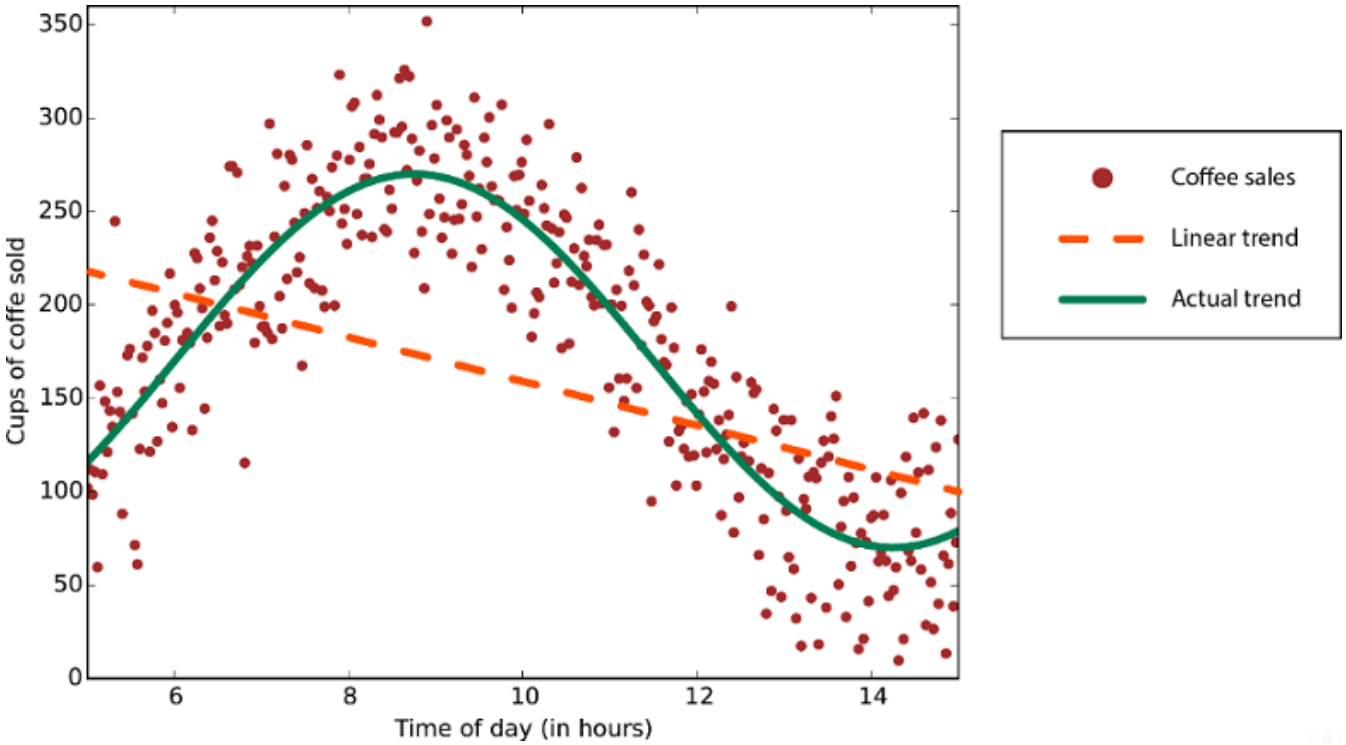
2000 USA Presidential Elections.

Votes for Buchanan and Bush in cities of Florida on a log scale.

https://en.wikipedia.org/wiki/United_States_presidential_election_in_Florida,_2000
http://andrys.com/flballot.html

SUPERVISED LEARNING

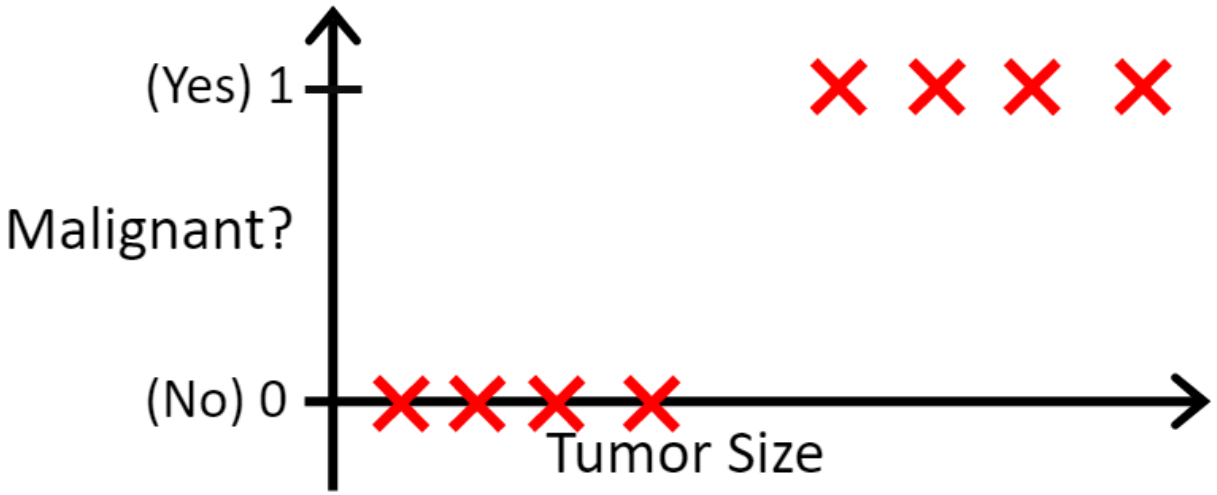
Regression (Non-linear)



SUPERVISED LEARNING

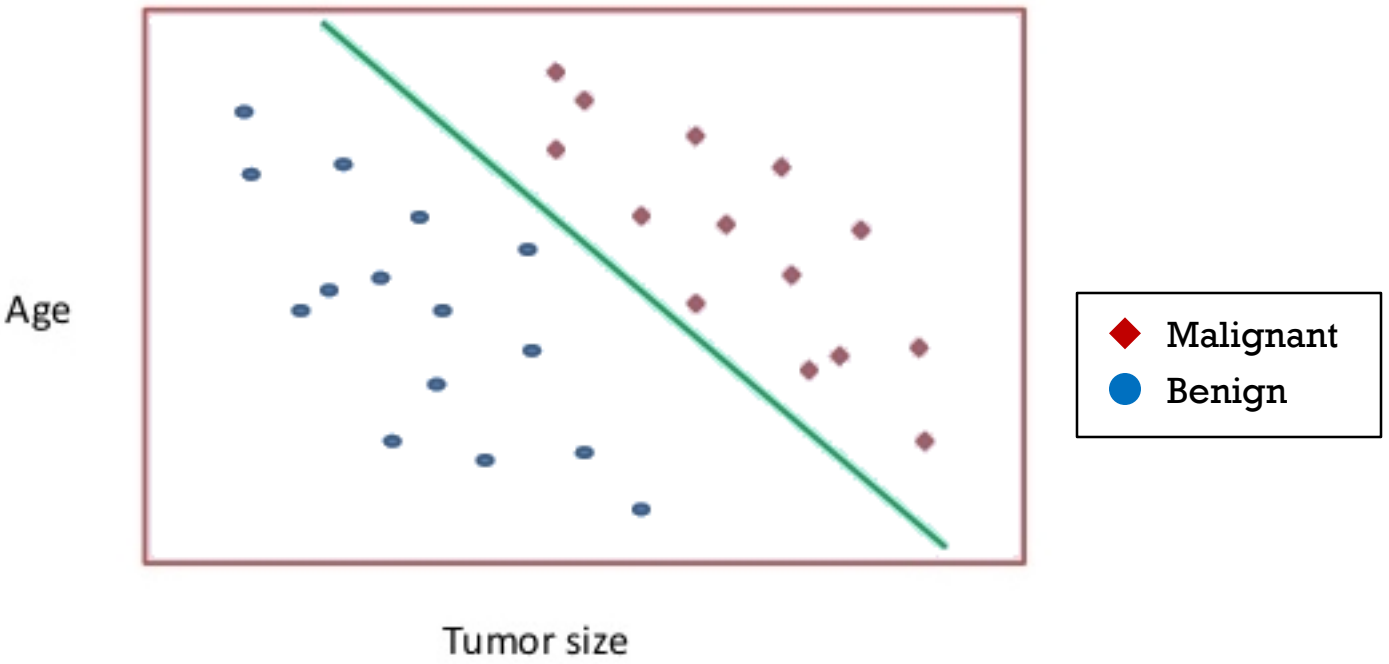
Learning a function
$y = f(x)$
$x \in \mathbb{R}$
$y \in \{1, 2, \ldots, k\}$

