

Welcome to Evolve Machine Learning

Personal Introduction

- Education
 - ITB
 - University of Applied Science Mannheim, Germany
 - Fern Universitaet Hagen, Germany
- Job Experiences
 - Consultant IT(Machine Learning)
 - Detik.com
 - Markant AG, Germany
 - Abkoo AG, Germany
 - Volz Stopa, Germany

Personal Introduction

- Open source projects

- https://github.com/jonysugianto/dfa_nn

- Direct feedback alignment learning algorithm for multilayer feed forward network and multilayer convolutional neural network.
 - Language: Go

- <https://github.com/jonysugianto/gng>

- Supervised and unsupervised learning algorithms for growing neural gas
 - Language: Scala

- <https://github.com/jonysugianto/textvectorization>

- Text vectorization algorithms
 - Language: Python

- https://github.com/jonysugianto/vad_lsfm

- Efficient voice activity detection algorithm using long-term spectral flatness measurement
 - Language: Go

- <https://github.com/jonysugianto/gscng>

- Generalized Sparse Coding Neural Gas : Learning of Overcomplete Data Representations
 - Language: Scala

- <https://github.com/jonysugianto/mathlib>

- Math library functions for neural network
 - Language: Go

Personal Introduction

- Private Projects

2007-2009

Implementing quality control of map materials with Java Topology Suite and Postgis

Implementing Mapserver with OpenMap

Implementing Routeplanner with JgraphT and Jess

Implementing Cityguide Web Application with Google Web Toolkit

Implementing Cityguide Mobile App Application with J2ME

Develop Symbian based Application for finding BTS Tower Location

2013-2014

Implement Power Normalized Cepstral Coefficient for Voice Data Preparation in noisy Environment

Voice Command Map Navigation while car driving

first version with HMM and the second version with Convolutional Neural Network

2015

Song Identification

Using Source codes from Voice Recognition projects and Akka Framework(handling performance issue)

Personal Introduction

- Private Projects

2013-2015 Implement Algorithms in Scala

Parallel and Distributed Genetic Algorithm(intensive use of Akka Framework)

Convolutional Neural Network

Deep Stacked Autoencoder

Deep Stacked Denoising Autoencoder

Implement Algorithms in Go

Parallel and Distributed Genetic Algorithm(Intensive use of go channels)

Long Short Term Memory Neural Network(Lstm)

Deep Stacked Lstm

Convolutional Neural Network

2016 Implement “semantic folding theory” (cortical.io) for Indonesian Text Natural
and develop Algorithm for the similarity between topics

language Processing

2017 Research for building new algorithms in machine learning based on neocortical
model

Small Talk

- Background
- Current Job
- Why learn Machine Learning?

What is Machine Learning?

Example: Netflix Challenge

- Goal: Predict how a viewer will rate a movie
- 10% improvement = 1 million dollars



The screenshot shows the official Netflix Prize website. At the top, it says "NETFLIX" and "Netflix Prize". Below that is a "Welcome!" message: "The Netflix Prize aims to substantially improve the accuracy of predictions about how much a user will like a movie. It's going to take a lot of work, but we're up for the challenge. We're offering a \$1,000,000 prize to the team that can build the best system. Enter now!" There are also sections for "Movies For You" and "You really liked it...".



A photograph of seven men standing behind a large ceremonial check. The check is from Netflix to BellKor's Pragmatic Chaos for \$1,000,000, dated 09.21.09, for the Netflix Prize. The men are dressed in business attire, and the background features a red banner with the word "The" partially visible.

Example: Netflix Challenge

- Goal: Predict how a viewer will rate a movie
- 10% improvement = 1 million dollars
- Essence of Machine Learning:
 - A pattern exists
 - We cannot pin it down mathematically
 - We have data on it

AlphaGo vs Lee Sedol





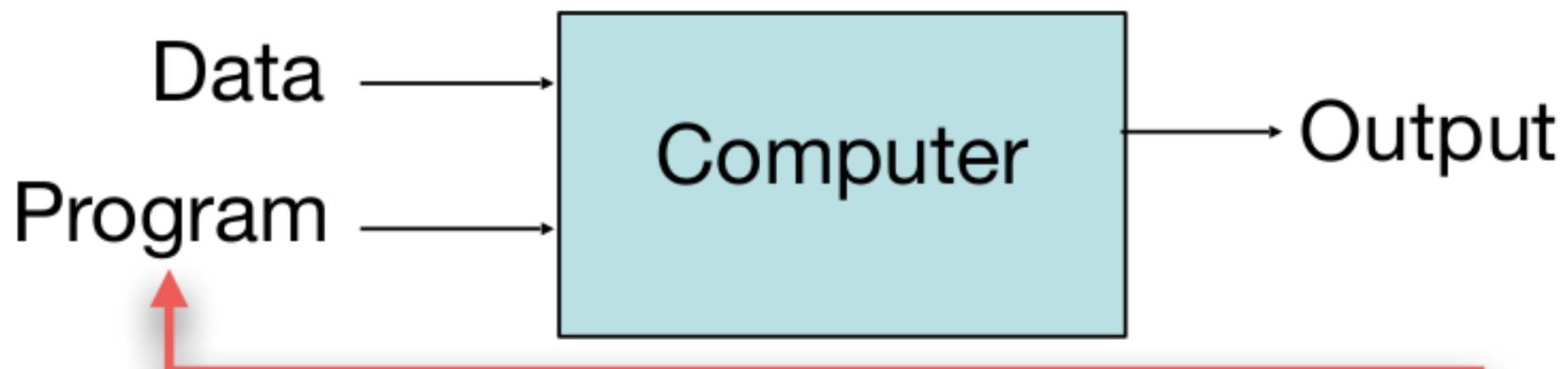
End-to-End Learning for Self-Driving Cars

NVIDIA BB8 AI Car

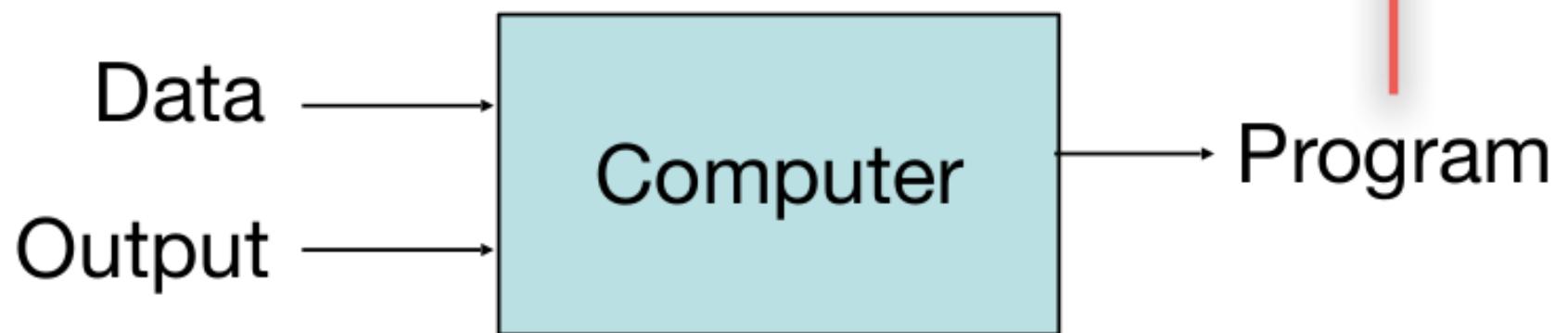


Comparison

- **Traditional Programming**



- **Machine Learning**



Why Study Machine Learning?

Engineering Better Computing Systems

- Develop systems
 - too difficult/expensive to construct manually
 - because they require specific detailed skills/knowledge
 - ***knowledge engineering bottleneck***
- Develop systems
 - that adapt and customize themselves to individual users.
 - Personalized news or mail filter
 - Personalized tutoring
- Discover new knowledge from large databases
 - Medical text mining (e.g. migraines to calcium channel blockers to magnesium)
 - ***data mining***

Why Study Machine Learning?

cognitive Science

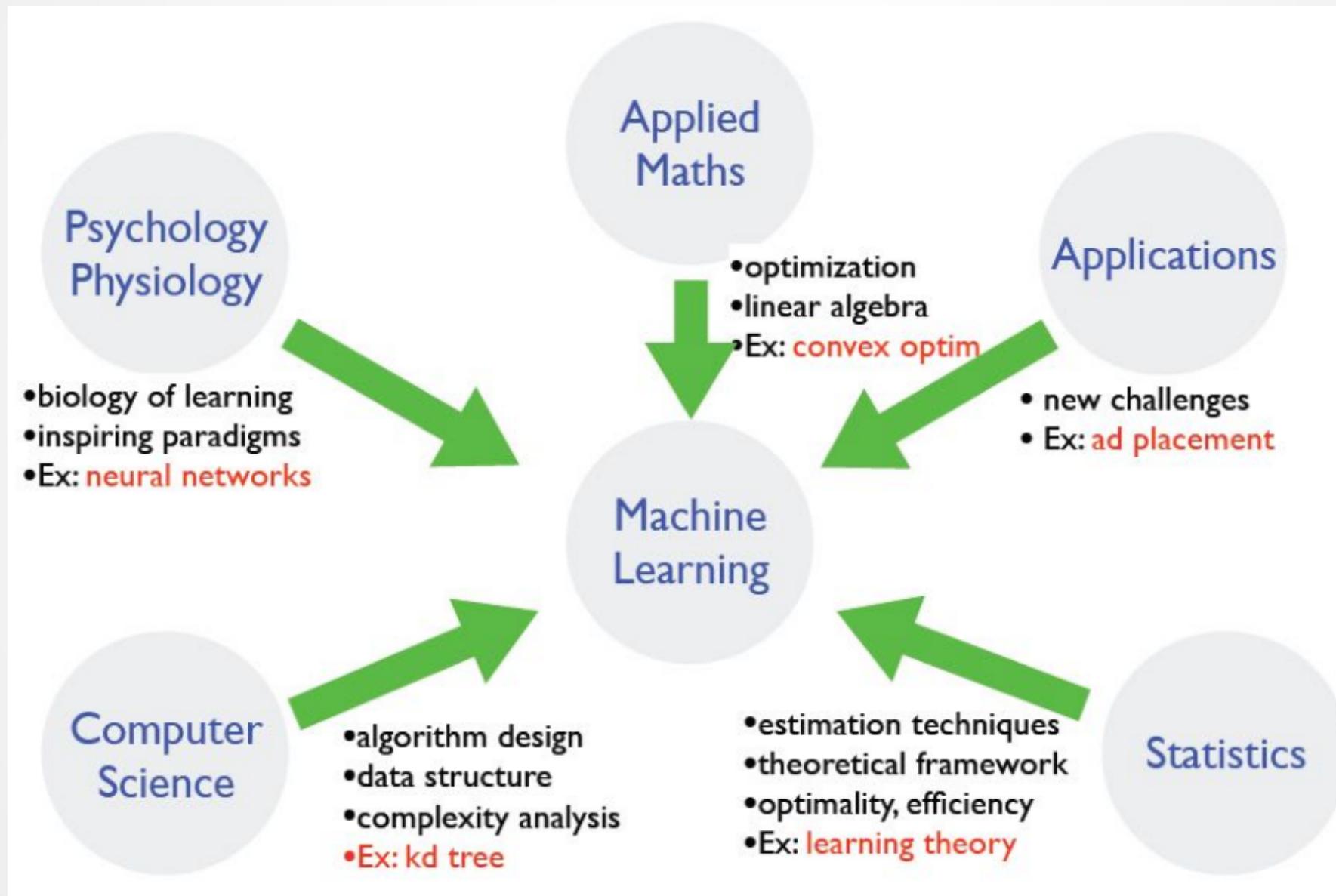
- Computational studies of learning may help us understand learning in humans
 - and other biological organisms.
- Hebbian neural learning
 - “Neurons that fire together, wire together.”

