PACMANN AI

Machine Learning for Beginners

PACMANN AI

Introduction to Machine Learning

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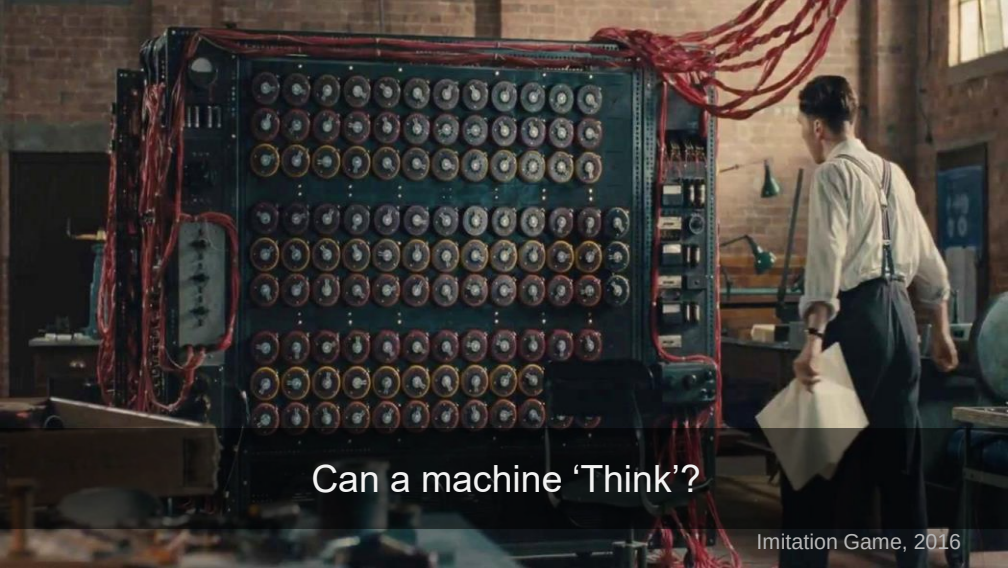
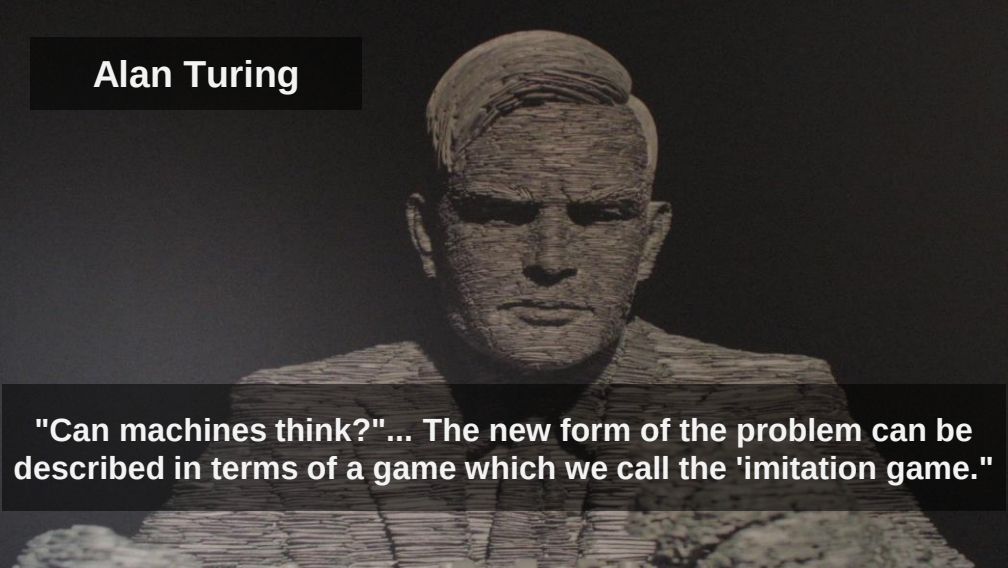
PACMANN AI

Introduction to Machine Learning

Adityo Sanjaya

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

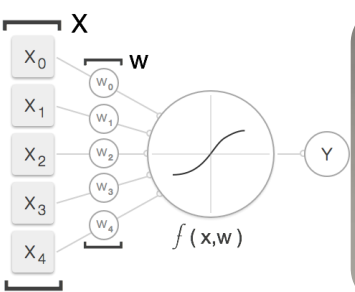
Machine Learning Historical Background

- Born from the ambitious goal of Artificial Intelligence

Dartmouth AI Conferences

Machine Learning Historical Background

- Perceptron: first artificial neuron.



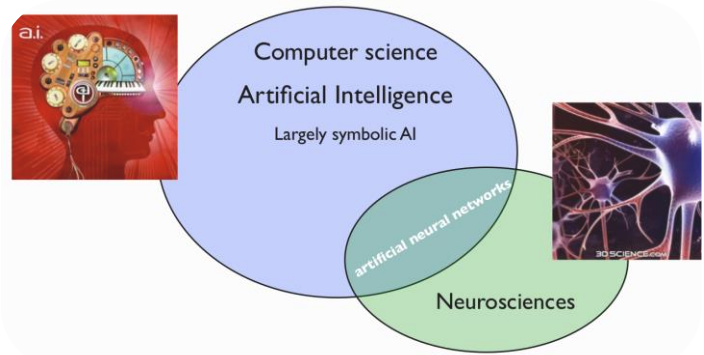
Rossenbalt, source: Wikipedia

Machine Learning:

- Learning
- Poor handling of uncertainty
- Hard coding

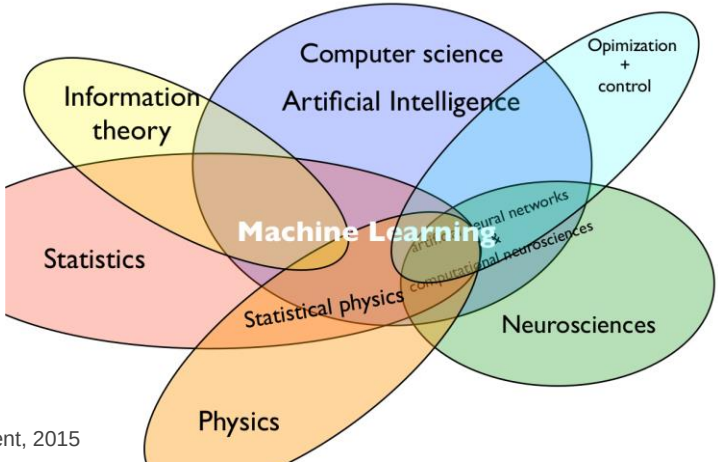
Machine Learning Historical Background

Artificial Intelligence 1960s



Pascal Vincent, 2015

Machine Learning Current View

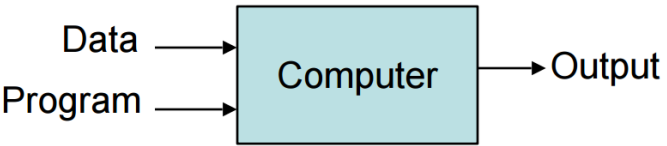


Pascal Vincent, 2015

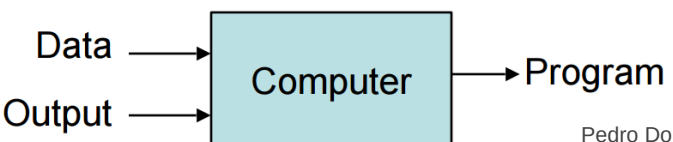
What is Machine Learning?

- “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

Motivation

1. The intent of the lecture is not to explain details of building ML systems.

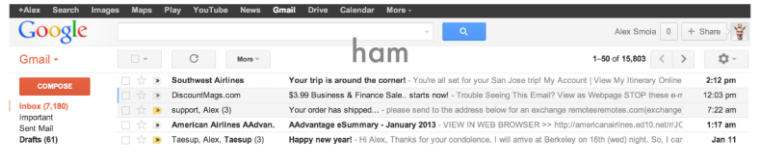
1. Rather it is an overview of what can be accomplished with ML.

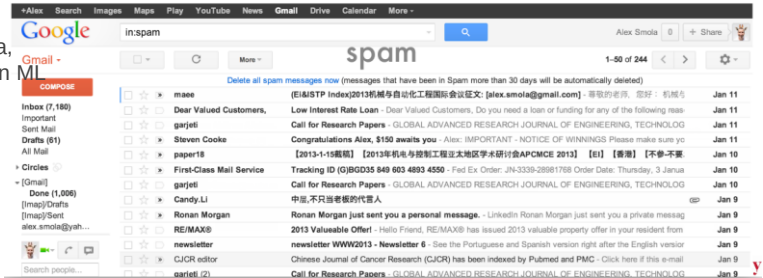
1. If it inspires you, then you'll have to take the course and learn a lot of cool stuff !


Machine Learning in The Wild

Classification

Spam Filtering

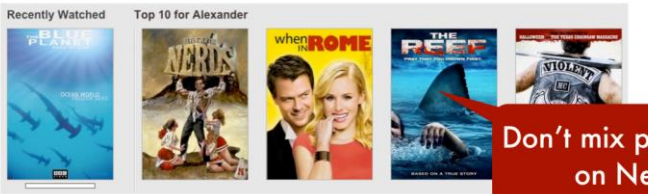




Alex Smola, Introduction ML

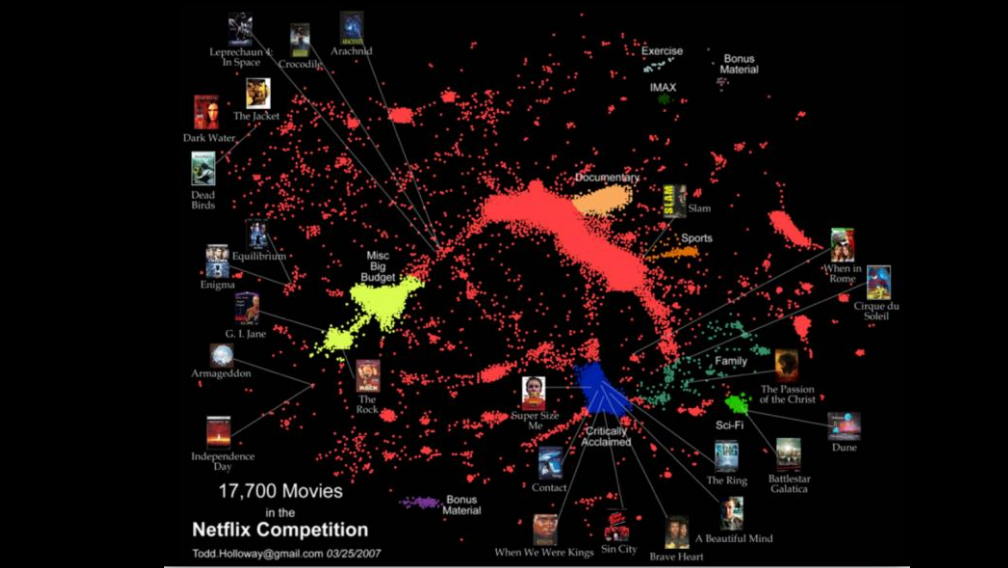
Product Recommendation: Imputing Missing Data