Classification



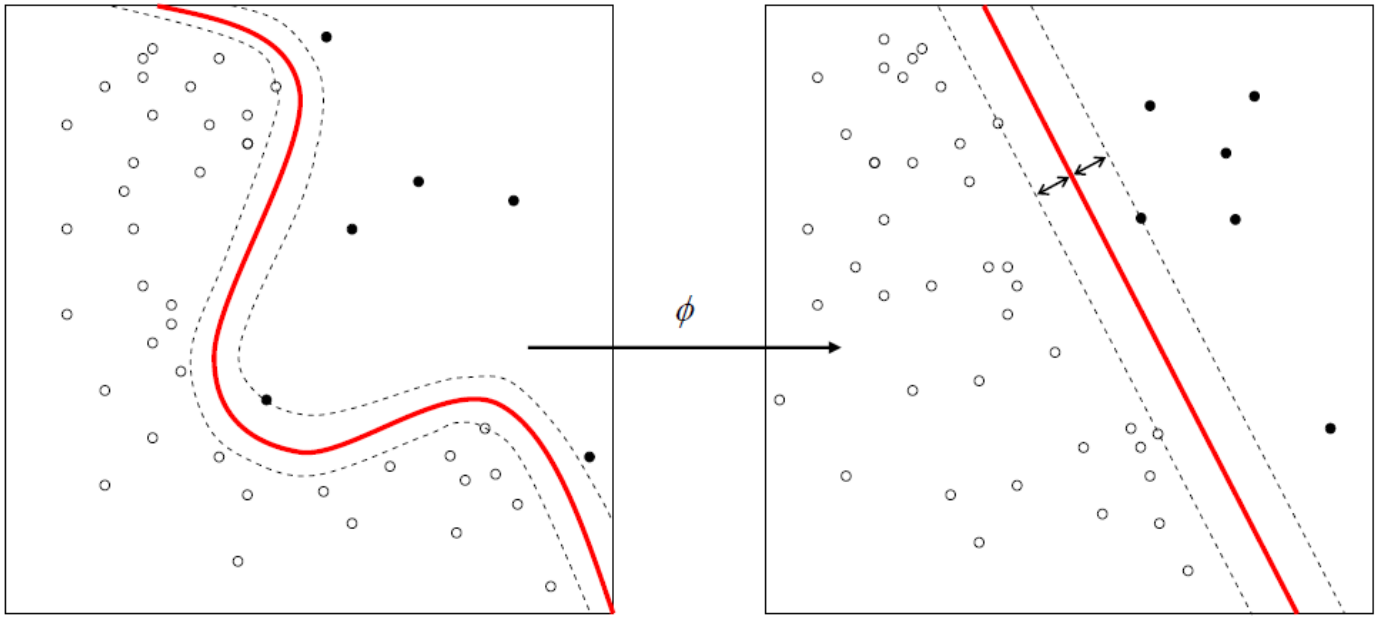
SUPERVISED LEARNING

Classification (Linear)



SUPERVISED LEARNING

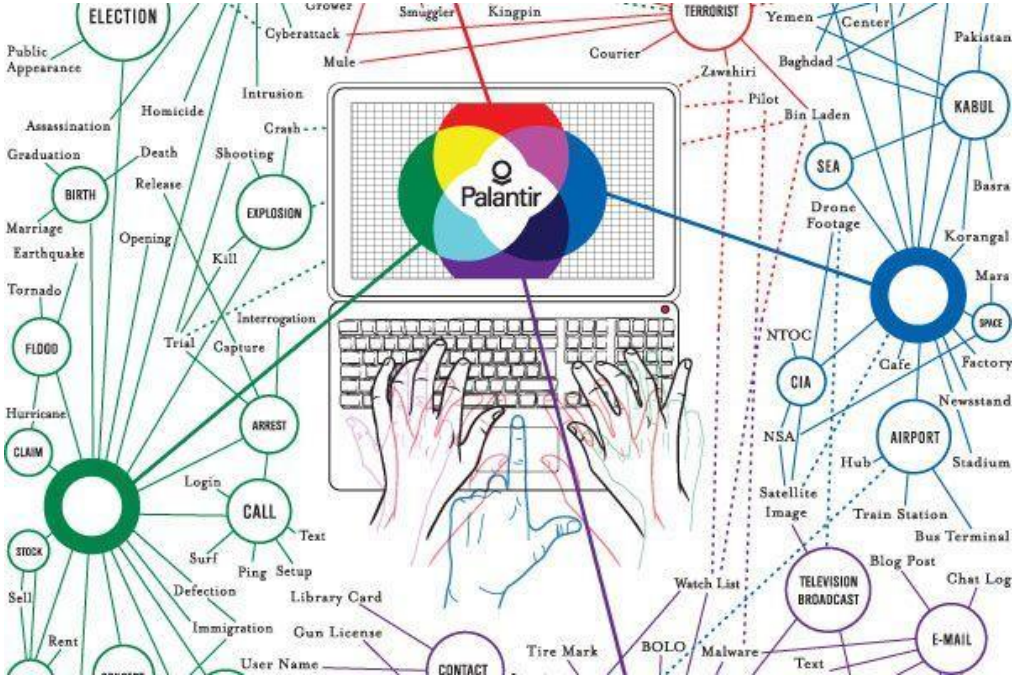
Classification (Non-linear)