Why Study Machine Learning?

The Time is Ripe

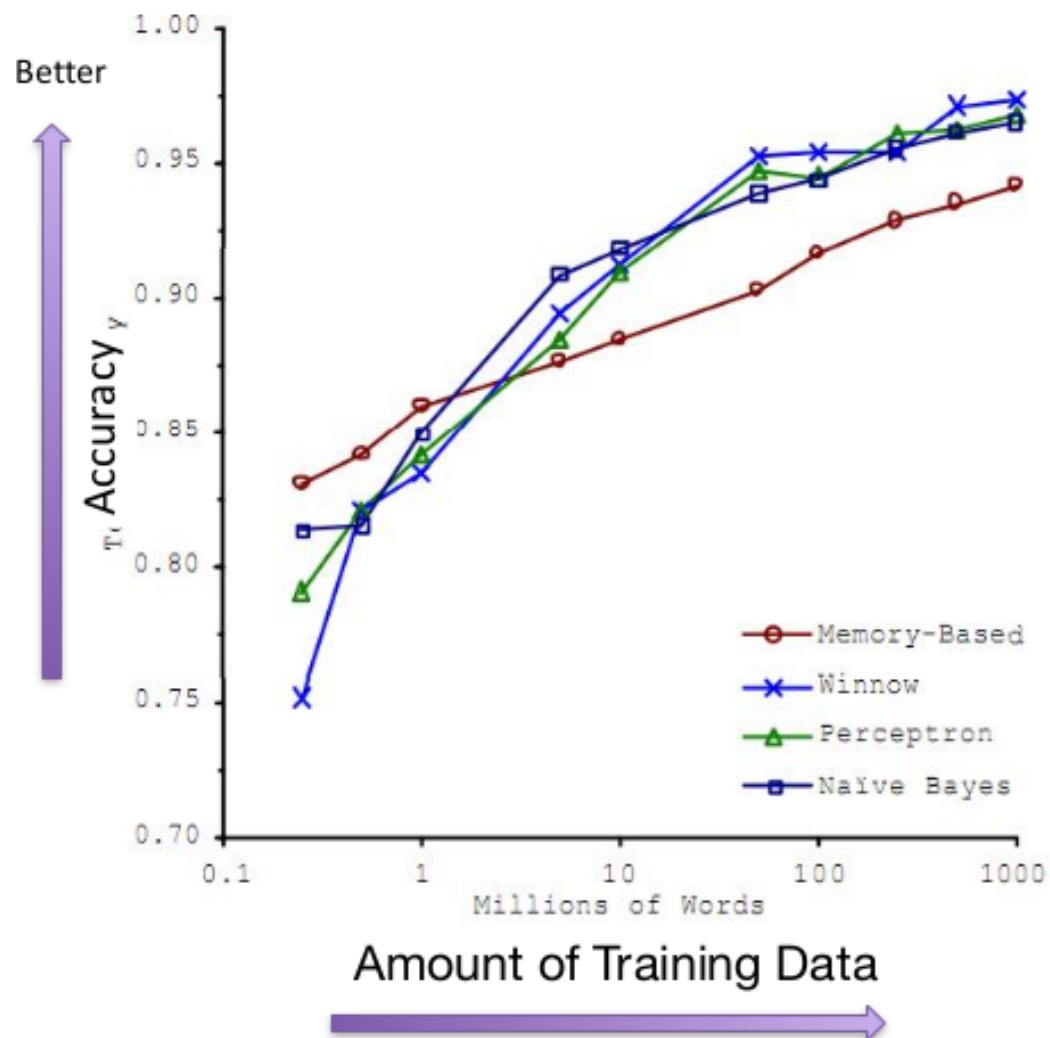
- Algorithms
 - Many basic effective and efficient algorithms available.
- Data
 - Large amounts of on-line data available.
- Computing
 - Large amounts of computational resources available.

Where does ML fit in?



Why are things working today?

- More compute power
- More data
- Better algorithms/ models



Machine Learning Examples

Pose Estimation



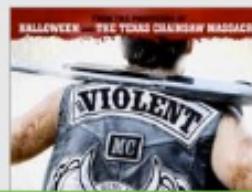
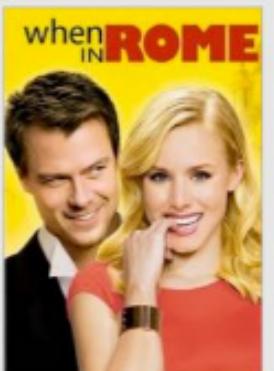
Machine Learning Examples

Collaborative Filtering

Recently Watched

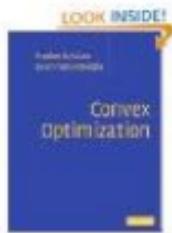


Top 10 for Alexander



Don't mix preferences on Netflix!

Customers Who Bought This Item Also Bought



Convex Optimization by
Stephen Boyd

★★★★★ (11)

\$65.78



[Point Processes \(Chapman & Hall / CRC Monographs on Statistics and Applied Probability\)](#) by D.R. Cox

\$125.47



Probabilistic Graphical Models: Principles and Techniques by Daphne Koller

★★★★★ (5)

\$71.52

Amazon books

Machine Learning Examples

Collaborative Filtering

BUSINESS INSIDER RETAIL

Amazon is being forced to review its website after it reportedly recommended shoppers buy items that can create explosives

Kate Taylor  
 © Sep. 20, 2017, 11:51 AM  6,591

[!\[\]\(9db8a0a2f8bc6ba7b48b09b6c779aced_img.jpg\) FACEBOOK](#) [!\[\]\(46a9da4e80960b218064a134fd098eb1_img.jpg\) LINKEDIN](#) [!\[\]\(30b3510f6b04bcb01c1ecb2b08a6b894_img.jpg\) TWITTER](#) [!\[\]\(3fcd2cf5f920c7c0c47db4cbbd1db4ea_img.jpg\) EMAIL](#) [!\[\]\(a03b456e5dc7ecff9132cc91a5934215_img.jpg\) PRINT](#)

Amazon is doing some self-examination after its website suggested customers purchase potentially dangerous groupings of products.

On Wednesday, Amazon told Reuters it was "reviewing its website" after the UK's Channel 4 News reported that the e-commerce giant's algorithm suggests that shoppers pair certain items with products that can be used to create homemade explosives.

Frequently bought together



Total price: **\$50.87**

[Add all three to Cart](#)

[Add all three to List](#)

<input checked="" type="checkbox"/>	...	\$25.99
<input checked="" type="checkbox"/>	...	\$3.89
<input checked="" type="checkbox"/>	...	\$20.99

This chemical compound's "frequently bought together" suggestions are the necessary ingredients to create a dangerous reaction. [Amazon.com](#)

Machine Learning Examples

Imitation Learning in Games



Black & White
Lionsgate Studios

Machine Learning Examples

Reinforcement Learning

```
Game will be controlled through named FIFO pipes.
Size 160-210
OK
<type 'str'> 67200
<type 'numpy.ndarray'> 84
S: 1 A: 0 R: 0 D: 0
Start

action: 1
S: 2 A: 1 R: 1 D: 0
_____
Reward 0

action: 1
S: 3 A: 2 R: 2 D: 0
_____
Reward 0

action: 1
S: 4 A: 3 R: 3 D: 0
_____
Reward 0

action NEURALNET: 3
S: 5 A: 4 R: 4 D: 1
_____
Reward 0

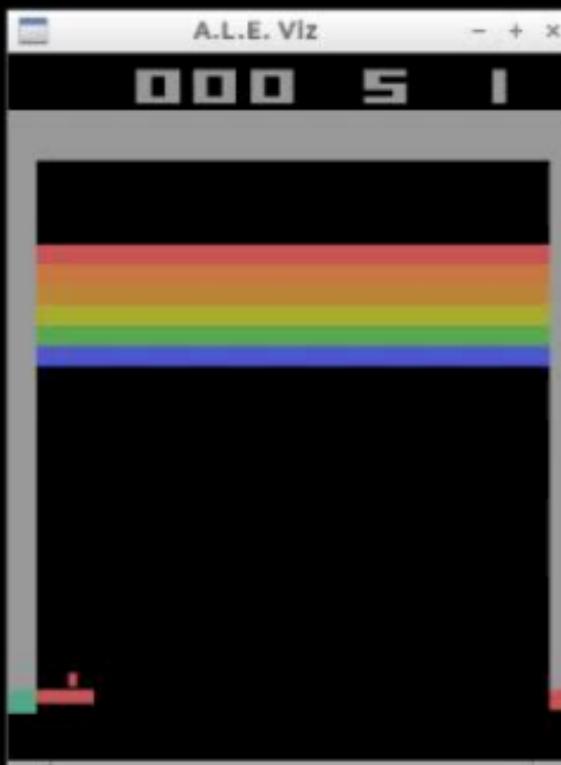
action NEURALNET: 3
S: 6 A: 5 R: 5 D: 2
_____
Reward 0

action NEURALNET: 8
S: 7 A: 6 R: 6 D: 3
_____
Reward 0

action NEURALNET: 3
S: 8 A: 7 R: 7 D: 4
_____
Reward 0

action NEURALNET: 8
S: 9 A: 8 R: 8 D: 5
_____
Reward 0

action NEURALNET: 3
```



Machine Learning Examples

Reinforcement Learning



Machine Learning Examples

Spam Filtering

+Alex Search Images Maps Play YouTube News Gmail Drive Calendar More

Google ham

Alex Smola 0 + Share 

Gmail COMPOSE

Inbox (7,180) Important Sent Mail Drafts (61)

1–50 of 15,803 < > 

<input type="checkbox"/>	Southwest Airlines	Your trip is around the corner! - You're all set for your San Jose trip! My Account View My Itinerary Online	2:12 pm
<input type="checkbox"/>	DiscountMags.com	\$3.99 Business & Finance Sale.. starts now! - Trouble Seeing This Email? View as Webpage STOP these e-m	12:03 pm
<input type="checkbox"/>	support, Alex (3)	Your order has shipped... - please send to the address below for an exchange remotesremotes.com/exchange	7:22 am
<input type="checkbox"/>	American Airlines AAdvan.	AAdvantage eSummary - January 2013 - VIEW IN WEB BROWSER >> http://americanairlines.ed10.net/nJC	1:17 am
<input type="checkbox"/>	Taesup, Alex, Taesup (3)	Happy new year! - Hi Alex, Thanks for your condolence. I will arrive at Berkeley on 16th (wed) night. So, I car	Jan 11

+Alex Search Images Maps Play YouTube News Gmail Drive Calendar More

Google in:spam

Alex Smola 0 + Share 

Gmail COMPOSE

Inbox (7,180) Important Sent Mail Drafts (61) All Mail Circles 

Done (1,006) [imap]/Drafts [imap]/Sent alex.smola@yahoo.com 

Search people... Barak Pearlmutter...

