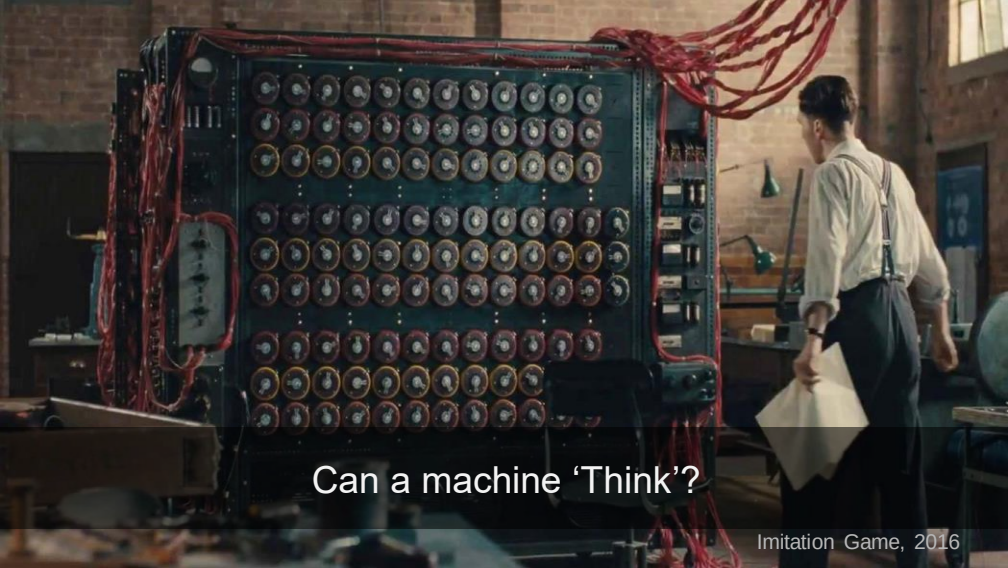
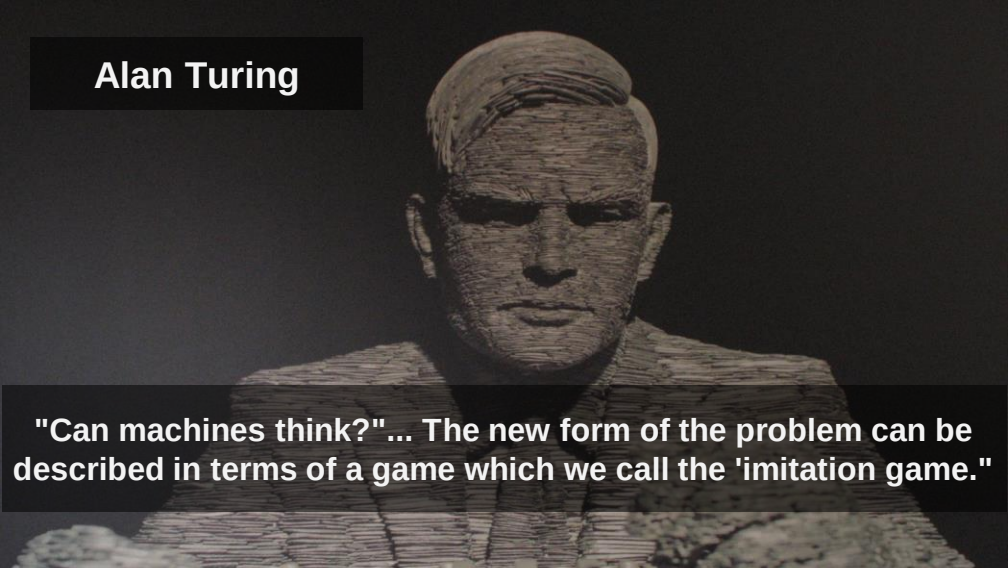
Introduction to Machine Learning

Imitation Game, 2016


Can a machine ‘Think’?
Imitation Game, 2016


Alan Turing
"Can machines think?"... The new form of the problem can be described in terms of a game which we call the 'imitation game."

What is Machine Learning?

Machine Learning Historical Background

Machine Learning Historical Background

From Quest of AI Book

Main problem..

- Classic AI: Symbolic Reasoning
  - No learning
  - Poor handling of uncertainty
  - Hard coding

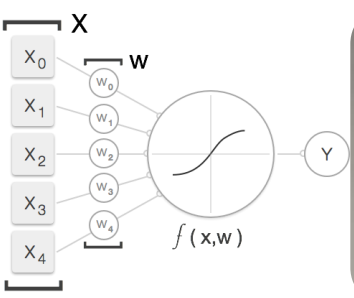
Machine Learning Historical Background

- Born from the ambitious goal of Artificial Intelligence

Dartmouth AI Conferences

Machine Learning Historical Background

- Perceptron: first artificial neuron.