SPAM FILTERS

Bayesian Networks

FRAUD DETECTION



PayPal

ebay

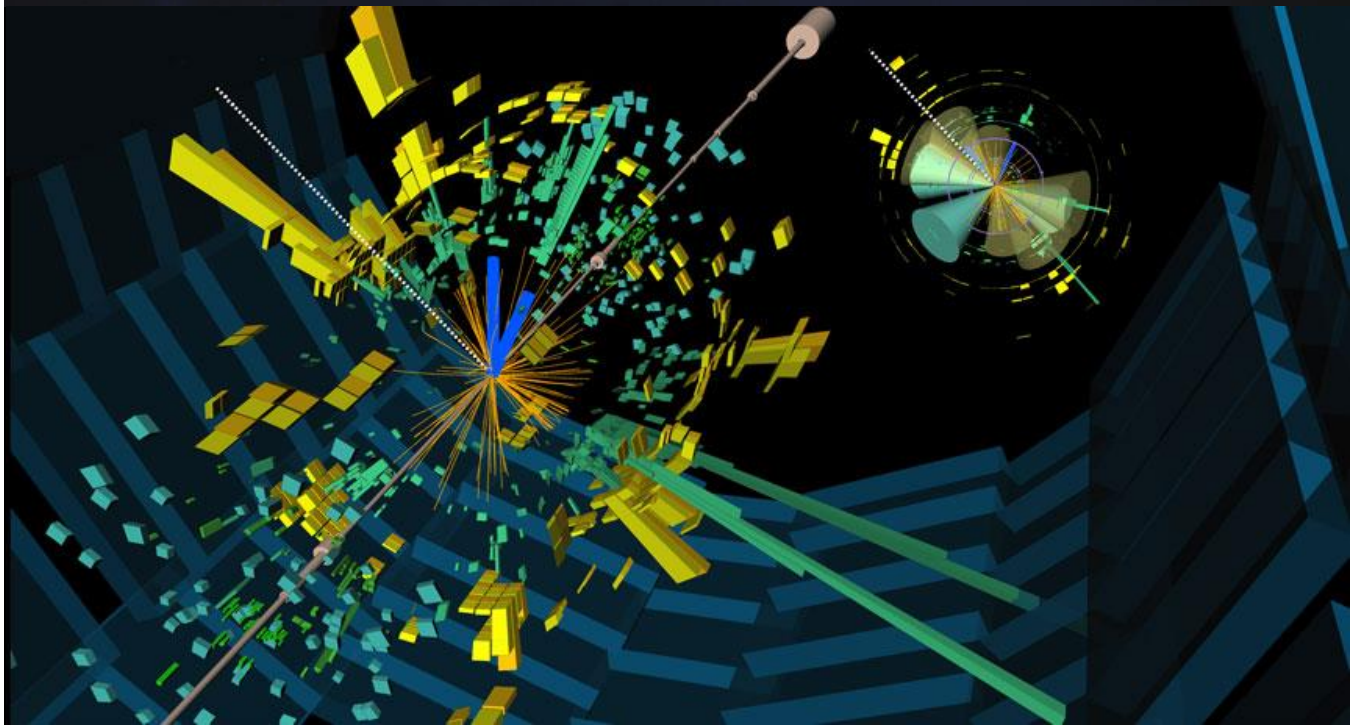
https://www.washingtonian.com/2012/01/31/killer-app/

Higgs challenge

the HiggsML challenge

May to September 2014

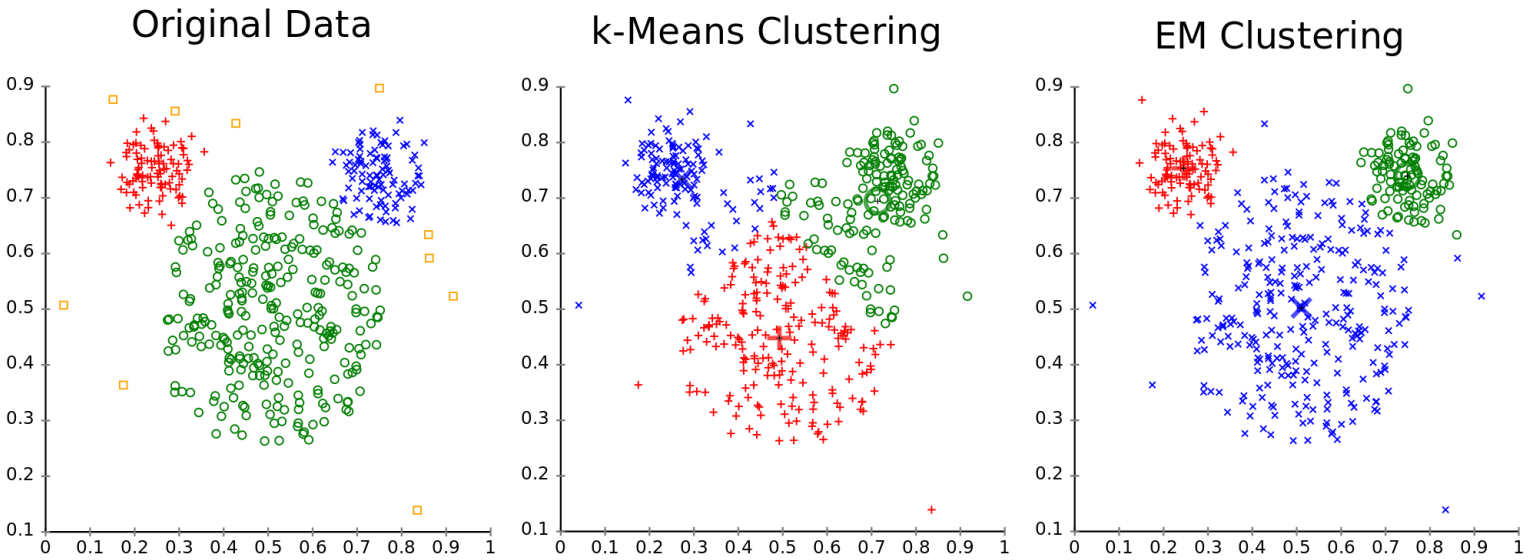
When **High Energy Physics** meets **Machine Learning**

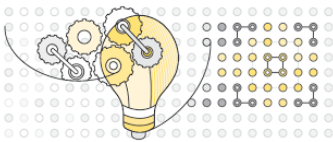


UNSUPERVISED LEARNING

Clustering

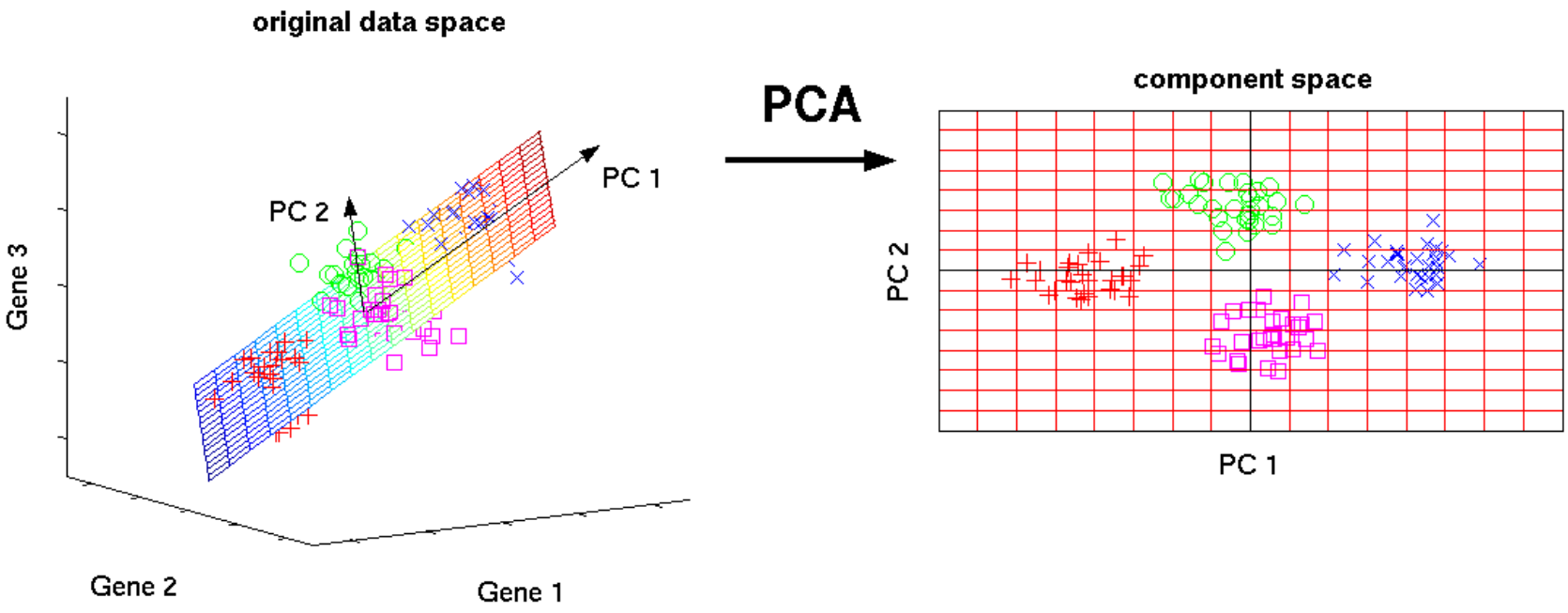
Different cluster analysis results on "mouse" data set:





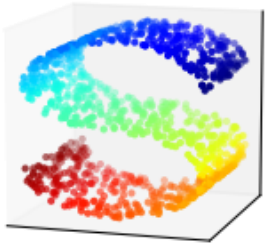
UNSUPERVISED LEARNING

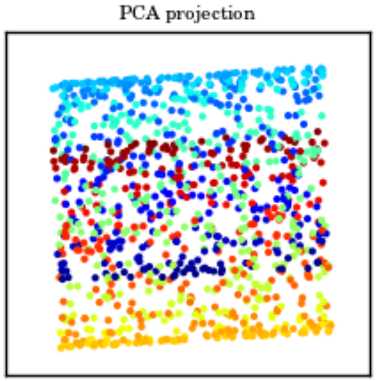
Dimensionality Reduction: Subspace Learning

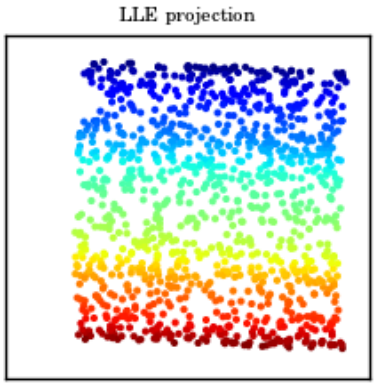


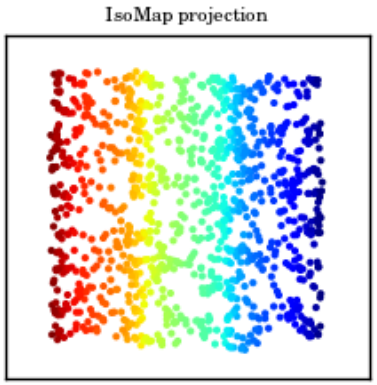
UNSUPERVISED LEARNING

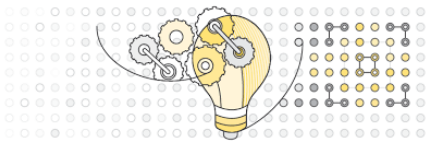
Dimensionality Reduction: Manifold Learning