1–50 of 244 < > 

Delete all spam messages now (messages that have been in Spam more than 30 days will be automatically deleted)

<input type="checkbox"/>	maee	(Ei&ISTP Index)2013机械与自动化工程国际会议征文: [alex.smola@gmail.com] - 尊敬的老师, 您好: 机械与	Jan 11
<input type="checkbox"/>	Dear Valued Customers,	Low Interest Rate Loan - Dear Valued Customers, Do you need a loan or funding for any of the following reas	Jan 11
<input type="checkbox"/>	garjeti	Call for Research Papers - GLOBAL ADVANCED RESEARCH JOURNAL OF ENGINEERING, TECHNOLOG	Jan 11
<input type="checkbox"/>	Steven Cooke	Congratulations Alex, \$150 awaits you - Alex: IMPORTANT - NOTICE OF WINNINGS Please make sure yo	Jan 11
<input type="checkbox"/>	paper18	【2013-1-15截稿】 【2013年机电与控制工程亚太地区学术研讨会APCMCE 2013】 【EI】 【香港】 【不参-不要:	Jan 10
<input type="checkbox"/>	First-Class Mail Service	Tracking ID (G)BGD35 849 603 4893 4550 - Fed Ex Order: JN-3339-28981768 Order Date: Thursday, 3 Janua	Jan 10
<input type="checkbox"/>	garjeti	Call for Research Papers - GLOBAL ADVANCED RESEARCH JOURNAL OF ENGINEERING, TECHNOLOG	Jan 10
<input type="checkbox"/>	Candy.Li	中层,不只当老板的代言人 	Jan 9
<input type="checkbox"/>	Ronan Morgan	Ronan Morgan just sent you a personal message. - LinkedIn Ronan Morgan just sent you a private messag	Jan 9
<input type="checkbox"/>	RE/MAX®	2013 Valueable Offer! - Hello Friend, RE/MAX® has issued 2013 valuable property offer in your resident from	Jan 9
<input type="checkbox"/>	newsletter	newsletter WWW2013 - Newsletter 6 - See the Portuguese and Spanish version right after the English versior	Jan 9
<input type="checkbox"/>	CJCR editor	Chinese Journal of Cancer Research (CJCR) has been indexed by Pubmed and PMC - Click here if this e-mail	Jan 9
<input type="checkbox"/>	garjeti (2)	Call for Research Papers - GLOBAL ADVANCED RESEARCH JOURNAL OF ENGINEERING, TECHNOLOG	Jan 9
<input type="checkbox"/>	Wayne Smith	Wayne Smith has sent you a message - Linked In Wayne Smith just sent you a message Date: 1/09/2013 hi	Jan 9

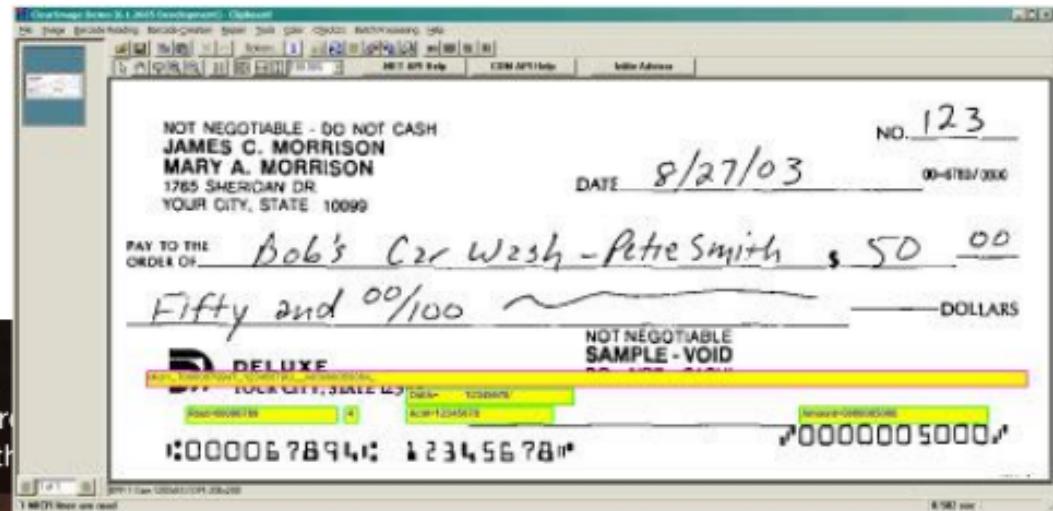
Machine Learning Examples

Cheque Reading

segment image

Photograph Front of Check

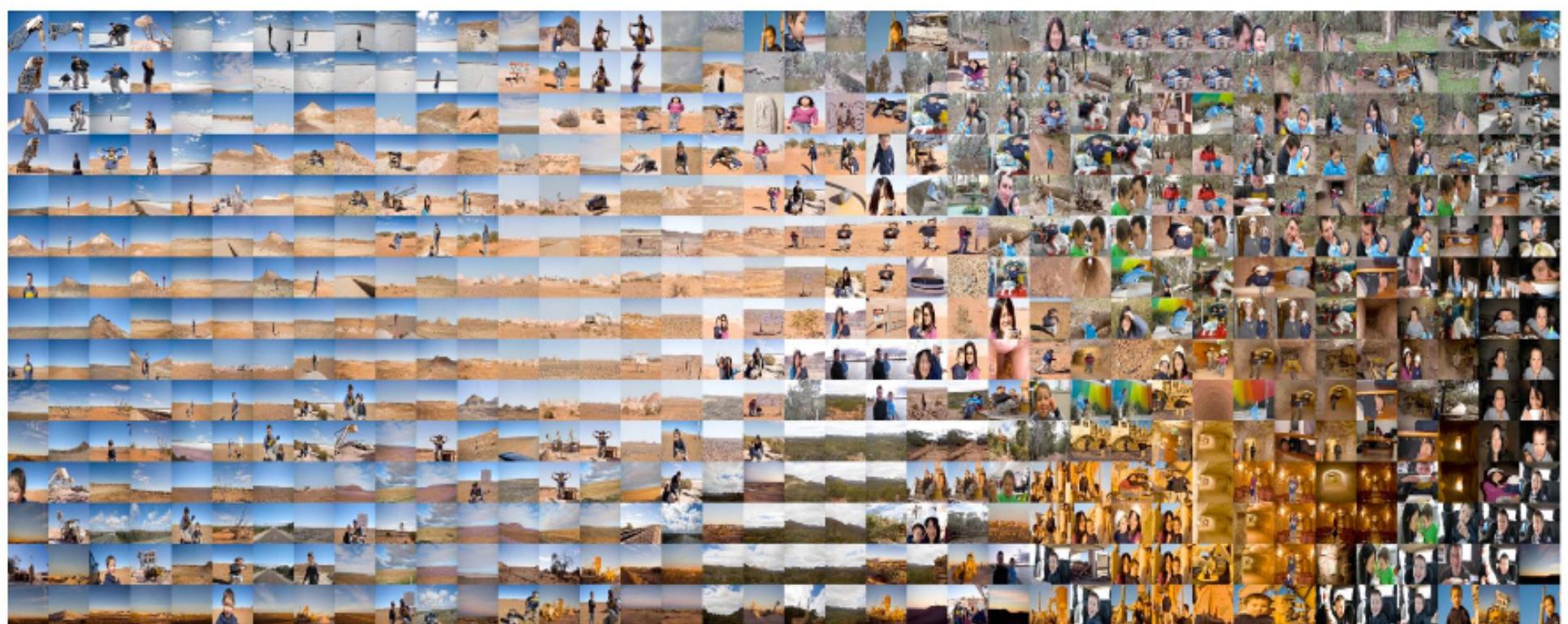
Place the check on a dark background in a well-lit area. Hold the camera steady and align the check's edges with the frame.



recognize
handwriting

Machine Learning Examples

Image Layout



- Raw set of images from several cameras
- Joint layout based on image similarity

Machine Learning Examples

Search Ads

Google mesothelioma

Web Images Maps Shopping News More Search tools

About 10,600,000 results (0.25 seconds)

Ads related to mesothelioma ⓘ

[Mesothelioma Symptoms - Lung cancer from Asbestos.](#)
www.mesothelioma-lung-cancer.org/
It can take 20-30 years to develop

What Is It? Symptoms
Portal Entrance Treatments

[Mesothelioma Symptoms - 101 Facts about Mesothelioma.](#)
www.mesothelioma-answer.org/
By Anna Kaplan, M.D.
Free Mesothelioma Book - Nutrition Book - Free Mesothelioma DVDs - Asbestos

[Mesothelioma Diagnosis? - Get the money you deserve fast](#)
www.mesotheliomaclaimscenter.info/
File with Mesothelioma Claim Center
Mesothelioma Compensation Amounts - File a Mesothelioma Claim

[Mesothelioma - Wikipedia, the free encyclopedia](#)
en.wikipedia.org/wiki/Mesothelioma
Mesothelioma (or, more precisely, malignant mesothelioma) is a rare form of cancer that develops from transformed cells originating in the mesothelium, the ...
Signs and symptoms - Cause - Diagnosis - Screening

[Mesothelioma Cancer Alliance | The Authority on Asbestos Cancer](#)
www.mesothelioma.com/
Mesothelioma treatment, diagnosis and related information for patients and families.
Legal options for those diagnosed with malignant mesothelioma.

Ads ⓘ

[Mesothelioma compensation](#)
www.simmonsfirm.com/888-360-4189
Free Consultation with Lawyers that Focus on Mesothelioma Cases.

[Mesothelioma Compensation](#)
www.sokolovelaw.com/Call_Now
Mesothelioma Diagnosis? Get the Money You Deserve! [800-581-8243](tel:800-581-8243)

[Mesothelioma 800-582-0706](#)

why these ads?