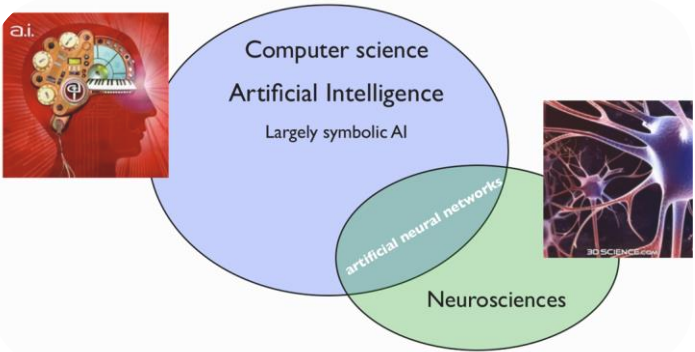
Rossenbalt, source: Wikipedia

Machine Learning:

- Learning
- Poor handling of uncertainty
- Hard coding

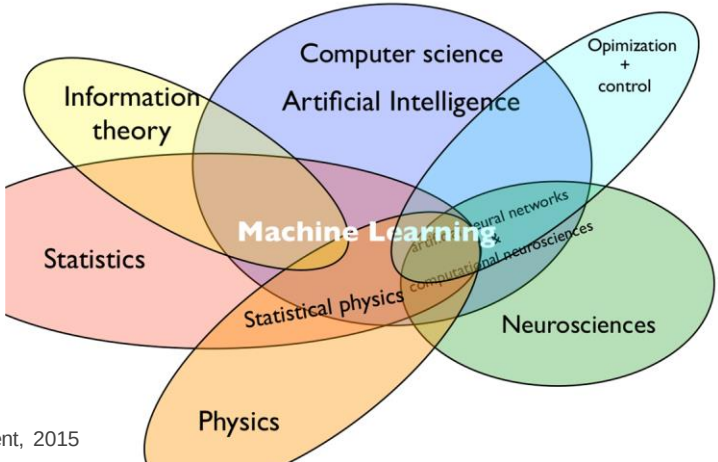
Machine Learning Historical Background

Artificial Intelligence 1960s



Pascal Vincent, 2015

Machine Learning Current View

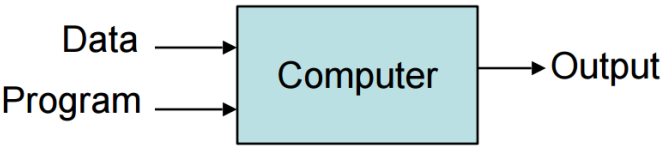


Pascal Vincent, 2015

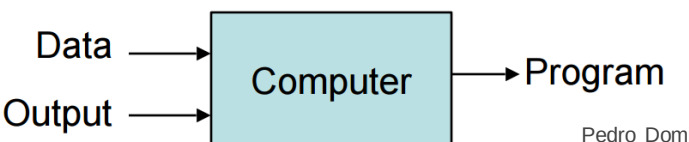
What is Machine Learning?

- “Field of study that gives computers the ability to learn without being explicitly programmed”
  - Arthur Samuel (1959)