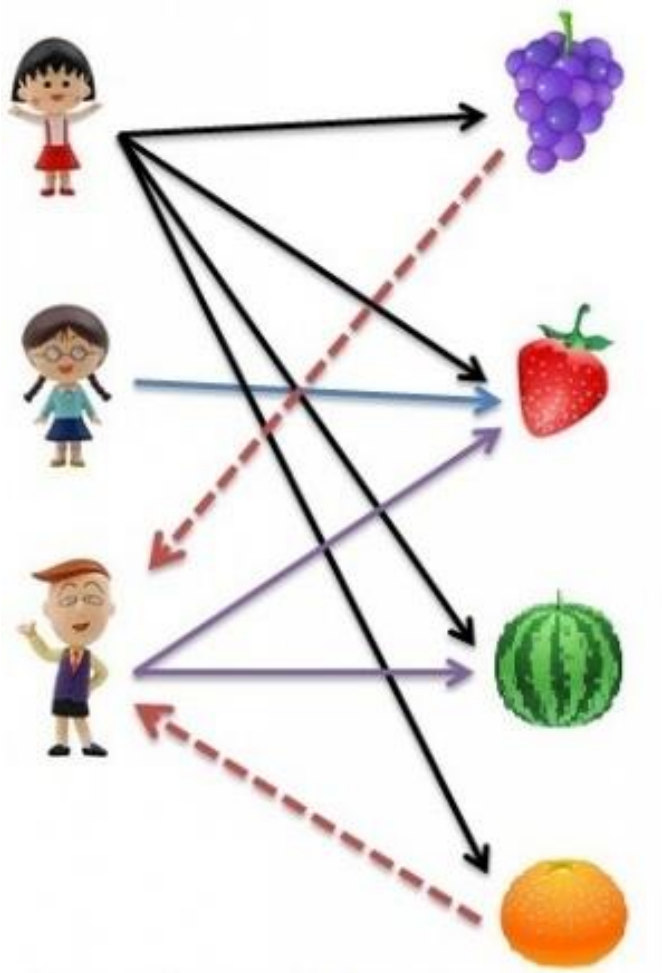






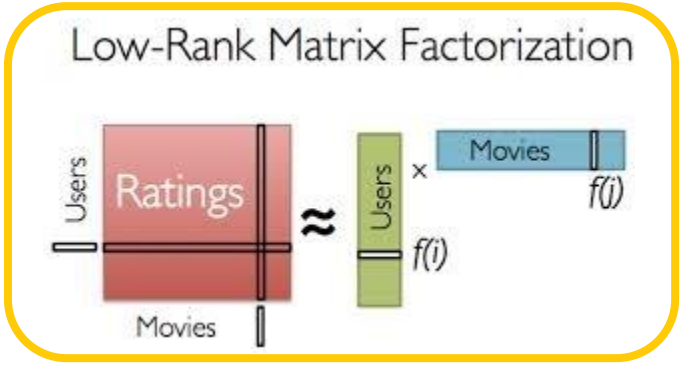


RECOMMENDER SYSTEMS

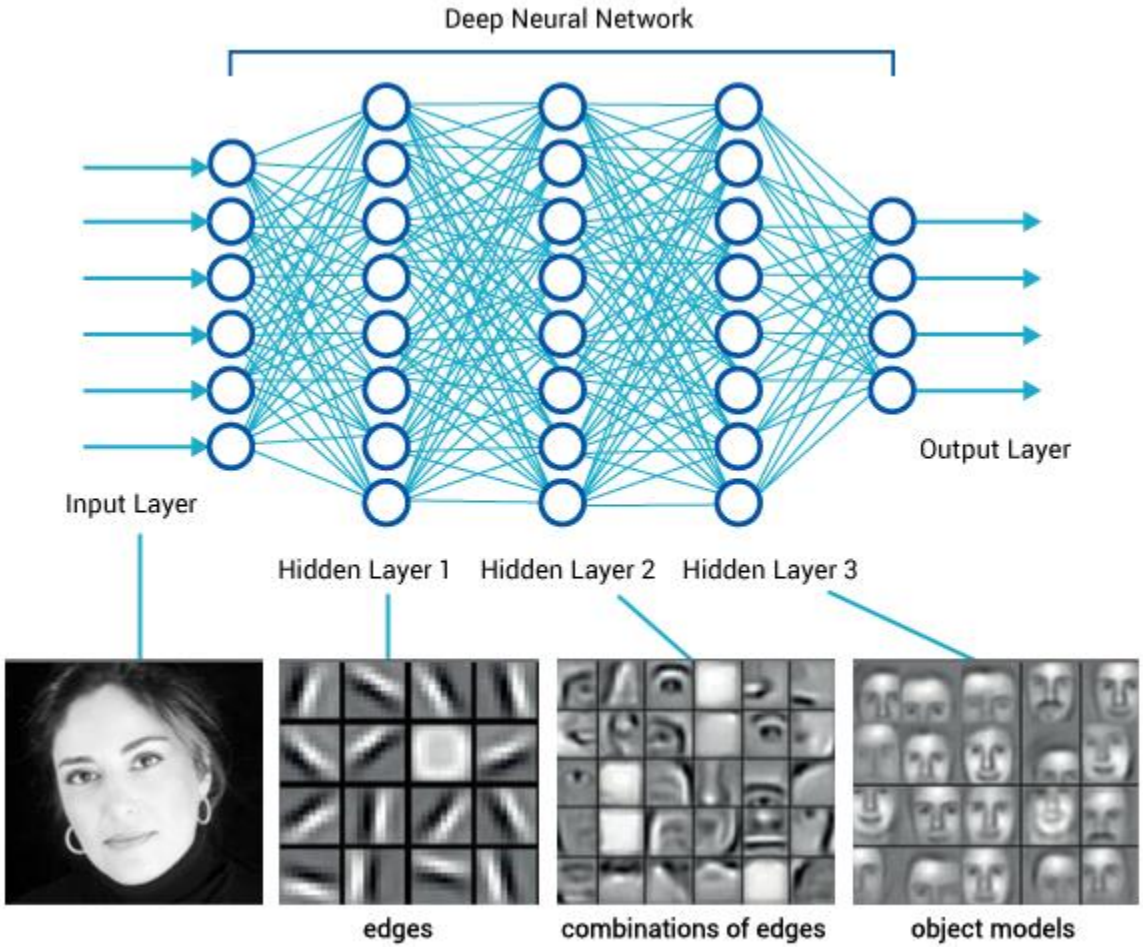


NETFLIX

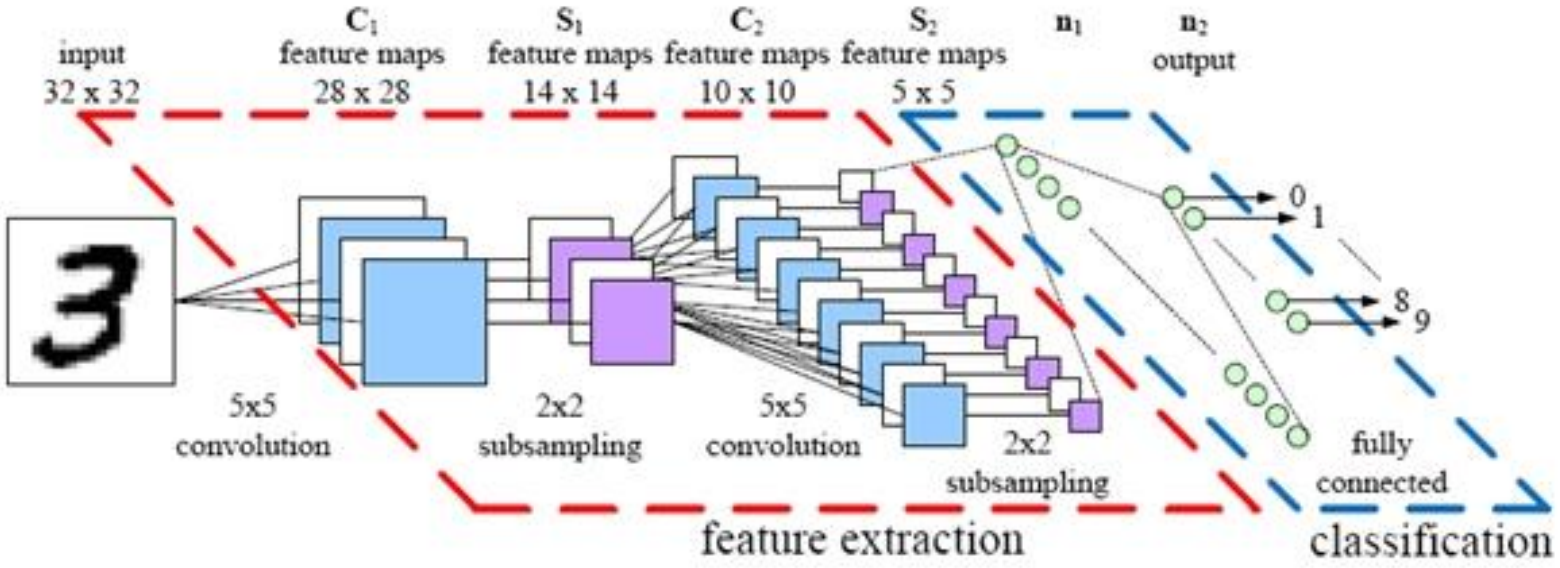
amazon

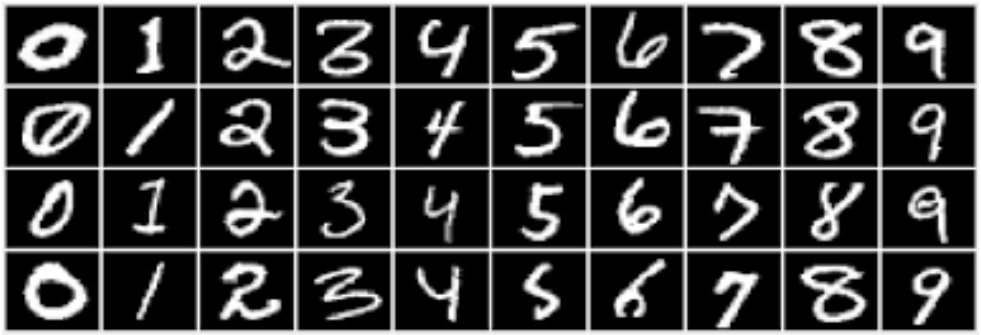


DEEP LEARNING

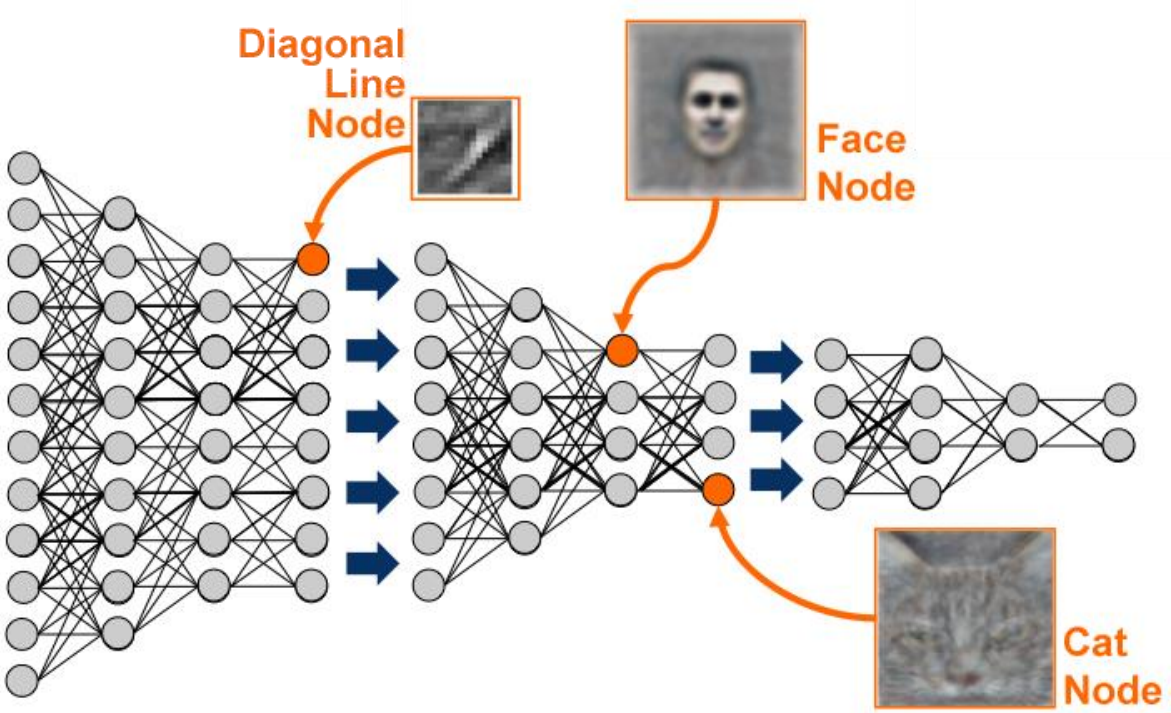


HANDWRITING RECOGNITION



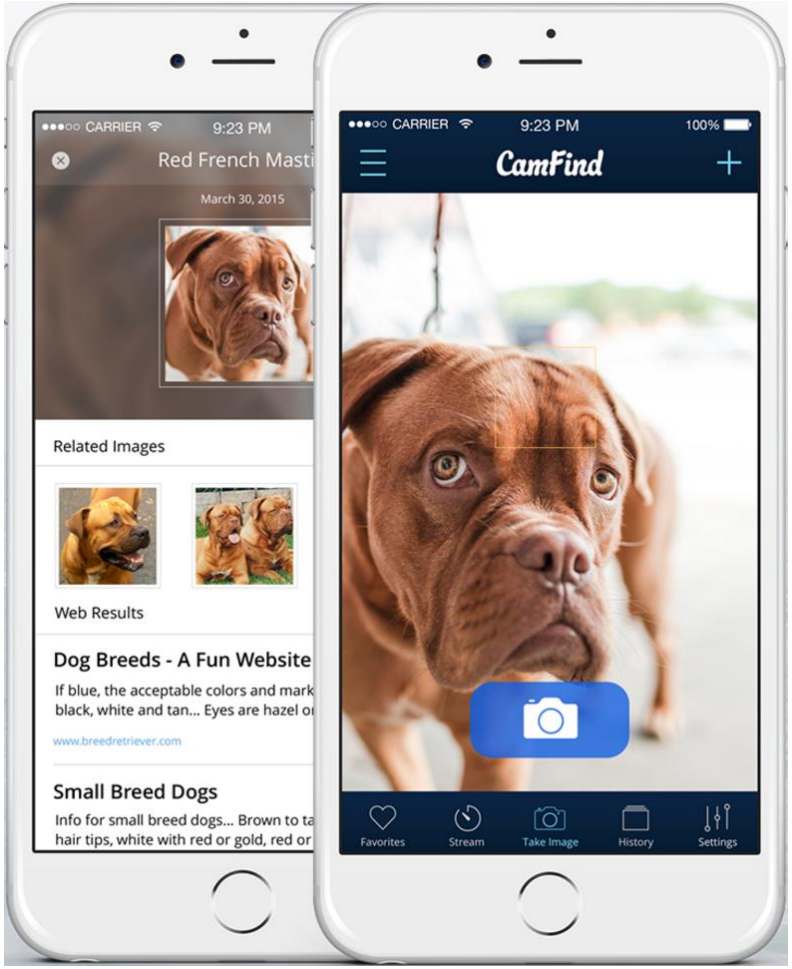