You Don't Have To Sue Anyone.
\$30 Billion Asbestos Trust Fund

[Mesothelioma & Asbestos](#)
www.navy-veterans-mesothelioma.org/
Important info for Navy Vets.
Learn About Mesothelioma Claims

[Asbestos Exposure?](#)
www.mesotheliomalawfirm.com/
Mesothelioma victims are entitled

Machine Learning Examples

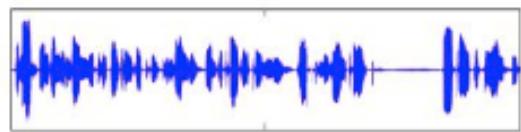
Self-Driving Cars



Machine Learning Examples

Speech Recognition

Given an audio waveform, robustly extract & recognize any spoken words

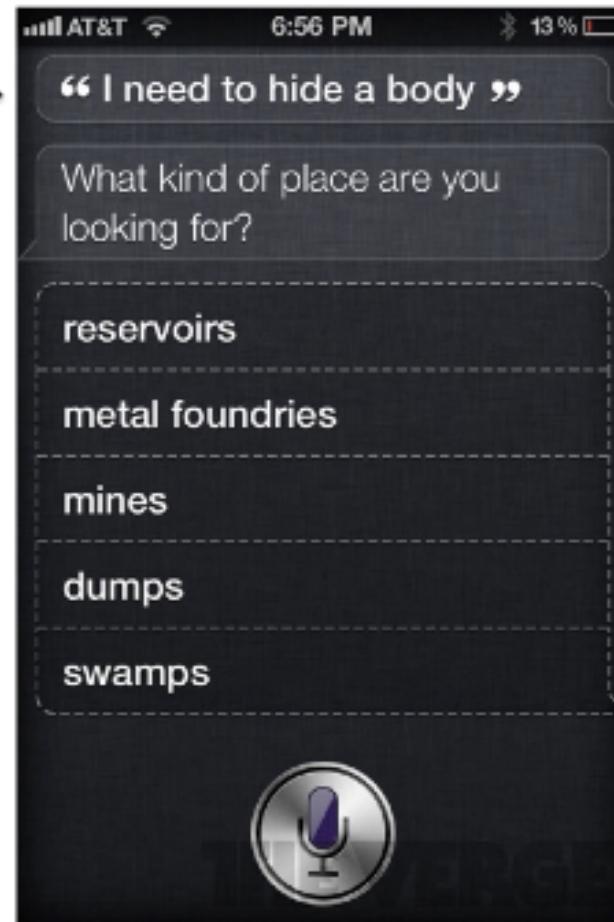
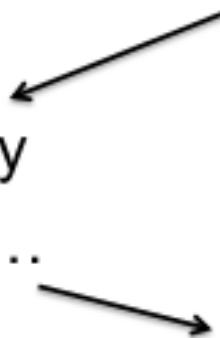


- Statistical models can be used to
 - Provide greater robustness to noise
 - Adapt to accent of different speakers
 - Learn from training

Machine Learning Examples

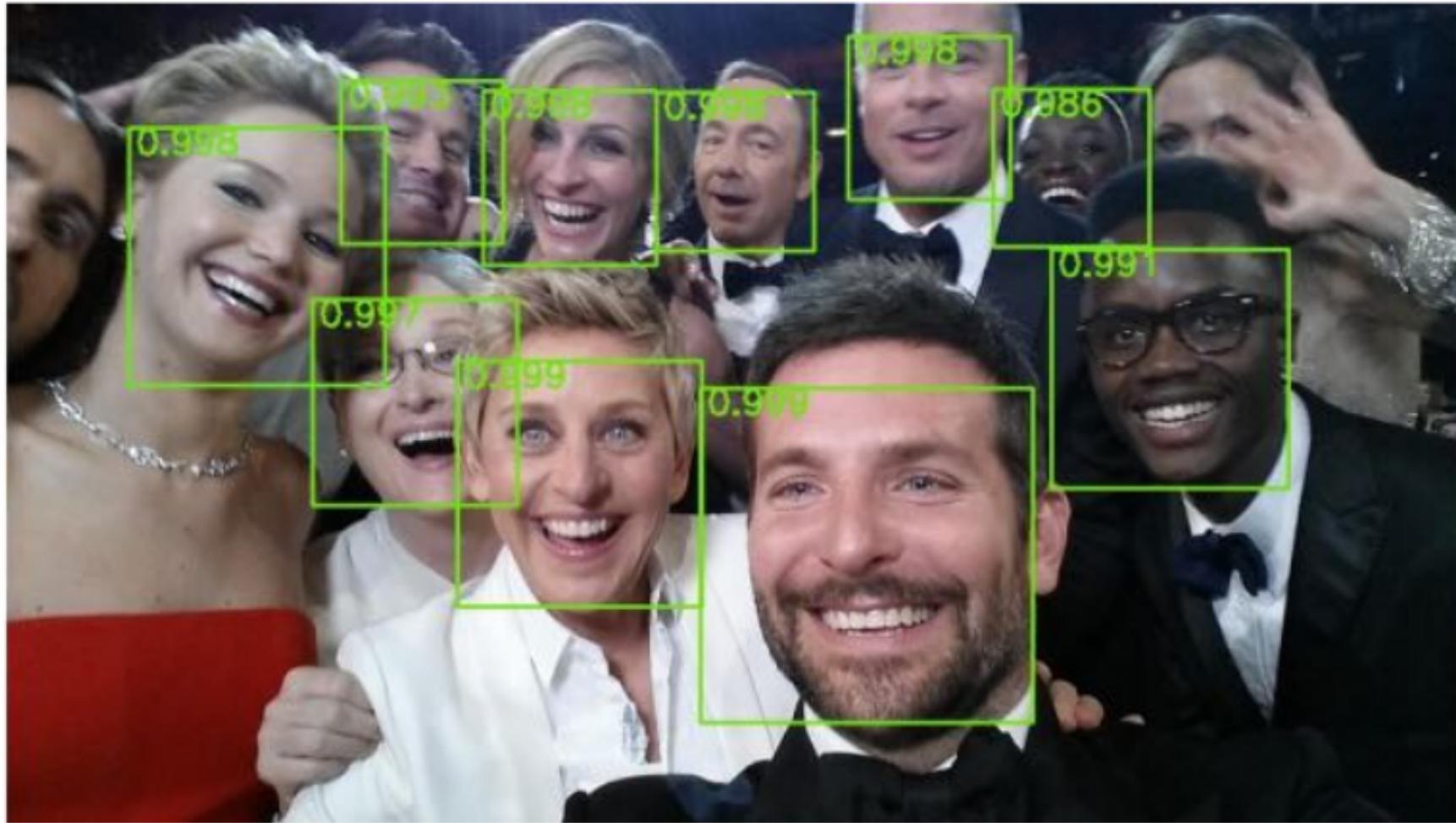
Natural Language Processing

I need to hide a body
noun, verb, preposition, ...



Machine Learning Examples

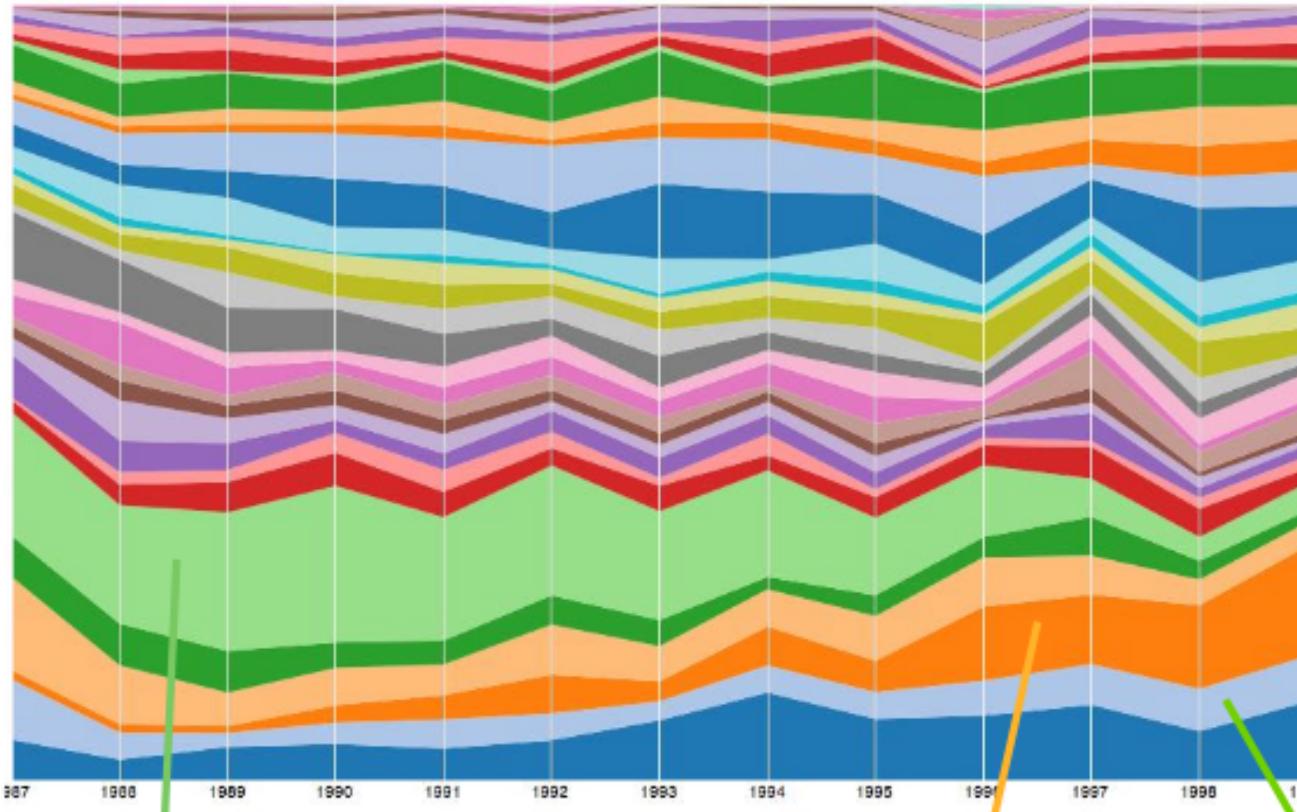
Face Detection



Sudhakar et al., Multi-view Face Detection Using Deep Convolutional Neural Networks, 2015

Machine Learning Examples

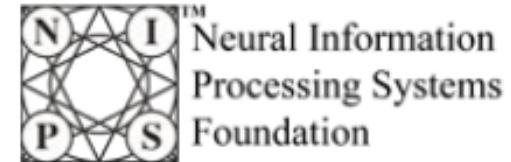
Topic Models of Text Documents



weight neural figure inputs error unit
input layer network units
 weights training learning net hidden
 architecture set networks output
 number

estimation density approach em
data probability **model** number set
 mixture gaussian posterior bayesian distribution
 figure parameters models
 log likelihood prior

cell responses motion
 field **cells**
 receptive input **model** tuning
 neurons direction response
 spatial cortex stimuli
 orientation cortical
 figure



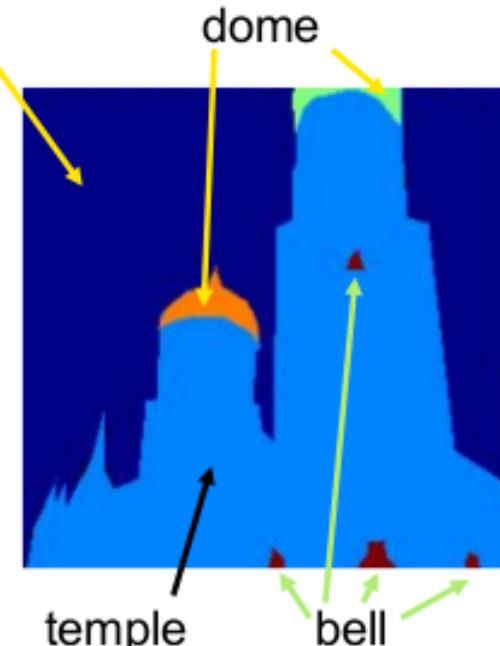
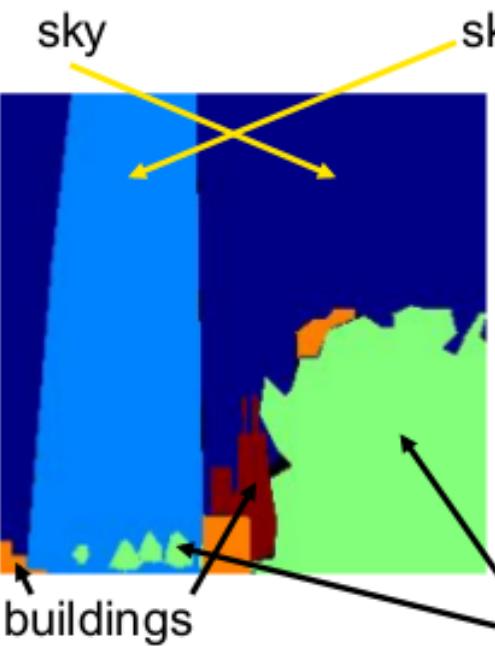
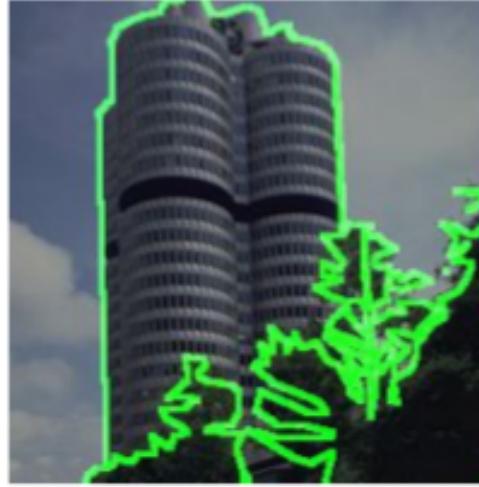
The
New York
Times