Traditional Programming



Machine Learning



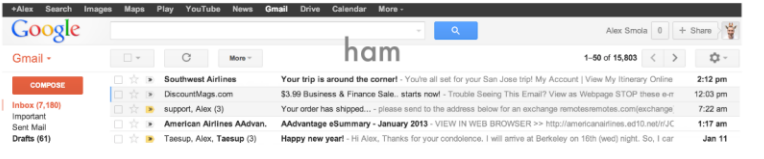
Pedro Domingos
Machine Learning Class

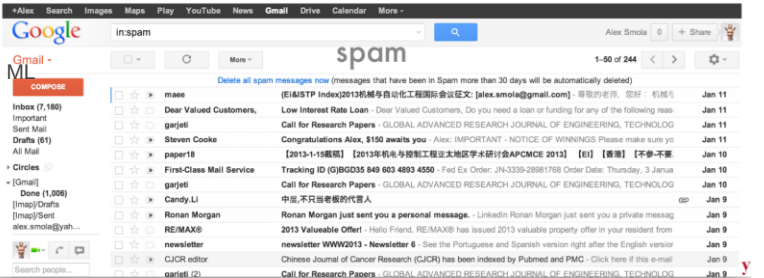
Stanford Autonomous Helicopter

Andrew Ng, Autonomous Helicopter

Classification

Spam Filtering

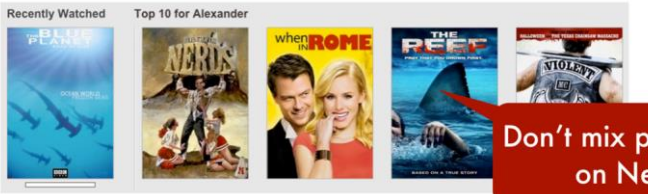




Alex Smola, Introduction ML

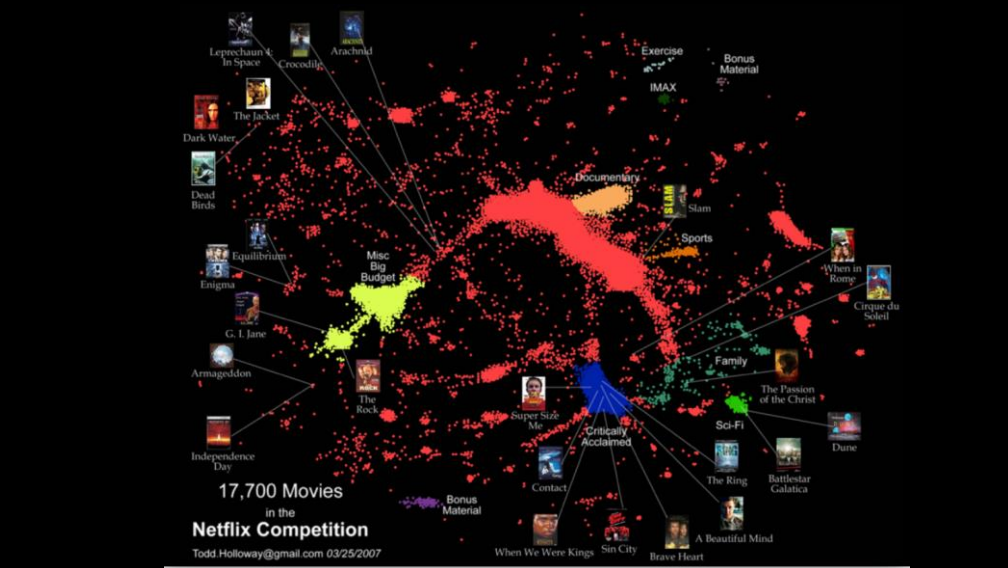
Product Recommendation: Imputing Missing Data

Collaborative Filtering

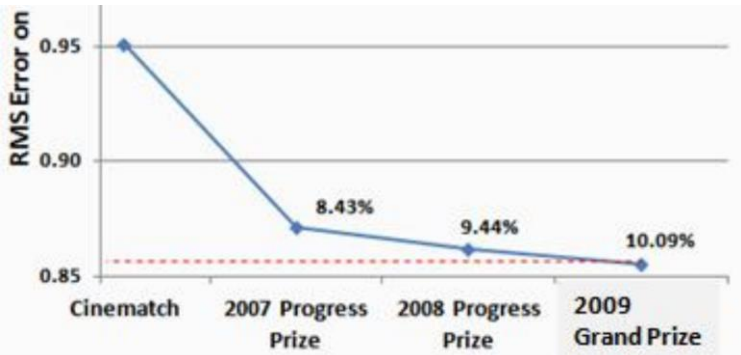


Alex Smola, Introduction ML

Netflix Prize


Leprechaun 6: In Space
Crocodile
Arachnid
Exercise
Bonus Material
IMAX
The Jacket
Dark Water
Dead Birds
Documentary
Slam
Sports
Equilibrium
Misc Big Budget
Enigma
When in Rome
Cirque du Soleil
G. I. Jane
Armageddon
Family
The Passion of the Christ
The Rock
Super Size Me
Critically Acclaimed
Sci-Fi
Dune
Independence Day
The Ring
Battlestar Galatica
Contact
Bonus Material
17,700 Movies
in the
Netflix Competition
Todd.Holloway@gmail.com 03/25/2007
When We Were Kings
Sin City
Brave Heart
A Beautiful Mind

Netflix Error time by time



HBR, Oct 2012

Time Series Prediction

Prediction

tomorrow's stock price

Alex Smola, Introduction ML

A new kind of hedge fund built by a network of data scientists.