Collaborative Filtering

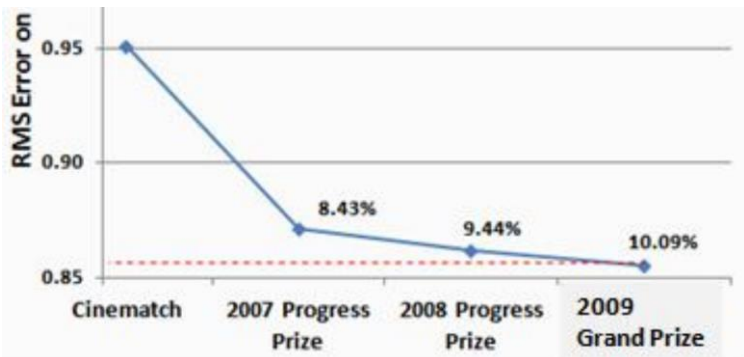


Alex Smola, Introduction ML

Netflix Prize


Leprechaun 6: In Space
Crocodile
Arachnid
Exercise
Bonus Material
IMAX
The Jacket
Dark Water
Dead Birds
Documentary
Slam
Sports
Equilibrium
Enigma
Misc Big Budget
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

3 Years Later…

"We evaluated some of the new methods offline but the **additional accuracy gains** that we measured **did not seem to justify the engineering effort** needed to bring them into a **production environment**."

Xavier Amatriain and Justin Basilico, 2012

Time Series Prediction

Prediction

Alex Smola,
Introduction ML

tomorrow's stock price

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

Alex Smola,
Introduction ML

Imitation Learning in Games

Black & White
Lionsgate Studios

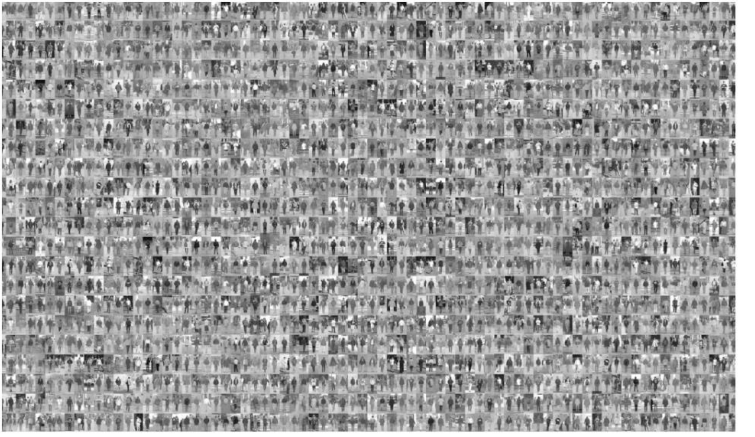
Alex Smola,
Introduction M

“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]