WIKIPEDIA
The Free Encyclopedia

Machine Learning Examples

Visual Scene Understanding



Programming with Data

- Want adaptive robust and fault tolerant systems
- Rule-based implementation is (often)
 - difficult (for the programmer)
 - brittle (can miss many edge-cases)
 - becomes a nightmare to maintain explicitly
 - often doesn't work too well (e.g. OCR)
- Usually easy to obtain examples of what we want
IF x THEN DO y
- Collect many pairs (x_i, y_i)
- Estimate function f such that $f(x_i) = y_i$ (supervised learning)
- Detect patterns in data (unsupervised learning)

Objectives of Machine Learning

- **Algorithms:** design of efficient, accurate, and general learning algorithms to
 - deal with large-scale problems.
 - make accurate predictions (unseen examples).
 - handle a variety of different learning problems.
- **Theoretical questions:**
 - what can be learned? Under what conditions?
 - what learning guarantees can be given?
 - what is the algorithmic complexity?

Definitions and Terminology

- **Example:** an object, instance of the data used.
- **Features:** the set of attributes, often represented as a vector, associated to an example (e.g., height and weight for gender prediction).
- **Labels:** in classification, category associated to an object (e.g., positive or negative in binary classification); in regression real value.
- **Training data:** data used for training learning algorithm (often labeled data).

Definitions and Terminology

- **Test data:** data used for testing learning algorithm (unlabeled data).
- **Unsupervised learning:** no labeled data.
- **Supervised learning:** uses labeled data.
- **Weakly or semi-supervised learning:** intermediate scenarios.
- **Reinforcement learning:** rewards from sequence of action.

Supervised Learning

- **Binary classification**

Given x find y in $\{-1, 1\}$

- **Multicategory classification**

Given x find y in $\{1, \dots, k\}$

often with loss

- **Regression**

Given x find y in R (or R^d)

$l(y, f(x))$

- **Sequence annotation**

Given sequence $x_1 \dots x_l$ find $y_1 \dots y_l$

- **Hierarchical Categorization (Ontology)**

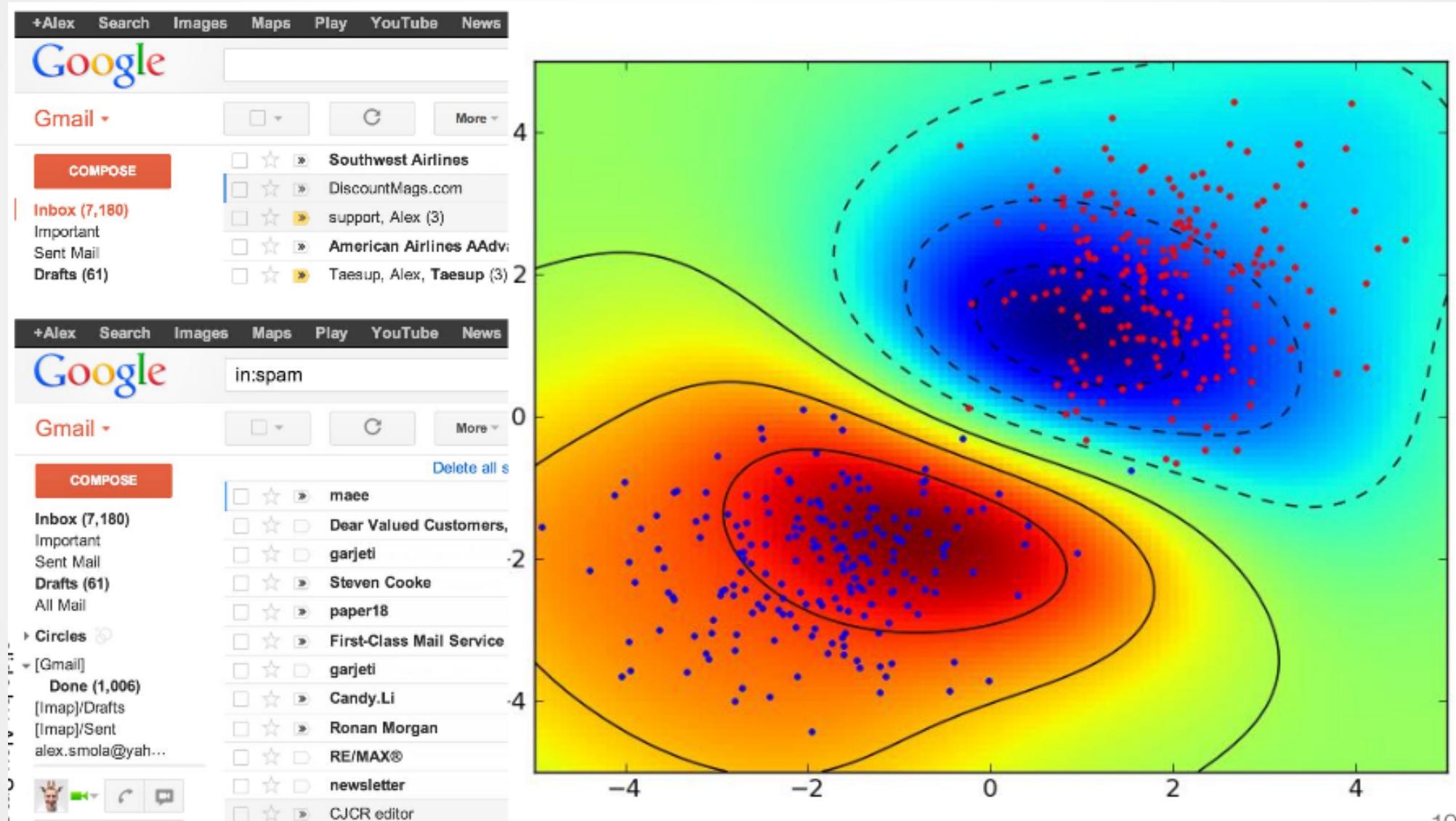
Given x find a point in the hierarchy of y (e.g. a tree)

- **Prediction**

Given x_t and $y_{t-1} \dots y_1$ find y_t

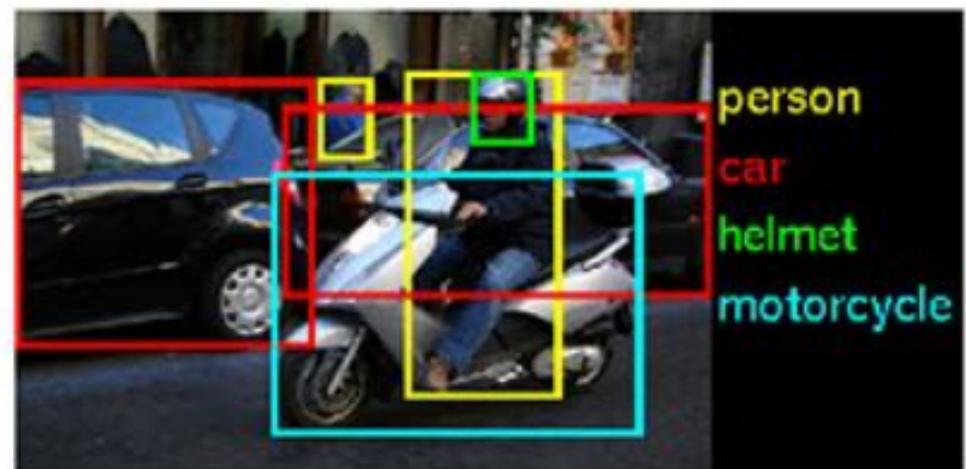
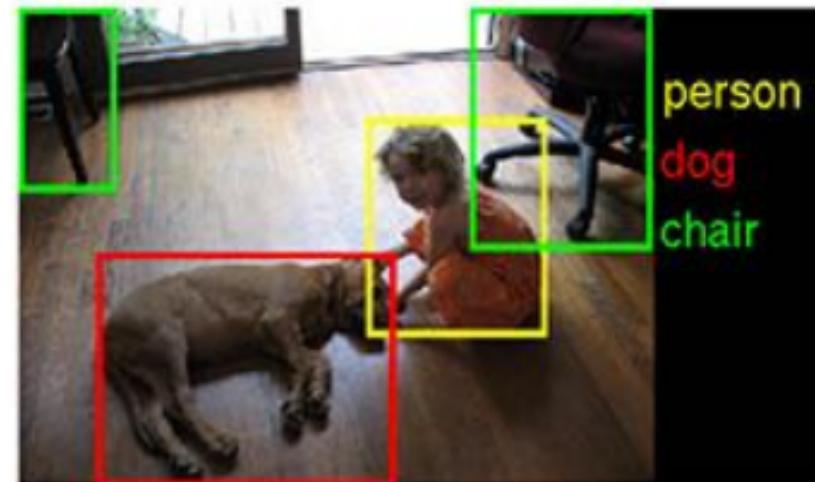
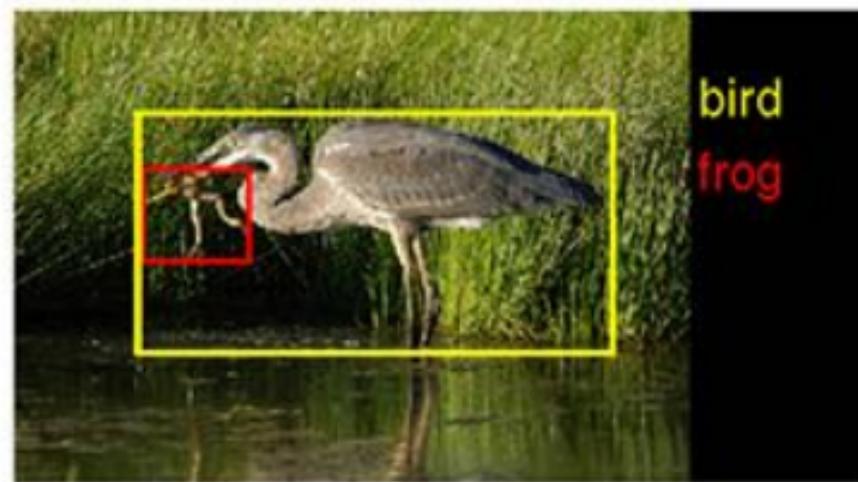
Supervised Learning