Learn more

NEW DATASET IN 3D 17H 14M 24S

37,329,090,110 PRICE PREDICTIONS

ANNUAL RATE		CAREER EARNINGS	LOGLOSS META MODEL	RANK
$54,000.00	DEPRIVING	$27.80	0.585	1
$22,704.00	FUNGIBLE	$69.87	0.592	2
$13,668.00	QUPIKA	$0.00	0.677	3
$9,540.00	ALOMOMOLA	$34.14	0.550	4
$7,212.00	INCANDESCING	$12.51	0.518	5
$5,748.00	VZIKK	$0.00	0.676	6
$4,740.00	TUNELITY2	$0.00	0.679	7
$4,008.00	BASSET	$5.28	0.675	8
$3,456.00	IDLING	$0.00	0.673	9
$3,036.00	BIDOOF	$1.11	0.546	10
$2,688.00	SWEETCHIC	$21.26	0.683	11
$2,412.00	VINTY	$0.00	0.677	12
$2,184.00	BARBARACLE	$0.89	0.667	13
$1,992.00	KORM3	$5.44	0.675	14
$1,824.00	PLAIDPANDA	$1.24	0.679	15
$1,680.00	MUFASA3	$0.00	0.673	16
$1,560.00	TEDIUM	$13.45	0.676	17
$1,452.00	TEACH	$177.35	0.683	18
$1,356.00	AZUMARILL	$2.49	0.618	19
$1,272.00	ZANAME	$0.00	0.674	20
$1,200.00	NEKUS	$0.00	0.679	21

Assembling a Super Intelligence

Numerai is not a search for the 'best' model; it is a platform to synthesize many different, uncorrelated models with many different characteristics.

Data scientists compete on the leaderboard but models are ranked and rewarded based on their contribution to the meta model.

Learn more in *Super Intelligence for the Stock Market*

Imitating Behavior

Imitation Learning

Imitation Learning in Games

Black & White
Lionsgate Studios

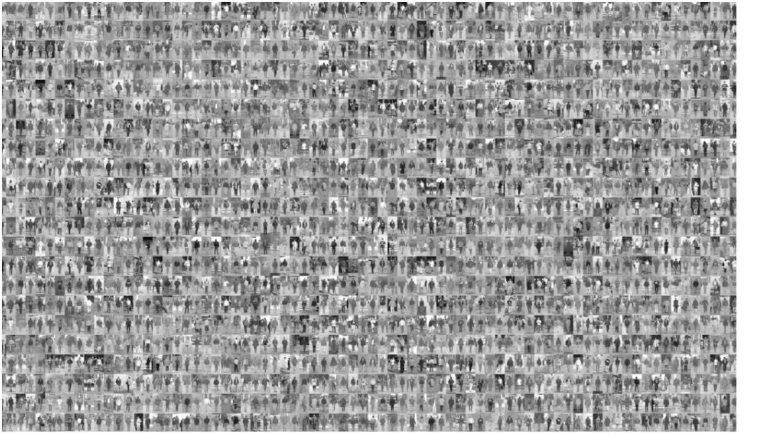
Alex Smola,
Introduction M

“Hassabis worked as lead AI programmer on the iconic god game *Black & White*”

Google DeepMind

Machine Learning in Industry

Nando de Freitas, Introduction ML



Millions of labeled examples are used to build real-world applications, such as pedestrian detection

[Tomas Serre]

Nando de Freitas,
Introduction ML

[Thomas Serre 2012]