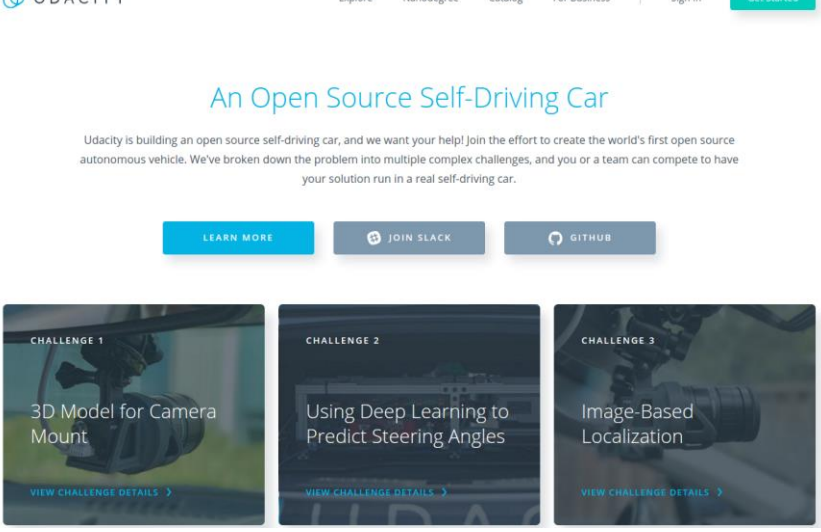

intel
Google
NXP
MDV
MOHR DAVIDOW VENTURES
Red Bull
ibeo
Powered by Diesel

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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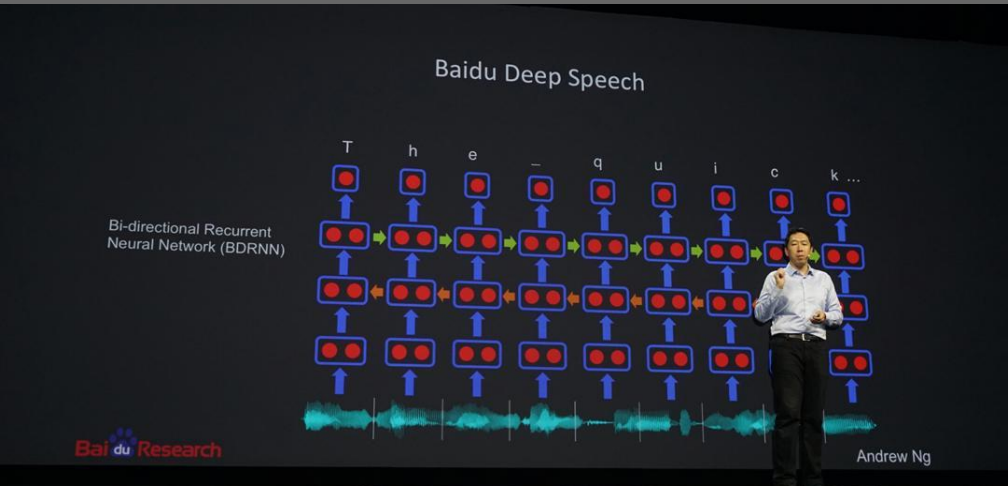
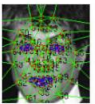
CHALLENGE 1
3D Model for Camera Mount
VIEW CHALLENGE DETAILS
CHALLENGE 2
Using Deep Learning to Predict Steering Angles
VIEW CHALLENGE DETAILS
CHALLENGE 3
Image-Based Localization
VIEW CHALLENGE DETAILS

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.

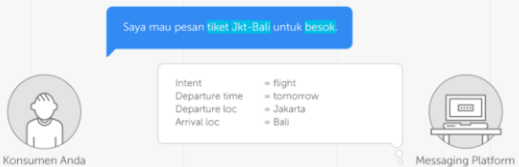
[Kotzias, Denil, Blunsom & NdF, 2014]

Chatbot

Kata.ai

Penuh Potensi. Tanpa Pretensi.

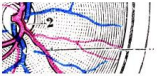
Kata.ai menyediakan chatbot yang menguasai Bahasa Indonesia dengan teknologi Natural Language Processing (NLP) untuk meningkatkan customer engagement.



PRODUK

02

Healthcare



Completed • $100,000 • 661 teams

Diabetic Retinopathy Detection

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

Dashboard

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Data
Make a submission

Information
Description
Evaluation
Rules
Prizes
References
Timeline

Forum

Kernels
New Script
New Notebook

Leaderboard
Public
Private

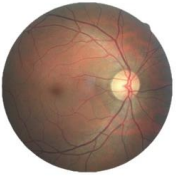
Private Leaderboard

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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Fourier Based Tutorial
Resources
Timeline

Forum

Leaderboard
Public
Private

Private Leaderboard

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

Transforming How We Diagnose Heart Disease

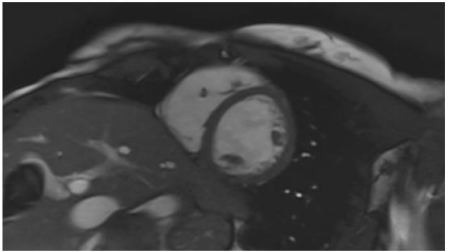
We all have a heart. Although we often take it for granted, it's our heart that gives us the moments in life to imagine, create, and discover. Yet cardiovascular disease threatens to take away these moments. Each day, 1,500 people in the U.S. alone are diagnosed with heart failure—but together, we can 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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Make a submission

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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.

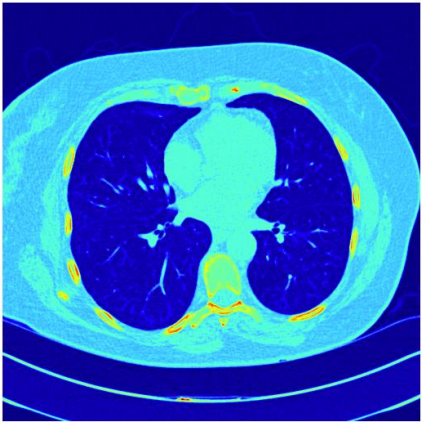
One year ago, the office of the U.S. Vice President spearheaded a bold new initiative, the Cancer Moonshot, to make a decade's worth of progress in cancer prevention, diagnosis, and treatment in just 5 years.

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.



Education

Machine Teaching: An Inverse Problem to Machine Learning and an Approach Toward Optimal Education

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Madison, WI, USA 53706
jerryzhu@cs.wisc.edu

Abstract

I draw the reader's attention to machine teaching, the problem of finding an optimal training set given a machine learning algorithm and a target model. In addition to generating fascinating mathematical questions for computer scientists to ponder, machine teaching holds the promise of enhancing education and personnel training. The Socratic dialogue style aims to stimulate critical thinking.

Of Machines

Q: *I know machine learning: What is machine teaching?*

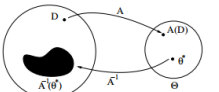
Consider a "student" who is a machine learning algorithm, for example, a Support Vector Machine (SVM) or kmeans clustering. Now consider a "teacher" who wants the student to learn a target model θ^*. For example, θ^* can be a specific hyperplane in SVM, or the location of the k centroids in kmeans. The teacher knows θ^* and the student's learning algorithm, and teaches by giving the student training examples. Machine teaching aims to design the optimal training set D.