Binary Classification



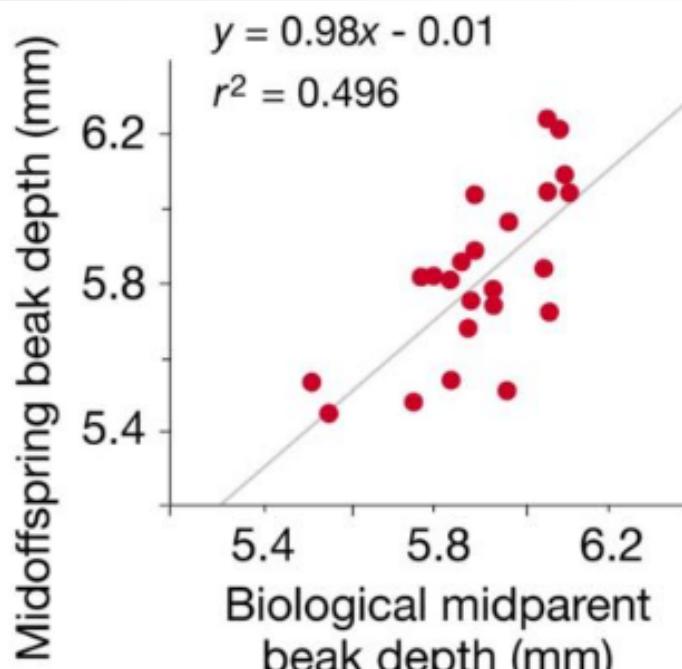
Supervised Learning

Multiclass Classification + Annotation



Supervised Learning

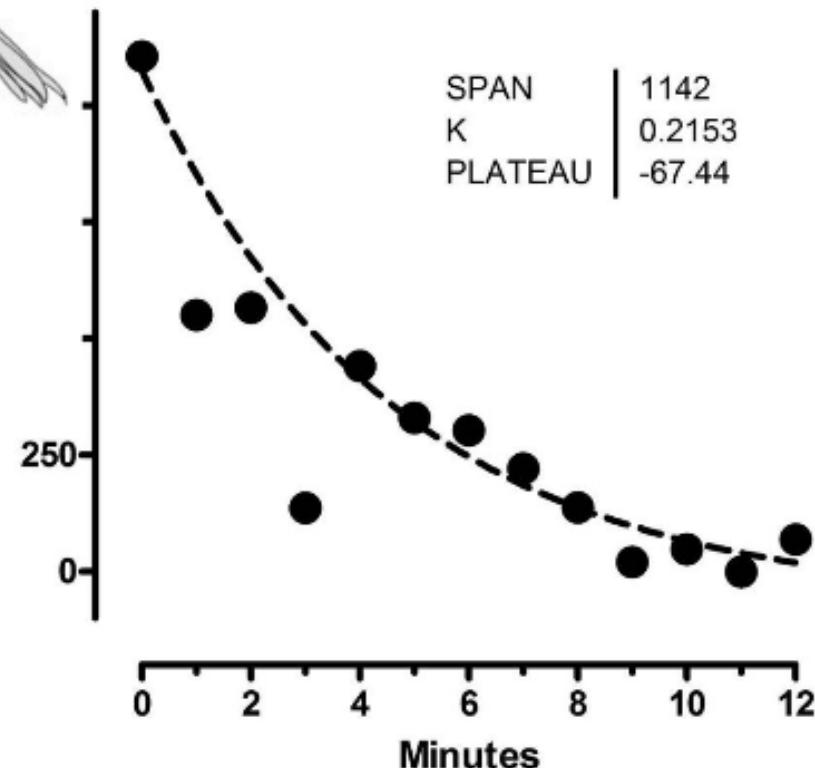
Regression



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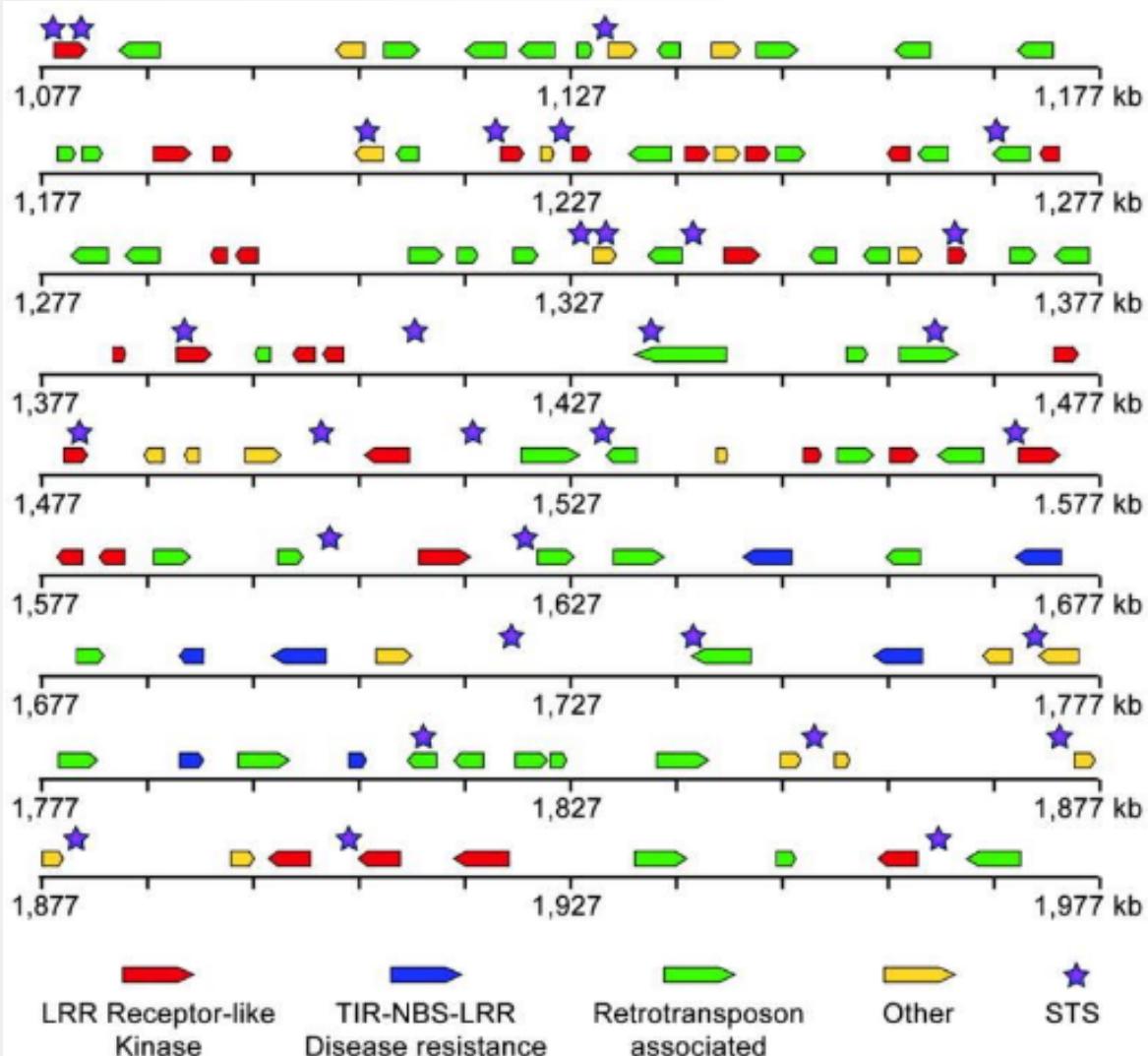


nonlinear



Supervised Learning

Sequence Annotation



given sequence

gene finding
 speech recognition
 activity segmentation
 named entities

Supervised Learning

Prediction

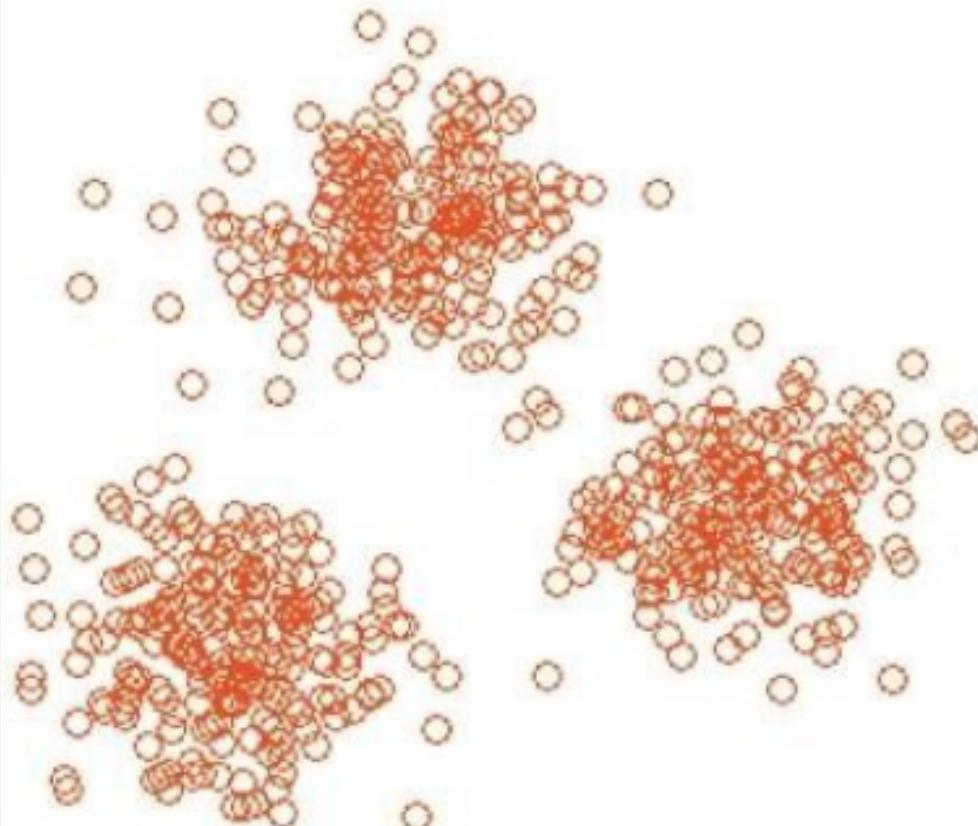


Unsupervised Learning

- Given data x , ask a good question ... about x or about model for x
- **Clustering**
Find a set of prototypes representing the data
- **Principal Components**
Find a subspace representing the data
- **Sequence Analysis**
Find a latent causal sequence for observations
 - Sequence Segmentation
 - Hidden Markov Model (discrete state)
 - Kalman Filter (continuous state)
- **Hierarchical representations**
- **Independent components / dictionary learning**
Find (small) set of factors for observation
- **Novelty detection**
Find the odd one out