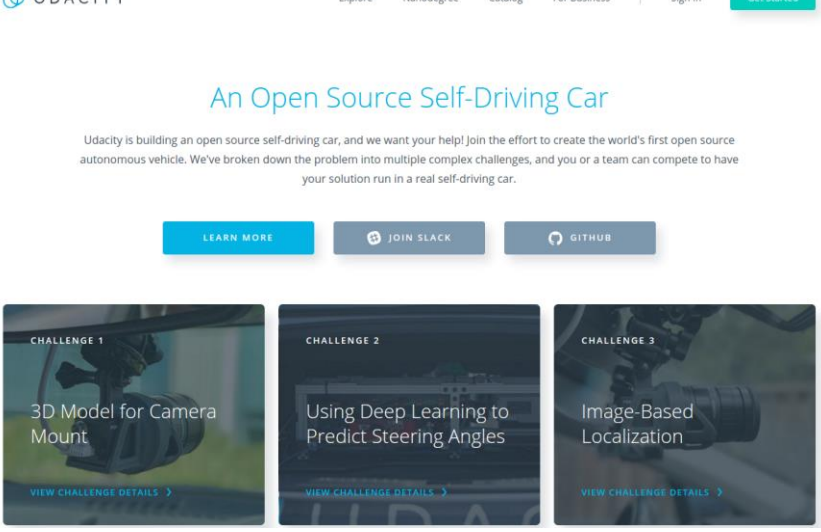

intel
Google
NXP
MDV
MOHR DAVIDOW VENTURES
Red Bull
ibeo
Powered by Diesel

Hot Research: Driverless Car

A Tesla driver was caught sleeping on the highway with his car on Autopilot

Dave Smith

May 24, 2016, 11:22 AM 34,432 2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An Open Source Self-Driving Car
Udacity is building an open source self-driving car, and we want your help! Join the effort to create the world's first open source autonomous vehicle. We've broken down the problem into multiple complex challenges, and you or a team can compete to have your solution run in a real self-driving car.
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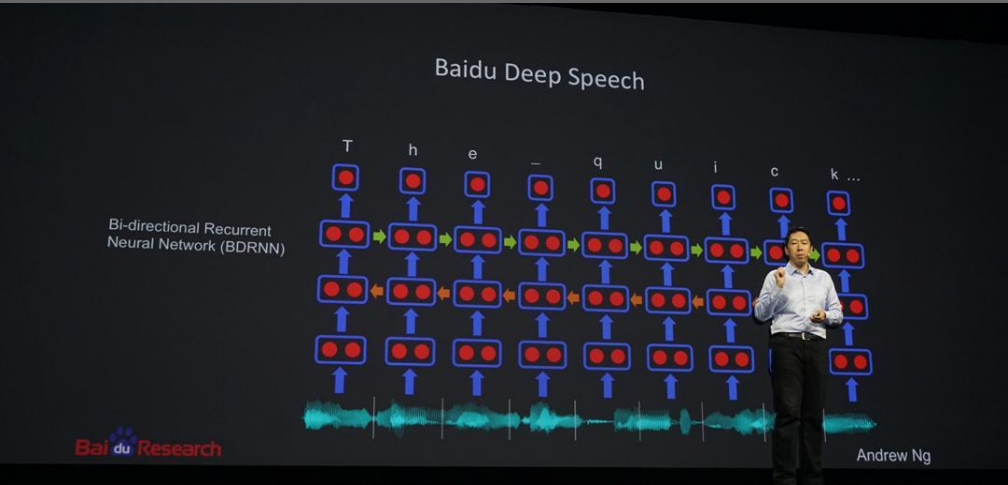
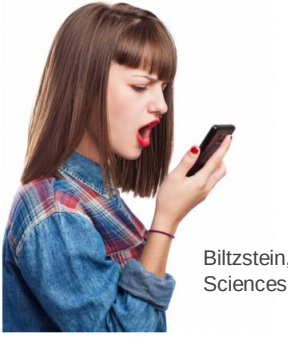
CHALLENGE 1
3D Model for Camera Mount
VIEW CHALLENGE DETAILS
CHALLENGE 2
Using Deep Learning to Predict Steering Angles
VIEW CHALLENGE DETAILS
CHALLENGE 3
Image-Based Localization
VIEW CHALLENGE DETAILS

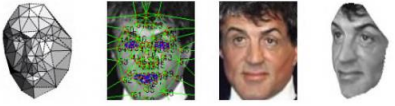
Speech Recognition



Machines that learn to recognise what they see and hear are at the heart of Apple, Google, Amazon, Facebook, Netflix, Microsoft, etc.



Biltzstein, Data Sciences Class



Sentiment Analysis

Review sentiment and summarization

Biltzstein, Data Sciences Class

Paul Bettany did a great role as the tortured father whose favorite little girl dies tragically of disease.
For that, he deserves all the credit.
However, the movie was mostly about exactly that, keeping the adventures of Darwin as he gathered data for his theories as incomplete stories told to children and skipping completely the disputes regarding his ideas.
Two things bothered me terribly: the soundtrack, with its whiny sound, practically shoving sadness down the throat of the viewer, and the movie trailer, showing some beautiful sceneries, the theological musings of him and his wife and the enthusiasm of his best friends as they prepare for a battle against blind faith, thus misrepresenting the movie completely.
To put it bluntly, if one were to remove the scenes of the movie trailer from the movie, the result would be a non descript family drama about a little child dying and the hardships of her parents as a result.
Clearly, not what I expected from a movie about Darwin, albeit the movie was beautifully interpreted.

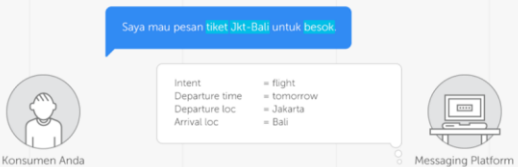
[Kotzias, Denil, Blunsom & NdF, 2014]

Chatbot

Kata.ai

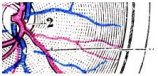
Penuh Potensi. Tanpa Pretensi.

Kata.ai menyediakan chatbot yang menguasai Bahasa Indonesia dengan teknologi Natural Language Processing (NLP) untuk meningkatkan customer engagement.