GOOGLE CAT VIDEOS



Deep Learning
with GPUs

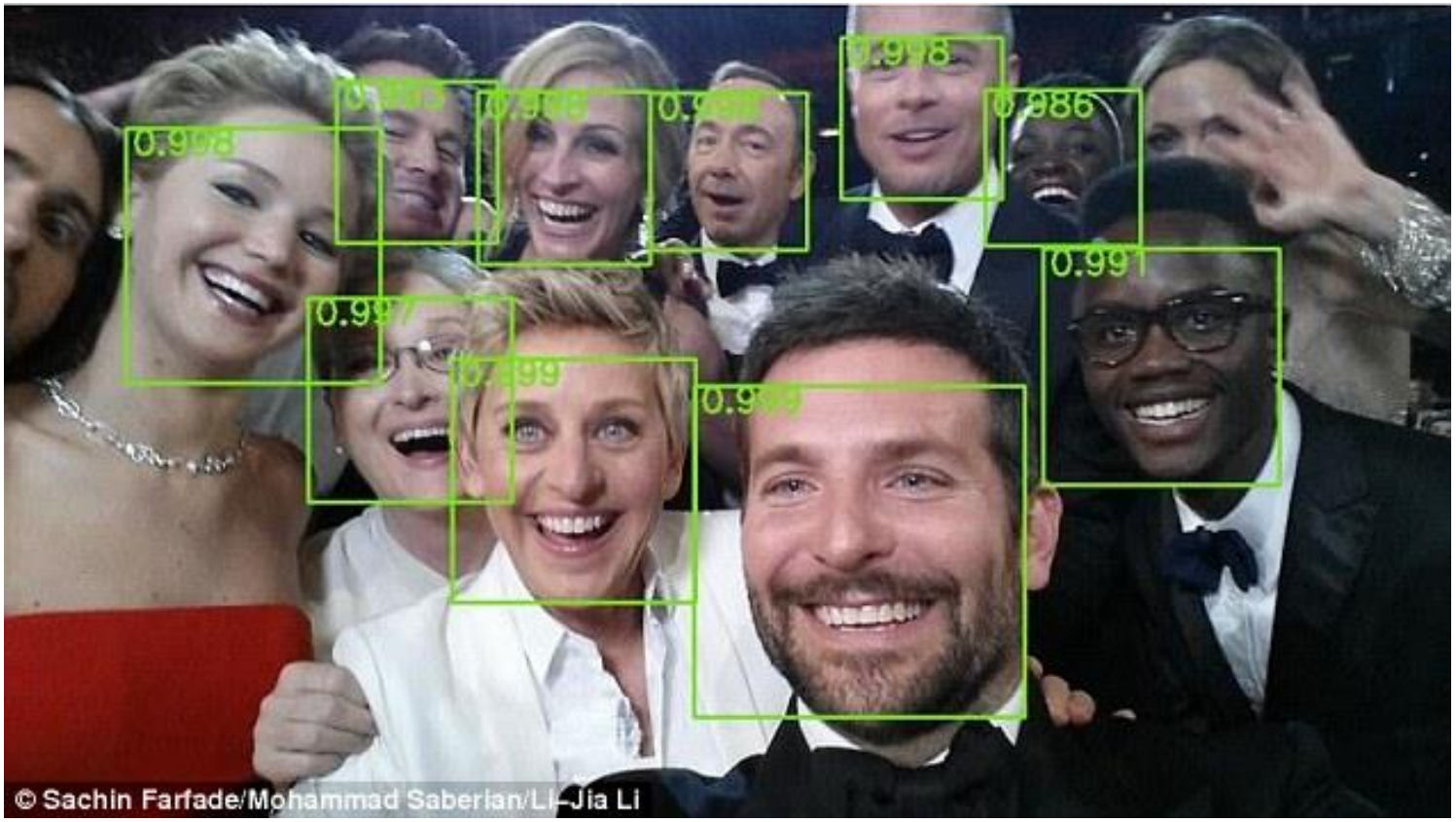
IMAGE RECOGNITION



CamFind

Visual Search Engine
(available on iOS, Android)

FACE RECOGNITION



SPEECH TRANSLATION

From Hidden Markov Models to Recurrent Neural Networks

https://www.youtube.com/watch?v=mWTySUGXR2k

HEALTHCARE

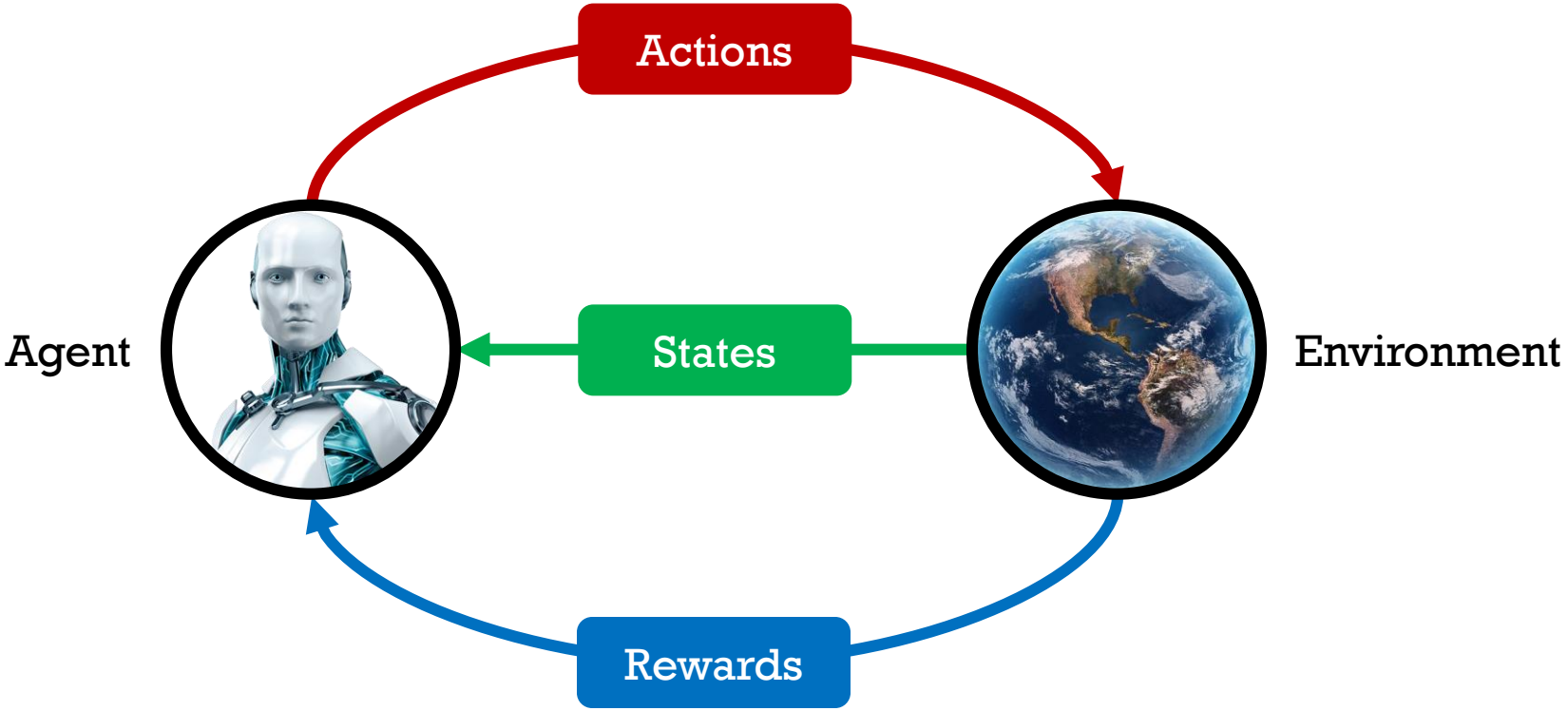
Watson correctly diagnoses woman after doctors were stumped