Q: *What do you mean by optimal?*

One definition is the cardinality of D: the smaller $|D|$ is, the better. But there are other definitions as we shall see.

Q: *If we already know the true model θ^*, why bother training a learner?*

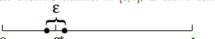
The applications are such that the teacher and the learner are separate entities, and the teacher cannot directly "hard wire" the learner. One application is education where the learner is a human student. A more sinister "application" is security where the learner is an adaptive spam filter, and the "teacher" is a hacker who wishes to change the filtering behavior by sending the spam filter specially designed messages. Regardless of the intention, machine teaching aims to maximally influence the learner via optimal training data.



Given a training set $D \in \mathbb{D}$, machine learning returns a model $A(D) \in \Theta$. Note A in general is many-to-one. Conversely, given a target model $\theta^* \in \Theta$ the inverse function A^{-1} returns the set of training sets that will result in θ^*. Machine teaching aims to identify the optimal member among $A^{-1}(\theta^*)$. However, A^{-1} is often challenging to compute, and may even be empty for some θ^*. Machine teaching must handle these issues.

Q: *Isn't machine teaching just active learning / experimental design?*

No. Recall active learning allows the learner to "ask questions" by selecting items x and asking an oracle for its label y (Settles 2012). Consider learning a noiseless threshold classifier in $[0, 1]$, as shown below.



To learn the decision boundary θ^* up to ϵ, active learning needs to perform binary search with $\log(\frac{1}{\epsilon})$ queries. In contrast, in machine teaching the teacher only needs **two** examples: $(\theta^* - \frac{\epsilon}{2}, -1)$, $(\theta^* + \frac{\epsilon}{2}, +1)$. The key difference is that the teacher knows θ^* upfront and doesn't need to explore. Note passive learning, where training items x are sampled *iid* uniformly from $[0, 1]$, requires $O(\frac{1}{\epsilon})$ items.

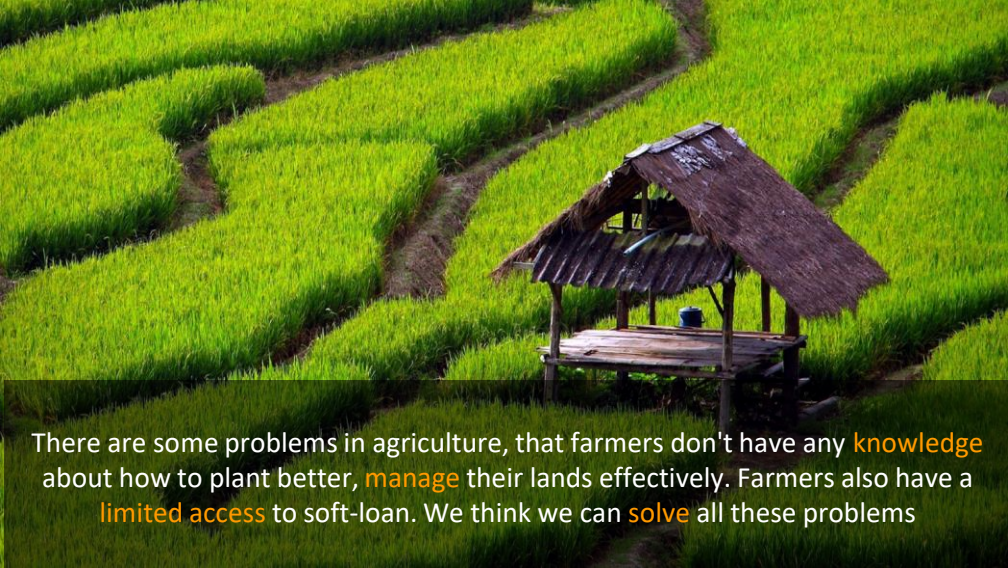
Q: *So the teacher can create arbitrary training items?*

Abstract

I draw the reader's attention to machine teaching, the problem of finding an optimal training set given a machine learning algorithm and a target model. In addition to generating fascinating mathematical questions for computer scientists to ponder, machine teaching holds the promise of enhancing education and personnel training. The Socratic dialogue style aims to stimulate critical thinking.

Smart Farming


What Is Smart Farming?
PACMANN AI



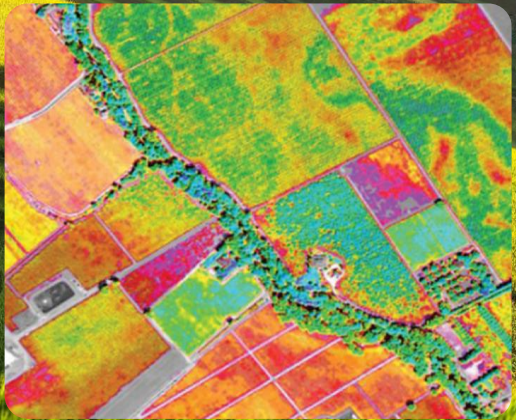
There are some problems in agriculture, that farmers don't have any knowledge about how to plant better, manage their lands effectively. Farmers also have a limited access to soft-loan. We think we can solve all these problems