PRODUK

Healthcare



Completed • $100,000 • 661 teams

Diabetic Retinopathy Detection

Tue 17 Feb 2015 – Mon 27 Jul 2015 (18 months ago)

Dashboard

Home
Data
Make a submission

Information
Description
Evaluation
Rules
Prizes
References
Timeline

Forum

Kernels
New Script
New Notebook

Leaderboard
Public
Private

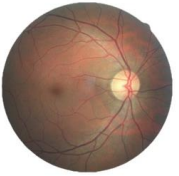
Private Leaderboard

1. Min-Pooling

Competition Details » Get the Data » Make a submission

Identify signs of diabetic retinopathy in eye images

Diabetic retinopathy is the leading cause of blindness in the working-age population of the developed world. It is estimated to affect over 93 million people.



The US Center for Disease Control and Prevention estimates that 29.1 million people in the US have diabetes and the World Health Organization estimates that 347 million people have the disease worldwide. Diabetic Retinopathy (DR) is an eye disease associated with long-standing diabetes. Around 40% to 45% of Americans with diabetes have some stage of the disease. Progression to vision impairment can be slowed or averted if DR is detected in time, however this can be difficult as the disease often shows few symptoms until it is too late to provide effective treatment.

Completed • $200,000 • 192 teams

Second Annual Data Science Bowl

Mon 14 Dec 2015 – Mon 14 Mar 2016 (10 months ago)

Dashboard

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About the DSB
Deep Learning Tutorial
Fourier Based Tutorial
Resources
Timeline

Forum

Leaderboard
Public
Private

Private Leaderboard

1. Tencia & Woshialex
2. kunsthart
3. Julian de Wit

Competition Details » Get the Data » Make a submission

Transforming How We Diagnose Heart Disease

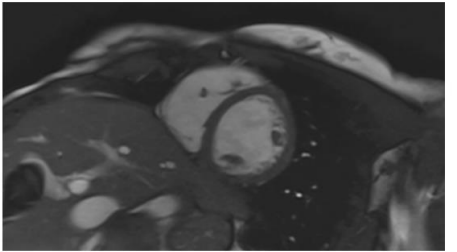
We all have a heart. Although we often take it for granted, it's our heart that gives us the moments in life to imagine, create, and discover. Yet cardiovascular disease threatens to take away these moments. Each day, 1,500 people in the U.S. alone are diagnosed with heart failure—but together, we can help. We can use data science to transform how we diagnose heart disease. By putting data science to work in the cardiology field, we can empower doctors to help more people live longer lives and spend more time with those that they love.

Declining cardiac function is a key indicator of heart disease. Doctors determine cardiac function by measuring end-systolic and end-diastolic volumes (i.e., the size of one chamber of the heart at the beginning and middle of each heartbeat), which are then used to derive the ejection fraction (EF). EF is the percentage of blood ejected from the left ventricle with each heartbeat. Both the volumes and the ejection fraction are predictive of heart disease. While a number of technologies can measure volumes or EF, Magnetic Resonance Imaging (MRI) is considered the gold standard test to accurately assess the heart's squeezing ability.

You only need to download one format of each file.
Each has the same contents but use different packaging methods.

In this dataset, you are given hundreds of cardiac MRI images in DICOM format. These are 2D cine images that contain approximately 30 images across the cardiac cycle. Each slice is acquired on a separate breath hold. This is important since the registration from slice to slice is expected to be imperfect.

The competition task is to create an automated method capable of determining the left ventricle volume at two points in time: after systole, when the heart is contracted and the ventricles are at their minimum volume, and after diastole, when the heart is at its largest volume.



The volumes at systole, V_S, and diastole, V_D, form the basis of an important clinical measurement known as the ejection fraction:

$$100 * \frac{V_D - V_S}{V_D}.$$

$1,000,000 • 874 teams

Data Science Bowl 2017

Merger and Entry Deadline

Thu 12 Jan 2017 — Wed 12 Apr 2017 (2 months to go)

Dashboard

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timeline
tutorial

Forum

Kernels
New Script
New Notebook

Leaderboard

Public Leaderboard

Competition Details » Get the Data » Make a submission

Can you improve lung cancer detection?

In the United States, lung cancer strikes 225,000 people every year, and accounts for $12 billion in health care costs. Early detection is critical to give patients the best chance at recovery and survival.