by Eric David | Aug 5, 2016 | 0 comments

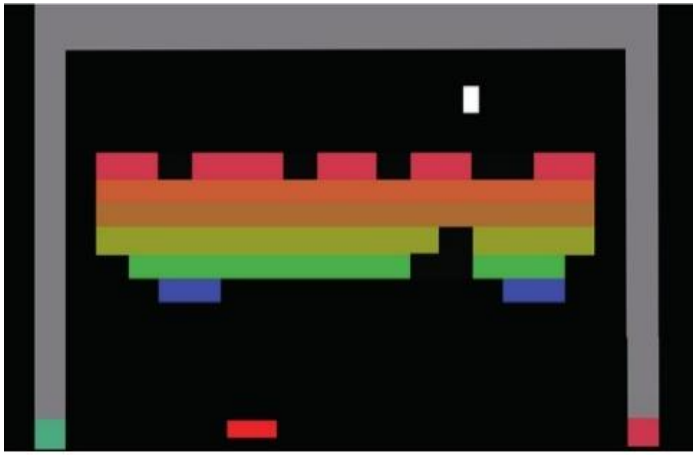
After treatment for a woman suffering from leukemia proved ineffective, a team of Japanese doctors turned to IBM's Watson for help, which was able to successfully determine that she actually suffered from a different, rare form of leukemia than the doctors had originally believed.