Credit Rating Map PACMANN AI

Sensor

Drone

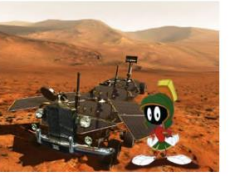
Super Computer



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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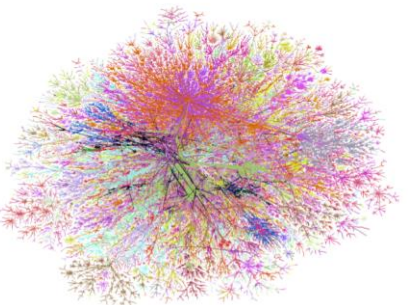

>10B useful webpages

Data - Identity & Graph

- Webpages (content, graph)
- Clicks (ad, page, social)
- Users (OpenID, FB Connect)
- e-mails (Hotmail, YIMail, Gmail)
- Photos, Movies (Flickr, YouTube, Vimeo ...)
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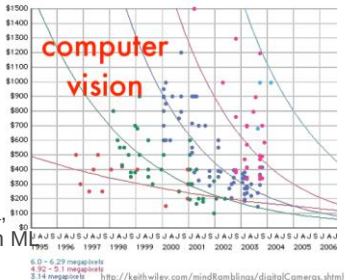
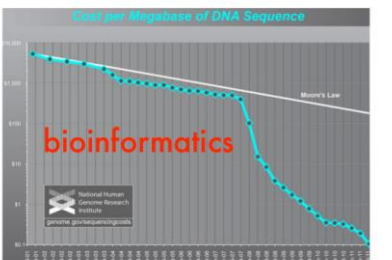
100M-1B vertices

Many more sources



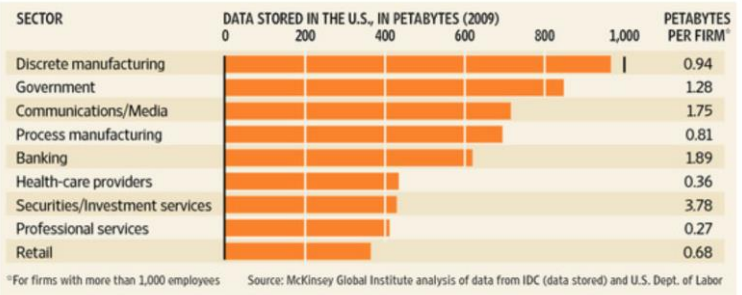


Alex Smola, Introduction M

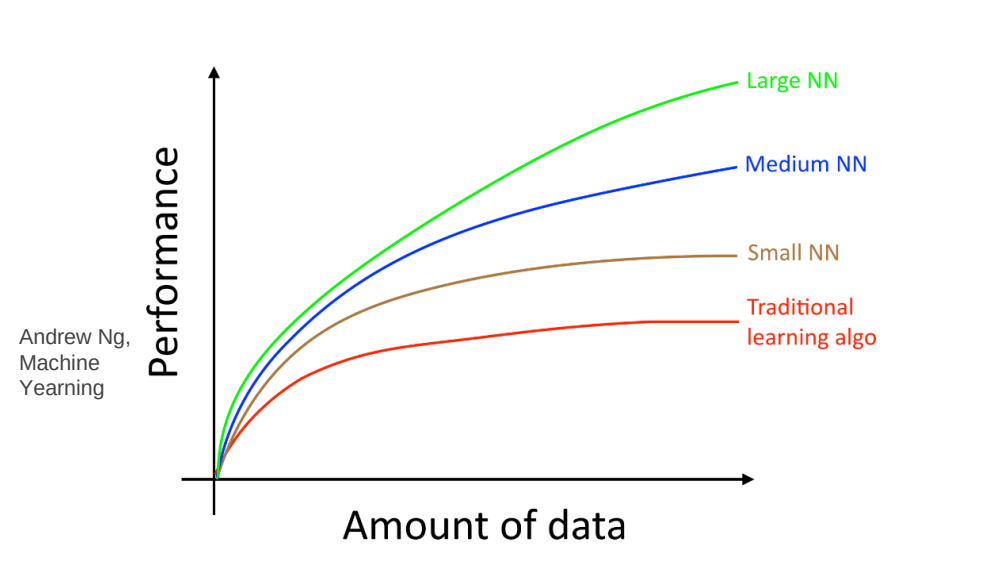
personalized sensors

ubiquitous control

Big Data



we need Big Learning


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

ML Researcher vs Statistician vs Data Analyst vs Data Scientist ?

ML Researcher vs Statistician vs Data Analyst vs Data Scientist ?

It doesn’t matter!

Hal Varian Explains...