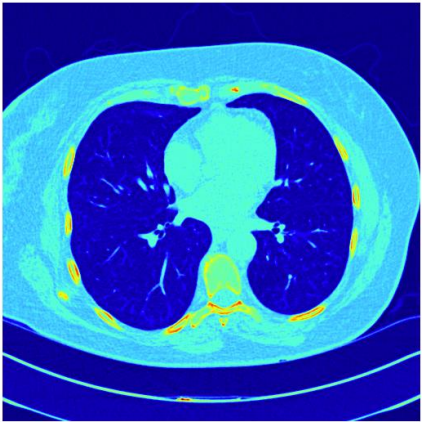
One year ago, the office of the U.S. Vice President spearheaded a bold new initiative, the Cancer Moonshot, to make a decade's worth of progress in cancer prevention, diagnosis, and treatment in just 5 years.

In 2017, the Data Science Bowl will be a critical milestone in support of the Cancer Moonshot by convening the data science and medical communities to develop lung cancer detection algorithms.

Using a data set of thousands of high-resolution lung scans provided by the National Cancer Institute, participants will develop algorithms that accurately determine when lesions in the lungs are cancerous. This will dramatically reduce the false positive rate that plagues the current detection technology, get patients earlier access to life-saving interventions, and give radiologists more time to spend with their patients.

In this dataset, you are given over a thousand low-dose CT images from high-risk patients in DICOM format. Each image contains a series with multiple axial slices of the chest cavity. Each image has a variable number of 2D slices, which can vary based on the machine taking the scan and patient.

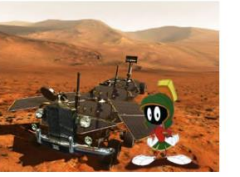
The DICOM files have a header that contains the necessary information about the patient id, as well as scan parameters such as the slice thickness.



Conclusion from Machine Learning Application

When to apply machine learning

- Human expertise is absent (*e.g. Navigating on Mars*)
- Humans are unable to explain their expertise (*e.g. Speech recognition, vision, language*)
- Solution changes with time (*e.g. Tracking, temperature control, preferences*)
- Solution needs to be adapted to particular cases (*e.g. Biometrics, personalization*)
- The problem size is to vast for our limited reasoning capabilities (*e.g. Calculating webpage ranks, matching ads to facebook pages*)



Q: Why now?

Data - User generated content

- Webpages (content, graph)
- Clicks (ad, page, social)
- Users (OpenID, FB Connect)
- e-mails (Hotmail, YIMail, Gmail)
- Photos, Movies (Flickr, YouTube, Vimeo ...)
- Cookies / tracking info (see Ghostery)
- Installed apps (Android market etc.)
- Location (Latitude, Loopt, Foursquared)
- User generated content (Wikipedia & co)
- Ads (display, text, DoubleClick, Yahoo)
- Comments (Disqus, Facebook)
- Reviews (Yelp, YILocal)
- Third party features (e.g. Experian)
- Social connections (LinkedIn, Facebook)
- Purchase decisions (Netflix, Amazon)
- Instant Messages (YIM, Skype, Gtalk)
- Search terms (Google, Bing)
- Timestamp (everything)
- News articles (BBC, NYTimes, Y!News)
- Blog posts (Tumblr, Wordpress)
- Microblogs (Twitter, Jaiku, Meme)

>1B images, 40h video/minute

Data

- Webpages (content, graph)
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- Users (OpenID, FB Connect)
- e-mails (Hotmail, Y!Mail, Gmail)
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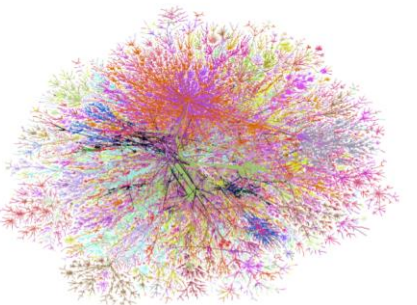

>10B useful webpages

Data - Identity & Graph

- Webpages (content, graph)
- Clicks (ad, page, social)
- Users (OpenID, FB Connect)
- e-mails (Hotmail, YIMail, Gmail)
- Photos, Movies (Flickr, YouTube, Vimeo ...)
- Cookies / tracking info (see Ghostery)
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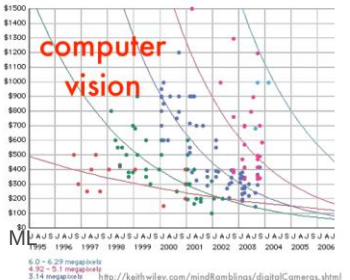
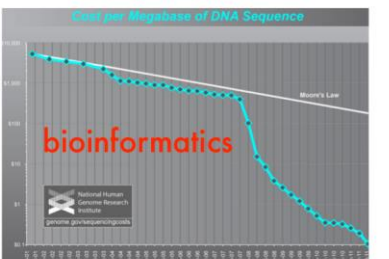
- Instant Messages (YIM, Skype, Gtalk)
- Search terms (Google, Bing)
- Timestamp (everything)
- News articles (BBC, NYTimes, Y!News)
- Blog posts (Tumblr, Wordpress)
- Microblogs (Twitter, Jaiku, Meme)