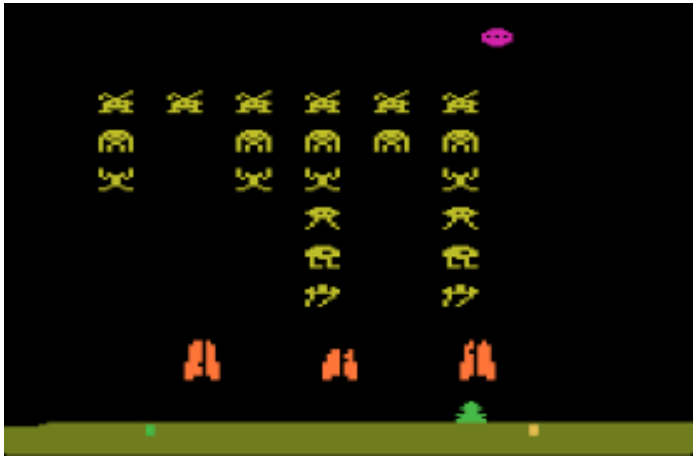
http://siliconangle.com/blog/2016/08/05/watson-correctly-diagnoses-woman-after-doctors-were-stumped/

REINFORCEMENT LEARNING



ATARI GAMES

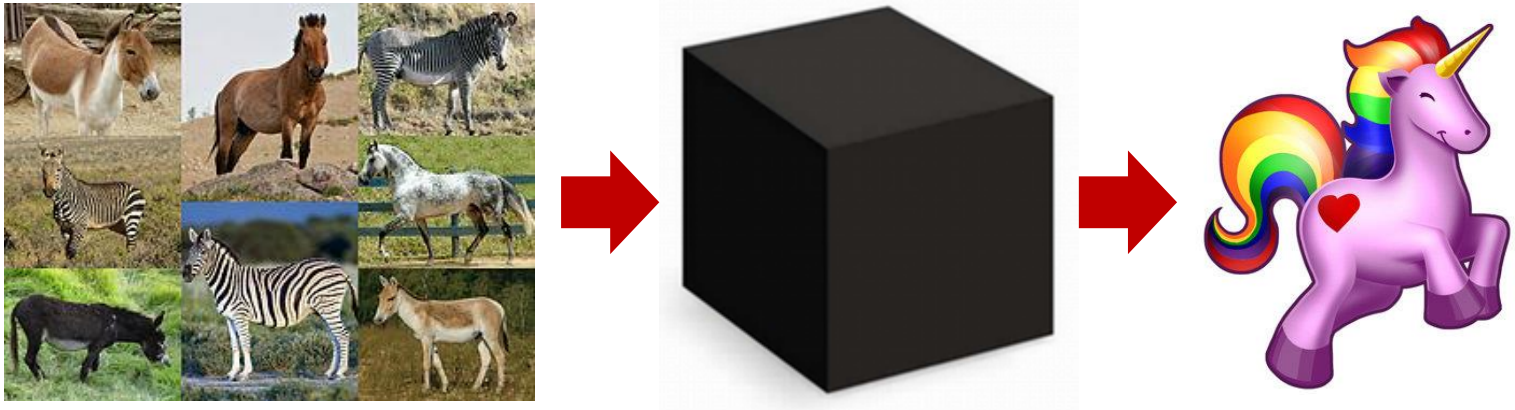




https://www.youtube.com/watch?v=rbsqaJwpu6A

SELF-DRIVING CARS

NOT A BLACK BOX!



Importance

More Structure

More Data

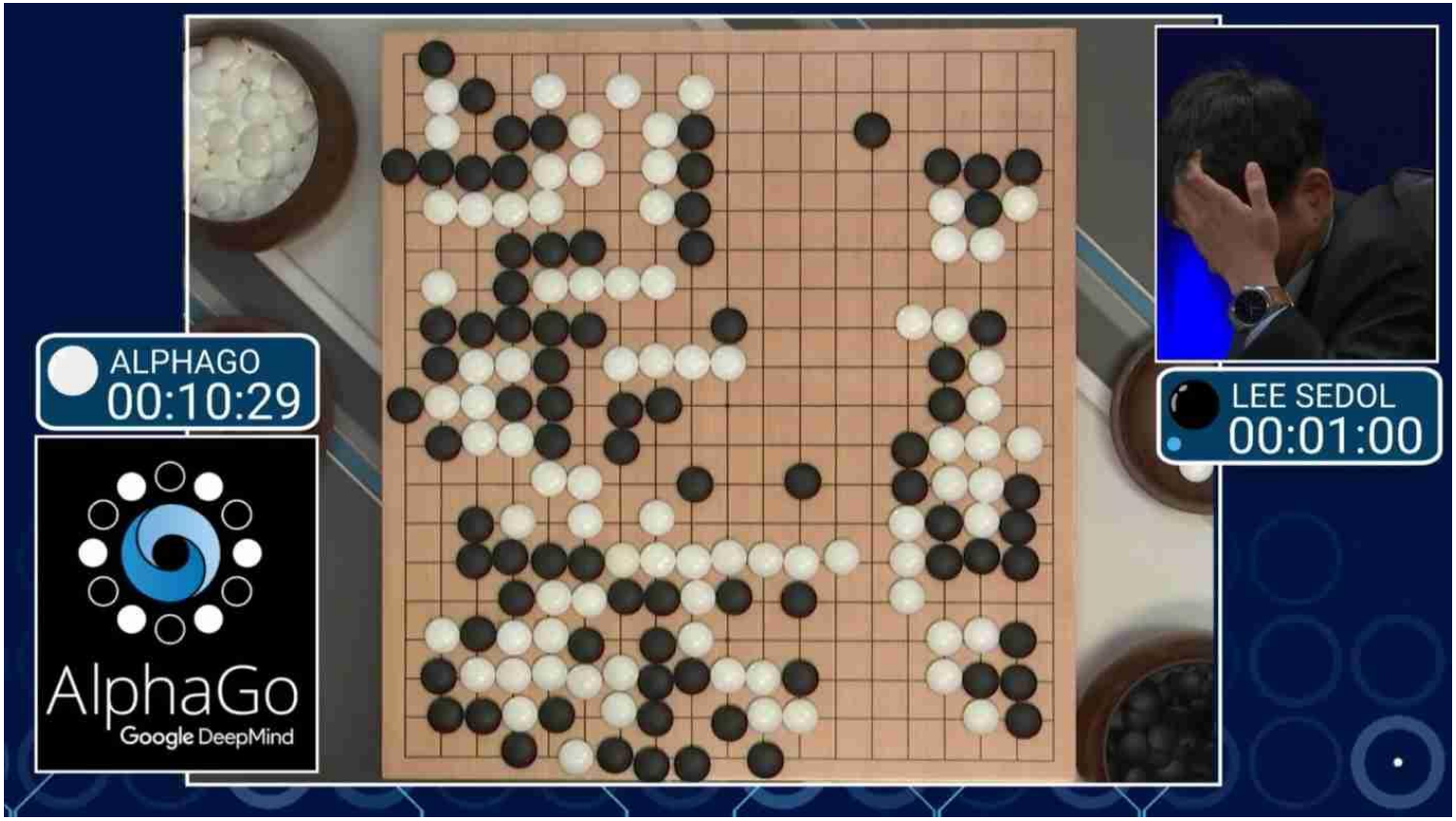
Better Machines

Better Algorithms

DETECTING TANKS

http://lesswrong.com/lw/7qz/machine_learning_and_unintended_consequences/
https://www.jefftk.com/p/detecting-tanks

ALPHAGO



https://www.youtube.com/watch?v=SUbqykXVx0A

INTENDED LEARNING OUTCOMES

Introduction

- Define machine learning in terms of algorithms, tasks, performance and experience.
- List four main types of machine learning, e.g. supervised, unsupervised, reinforcement, and transfer learning.
- Describe some potential dangers in machine learning, e.g. applying an algorithm without understanding its assumptions, forgetting that the training data could be biased.