Unsupervised Learning

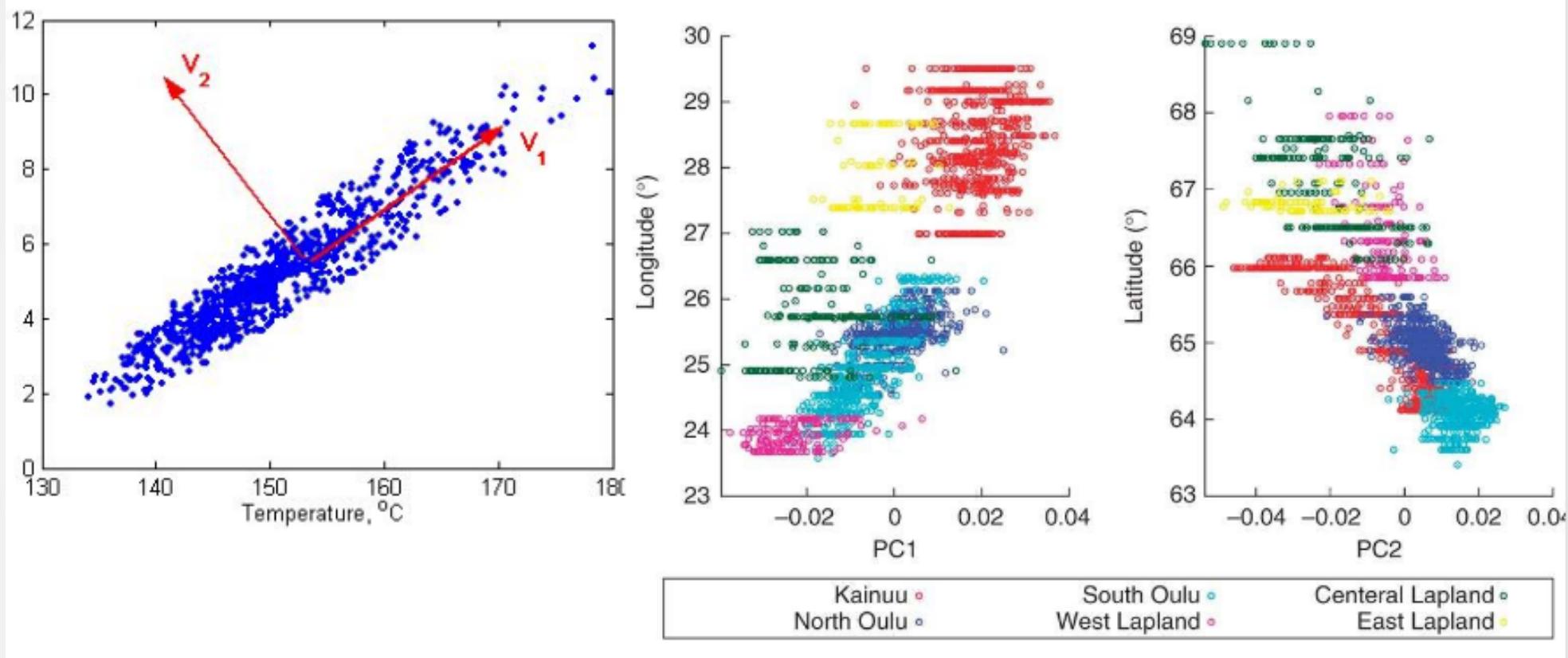
Clustering



- Documents
- Users
- Webpages
- Diseases
- Pictures
- Vehicles
- ...