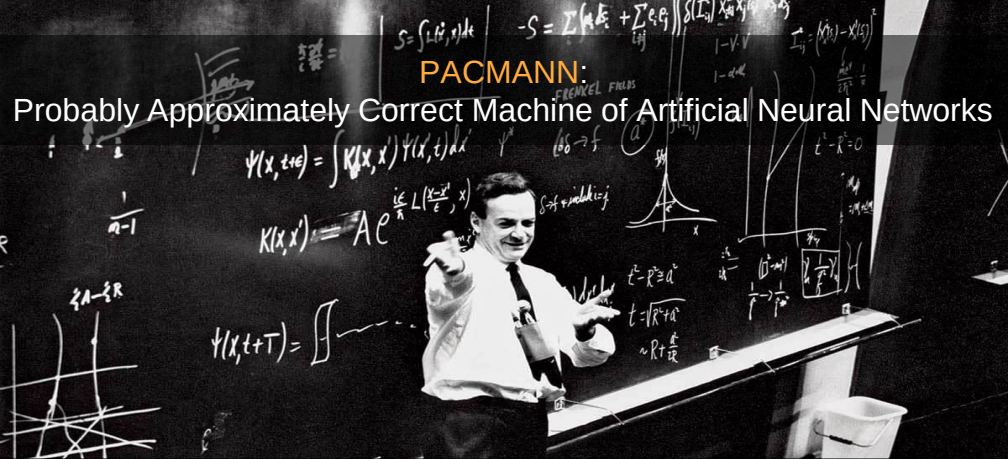
The ability to take **data** – to be able to **understand** it, to **process** it, to **extract value** from it, to **visualize** it, to **communicate** it's going to be a hugely important skill in the next decades, not only at the professional level but even at the educational level for elementary school kids, for high school kids, for college kids. Because now we really do have essentially free and **ubiquitous data**." – Hal Varian

Biltzstein, Data Sciences Class

Who are we?

PACMANN:

Probably Approximately Correct Machine of Artificial Neural Networks



We are a research group focusing on mathematical modeling and learning algorithm

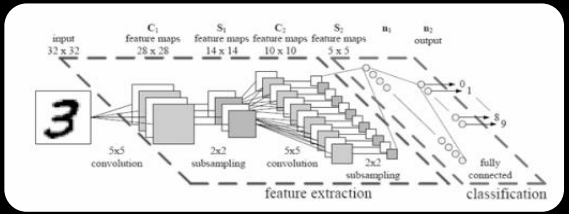
What we do:

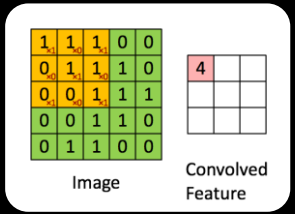
We are focusing on Computational Learning Theory as in PAC Learning and Artificial Neural Networks especially Deep Learning.

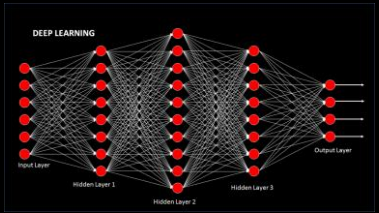
PACMANN

Research

PACMANN Research: Image Recognition



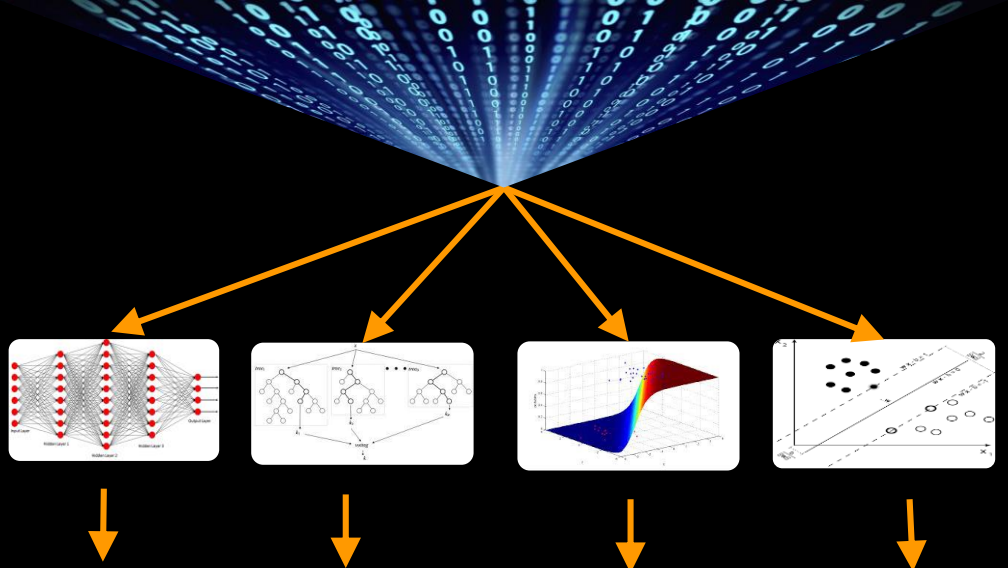


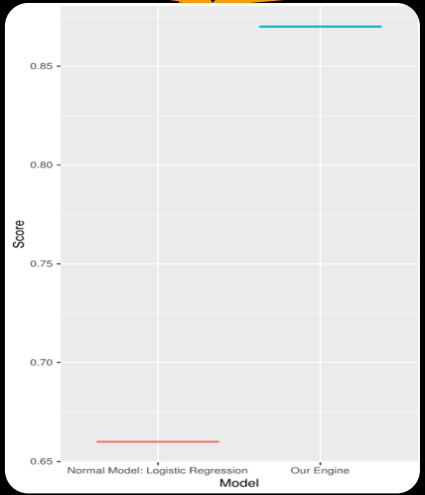


PACMANN Research: Optimizing Predictive Power

Geoffrey Hinton

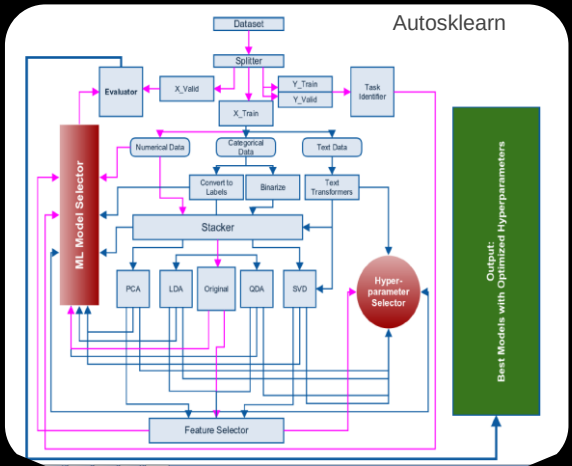
Dark Knowledge: The easiest way to extract a lot of knowledge from the
training data is to learn many different models in parallel