100M-1B vertices

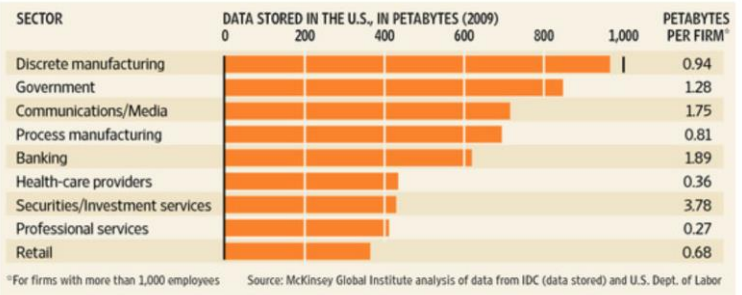
Many more sources



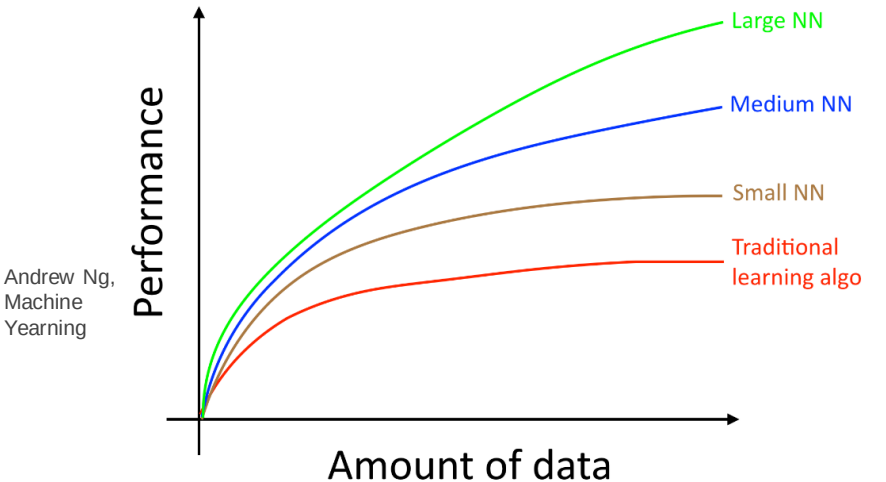


Alex Smola, Introduction M

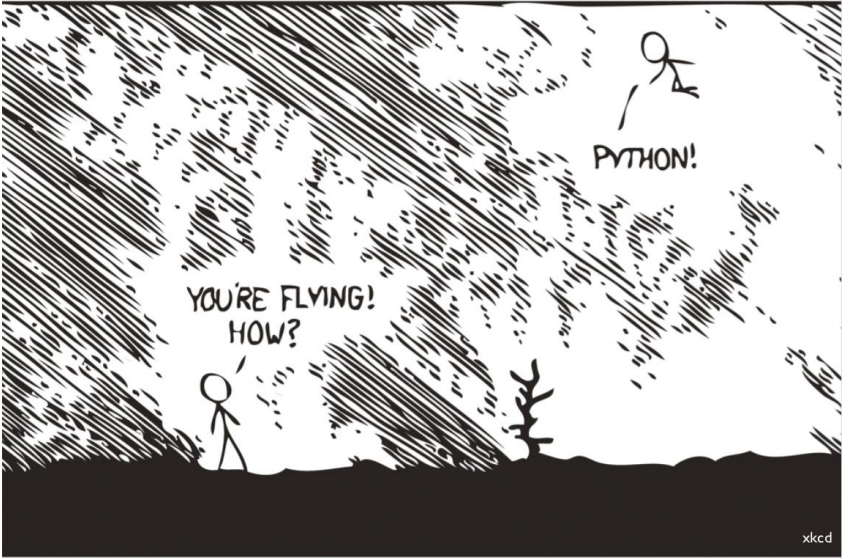
Big Data



we need Big Learning


Large NN
Medium NN
Small NN
Traditional learning algo
Performance
Amount of data
Andrew Ng, Machine Yearning

Tools


PYTHON!
YOU'RE FLYING! HOW?
xkcd

Programming

IP[y]: IPython
Interactive Computing

pandas

$$y_{it} = \beta' x_{it} + \mu_i + \epsilon_{it}$$

Biltzstein, Data Sciences

scikits learn

machine learning in Python

NumPy

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matplotlib