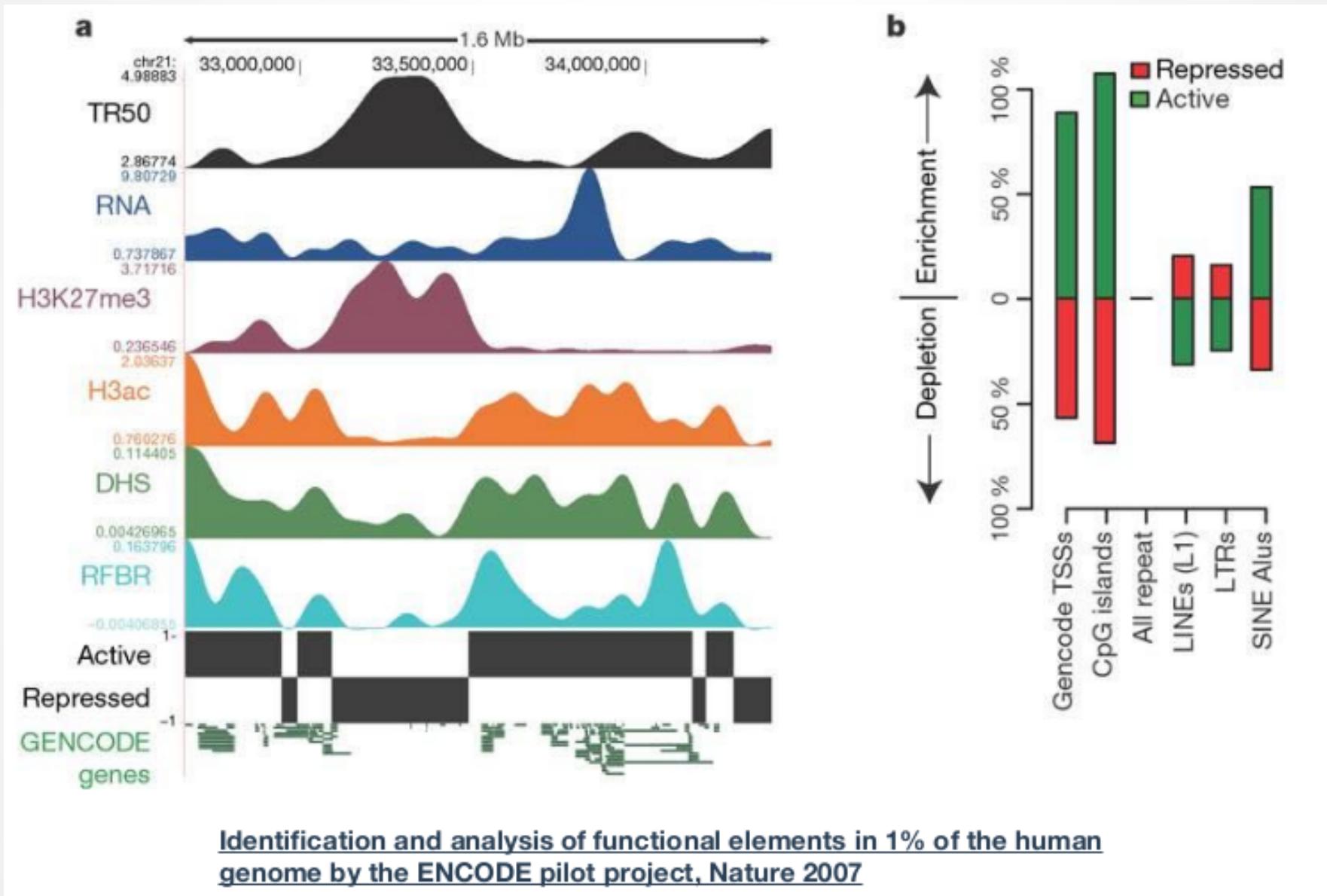
Unsupervised Learning

Principal Components



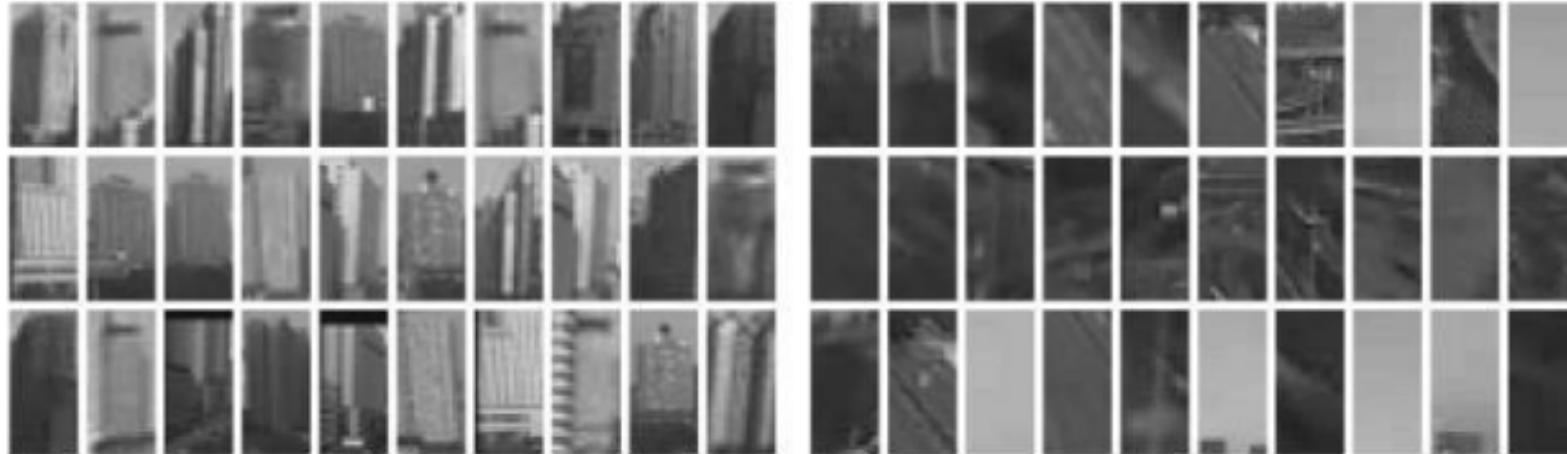
Unsupervised Learning

Sequence Analysis



Unsupervised Learning

Novelty detection



typical

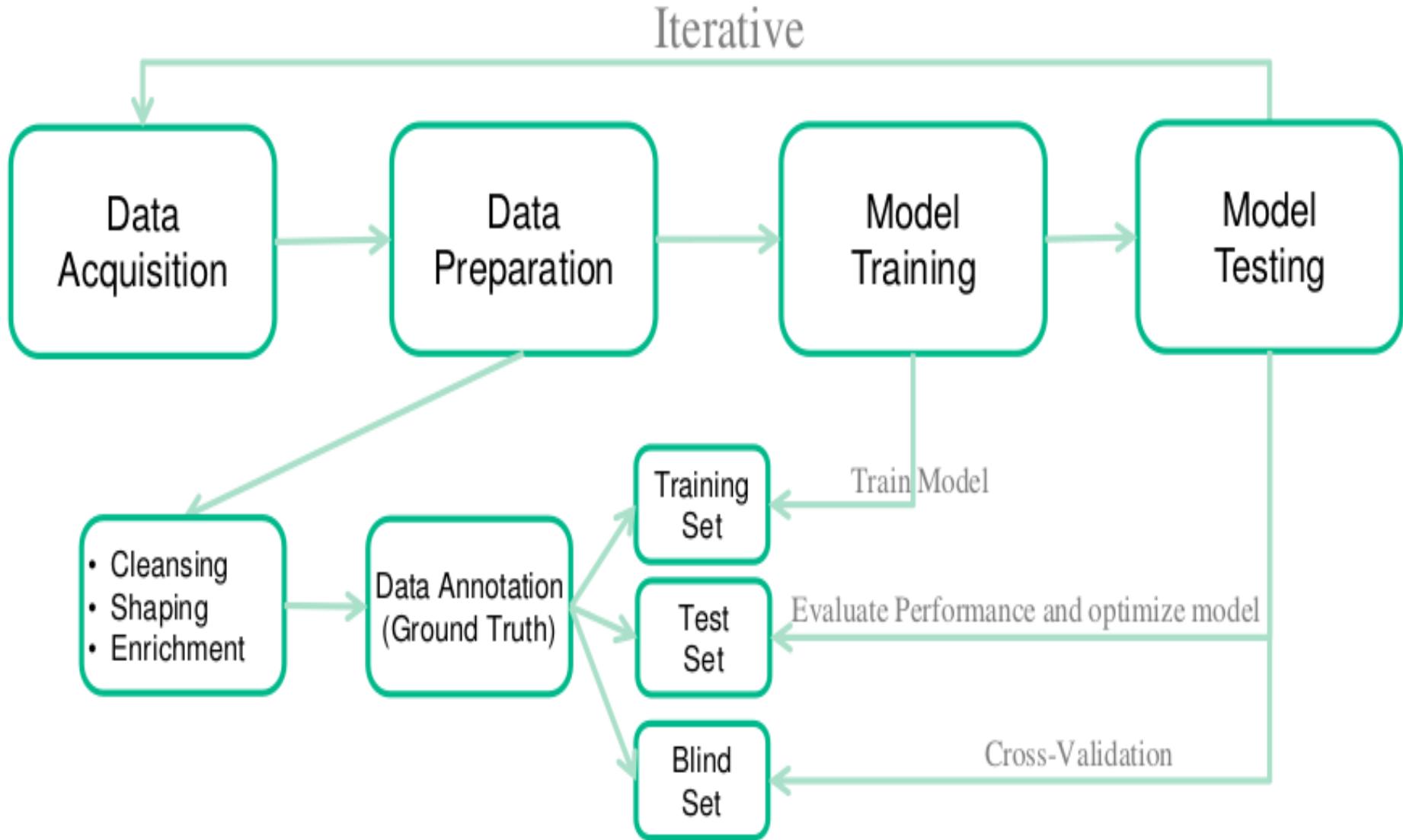


atypical

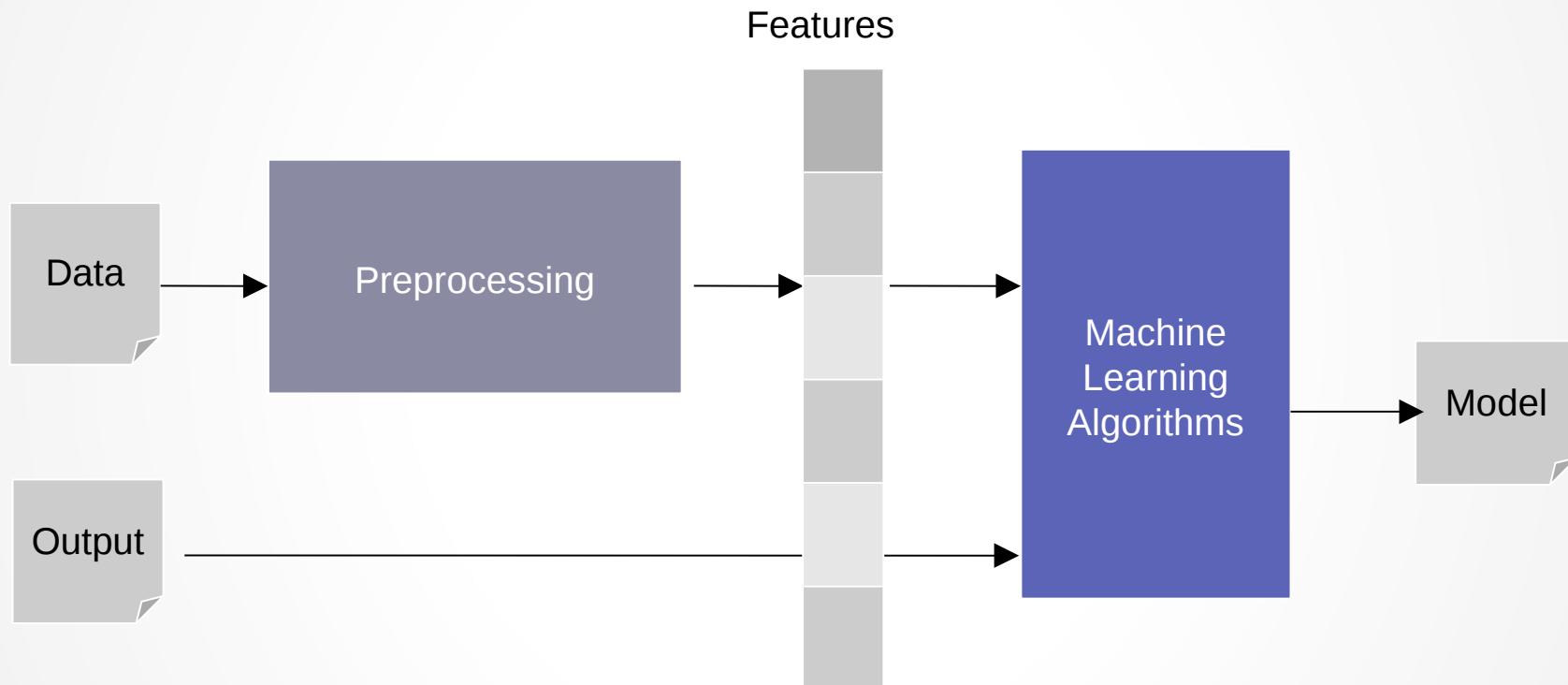
Important challenges in ML

- How important is the actual learning algorithm and its tuning
- Simple versus complex algorithm
- Overfitting
- Model Selection
- Regularization

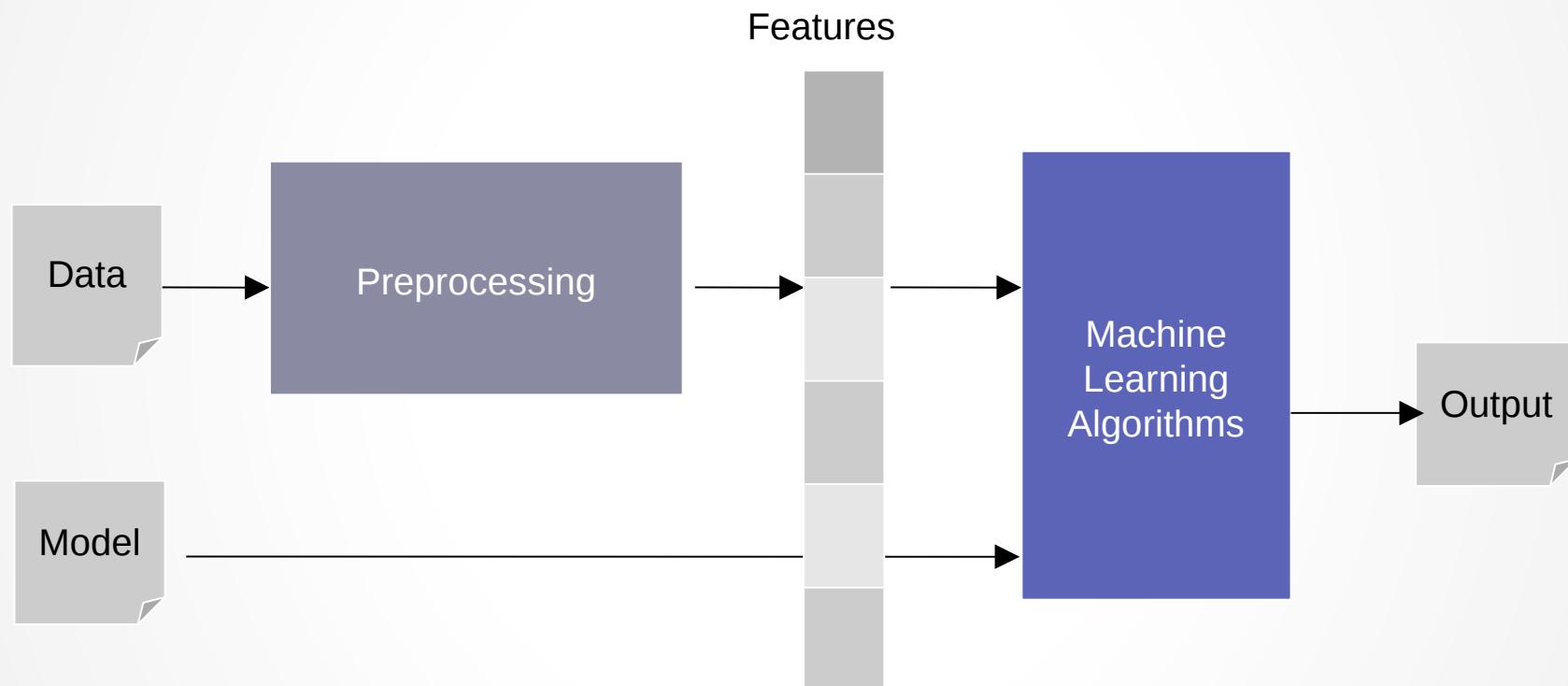
Machine Learning Process



Training Process



Production Process



Syllabus

Week 1: Introduction to Evolve Machine Learners.
Linear Algebra and PreSeries Bussiness Case.

Week 2: Linear Algebra and Optimization.
Logistic Regression and Support Vector Mahicne.

Week 3: K maeans Clustering and K nearest Neighbours.
Self Organizing Map.

Week 4: Navie bayes.
Decision Tree and Random Forest.

Week 5: Basic Neural Network and Perceptron.
Multilayer network and Backpropogation.

Week 6: MLP Network Adnavced.
MLP Network Application.

Week 7: Basic NLP.
Dimension Reduction (Autoencoder, PCA).

Week 8: Tensor and TensorFlow Introduction.
Review training material Week 1 - Week 8.

Week 9: Autoencoder and Denoising Autoencoder with tensorflow.
NLP Topic modeling and Latent Semantic Indexing.

Week 10: Convolutioal Neural Network.
NLP wordvector.

Week 11: Recurrent Neural Network.
NLP Recurrent neural language model.

Week 12: Validations.
Evaluation Metrics.

Week 13: Project Review.

Setup Learning Environments

- Install Anaconda
- Setup Virtual Environment
- Install Pycharm
- Install Numpy
- Install Pandas
- Install Mathplotlib
- Install Scikit-learns

Install Anaconda

- <https://www.digitalocean.com/community/tutorials/how-to-install-the-anaconda-python-distribution-on-ubuntu-16-04>
- <https://conda.io/docs/user-guide/install/macos.html>
- <https://conda.io/docs/user-guide/install/windows.html>

Create Virtual Environment

- <https://conda.io/docs/user-guide/tasks/manage-environments.html>
- “conda create -n eml python=3.5”
- “source activate eml”

Install PyCharm

- <https://www.jetbrains.com/pycharm/download/>
- Create new project in pycharm
- Running python code in pycharm

Install Numpy

- “source activate eml”
- “pip install numpy”

Install Matplotlib

- <https://matplotlib.org/users/installing.html>
- “source activate eml”
- “pip install matplotlib”

Install Pandas

- <https://pandas.pydata.org/pandas-docs/stable/install.html>
- “source activate eml”
- “pip install pandas”

Install scikit-learns

- <http://scikit-learn.org>
- “source activate eml”
- “pip install scikit-learn”

Questions