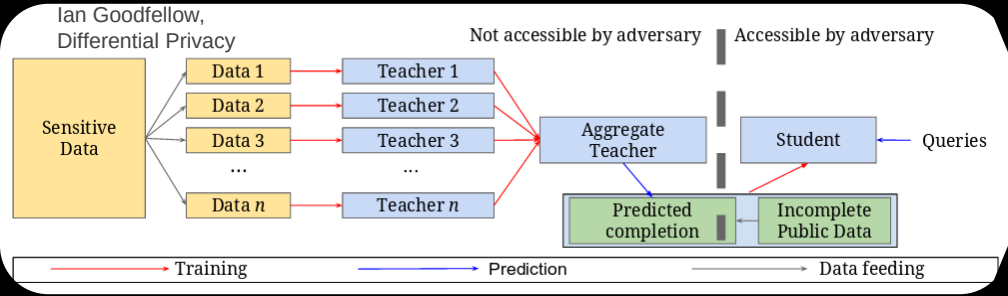

0.85
0.80
0.75
0.70
0.65
Score
Normal Model: Logistic Regression
Our Engine
Model

PACMANN Research:

Automated Machine Learning



Differential Privacy



Silabus

FMIPA

MACHINE LEARNING
For Beginners

FREE!

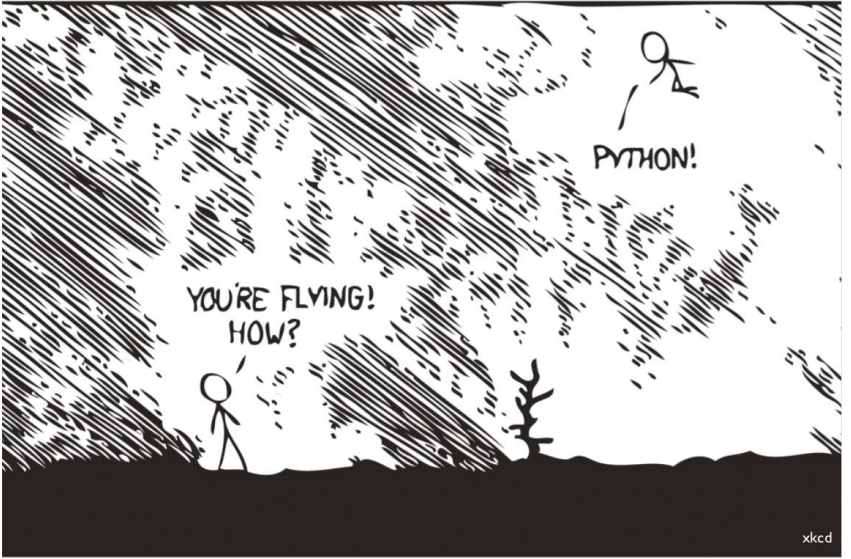
Tools:
- Python
- Scikit Learn
- Your own laptop

Introduction to ML	Python Scikit Learn	Intuition of the Models
KNN & Naive Bayes	Bias-Variance & Resampling	Linear Regression
Lasso & Ridge Regression	Logistic Regression	Support Vector Machines
Decision Tree	Bagging & Random Forest	Boosting
Study Cases		Advice in Learning ML

30th Jan until 3rd Feb 2017
09.00-16.00 at D108
Department of Mathematics FMIPA UI

Registration:
bit.ly/ML_Free_Training
CP: 089620615729 (Dhafin)

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

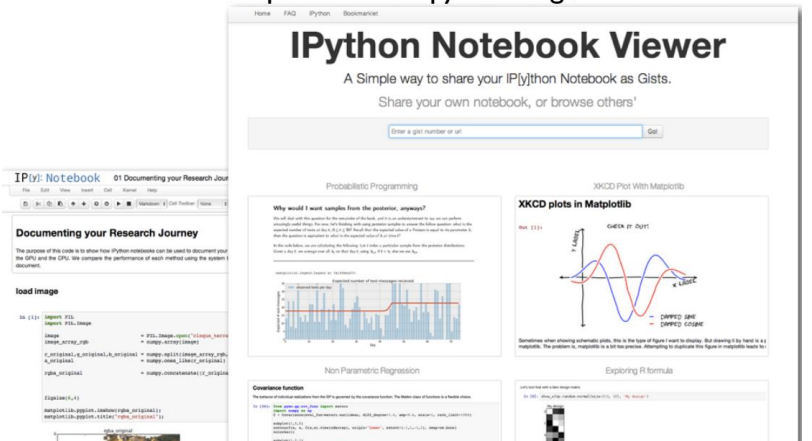
SciPy.org

Sponsored by ENTHOUGHT

matplotlib

IPython Notebooks

http://nbviewer.ipython.org/



Thank you, question?