

"Can machines think?"

source: "Computing Machinery and Intelligence" (*Mind*, 1950)



Google Intern :

```
grid_search.py
```

```
1 from keras.layers import *
2 from keras.models import *
3 from .data import load_data
4
5 x, y, x_test, y_test = load_data()
6
7 def get_model(num_layers):
8     model = Sequential()
9     for _ in range(num_layers):
10         model.add(Dense(100, activation='sigmoid'))
11     model.compile(loss='mse', optimizer='sgd')
12     return model
13
14 best_model = None
15 best_loss = None
16
17 for i in range(1, 10):
18     model = get_model(i)
19     model.fit(x, y)
20     loss = model.evaluate(x_test, y_test)
21     if best_loss is None or loss < best_loss:
22         best_loss = loss
23         best_model = model
24
```

Media :





Això només
el comença

LA LLUITA

NIM-M Mobilització

UNIM[®] Mobilització

**ATUREM
OCUPEM
ORGANIZEM
FEM VAGA
ESTENEM
LA LLUITA**

**ESTUDIANTS
TRABALLADORES
MATEIX
ENEMIG
MATEIXA
LLUITA**

ESTUDIANTS
TREBALLA
DORSSES

TO
REF
LAB
S
C
D
A

The logo for JNA SOLUCIONES, featuring the letters 'JNA' in a large, bold, black font above the words 'SOLUCIONES' and 'REVOLUCION' in a smaller, black font.

11

**NI REFORMA
LABORAL
NI RETALLADES
SOCIALS
NO PAGAREM
EL SEU DEUTE**

The flag of Austria, featuring a white field with a red cross in the center, and a blue field in the canton containing a golden eagle.

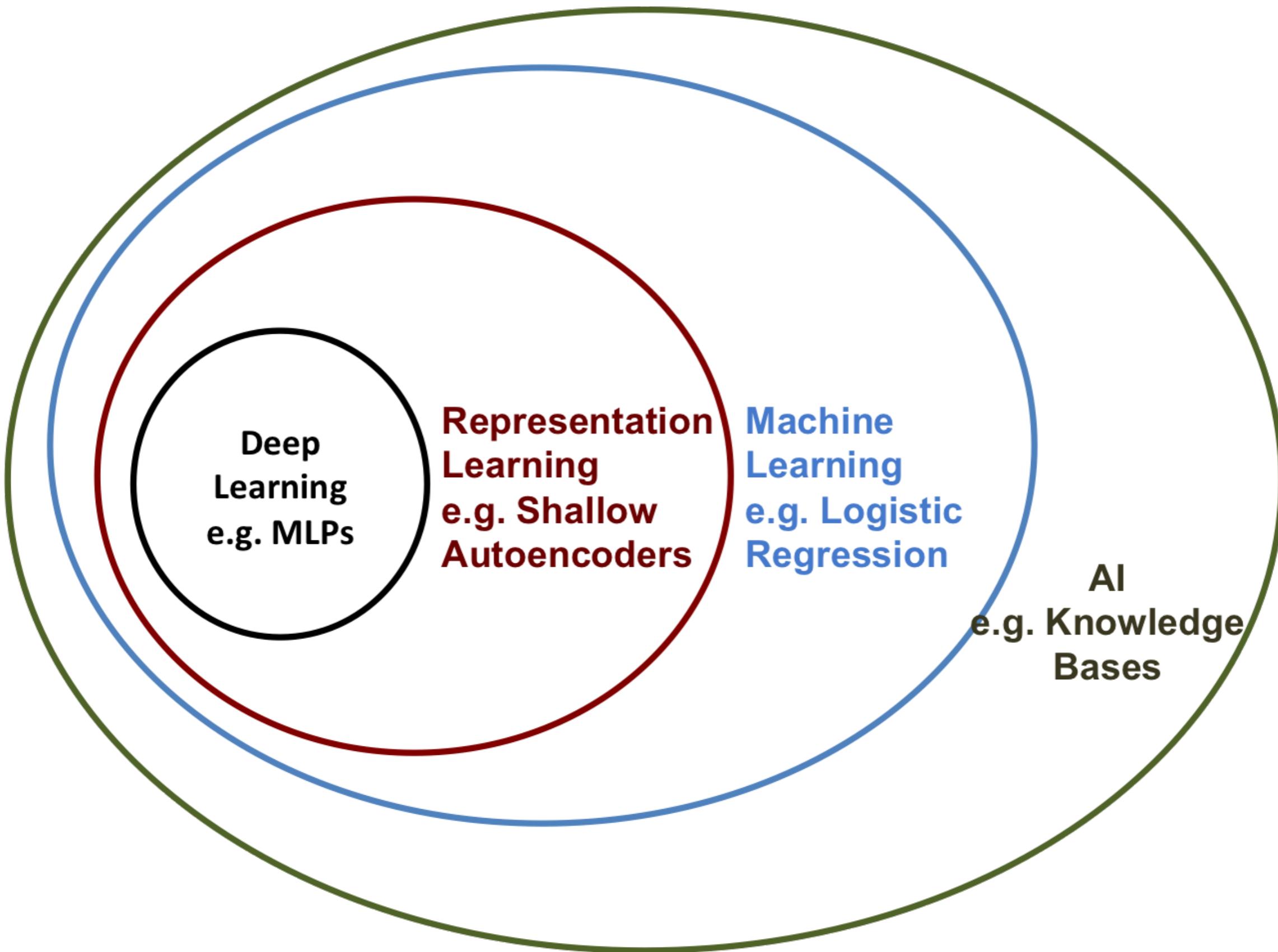
10

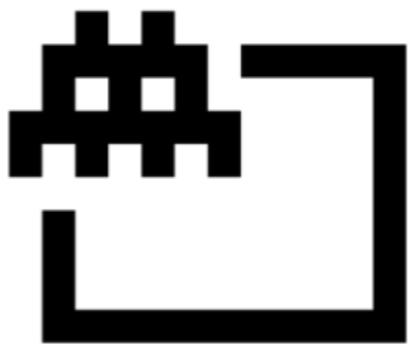
NI REFORMA LABORAL
NI RETALLADES SOCIALS
**NO PAGAREM
EL SEU DEUTE**

Machine Learning and Predictive Analytics

**Hisham Ihshaish
2021
Bristol**

Machine Learning?





Machine Learning is Fun!

Deep Learning Drops Error Rate for Breast Cancer Diagnoses by 85% - NVIDIA blog.

Posted on SEPTEMBER 19, 2016 by TONY KONTZER <https://goo.gl/kUy71x>





...much of it!

a definition <..>

'Field of study that gives computers the ability to learn without being explicitly programmed.' -

Arthur Samuel, 1959

'...it's about machines making sense out of data in much the same way that humans do' -

Matthew Kirk (in his 'thoughtful machine learning' book 1st Ed, 2017')

This simple!

Interviewer: What's your biggest strength?

Me: I'm an expert in machine learning.

Interviewer: What's $9 + 10$?

Me: Its 3.

Interviewer: Not even close. It's 19.

Me: It's 16.

Interviewer: Wrong. Its still 19.

Me: It's 18.

Interviewer: No, it's 19.

Me: it's 19.

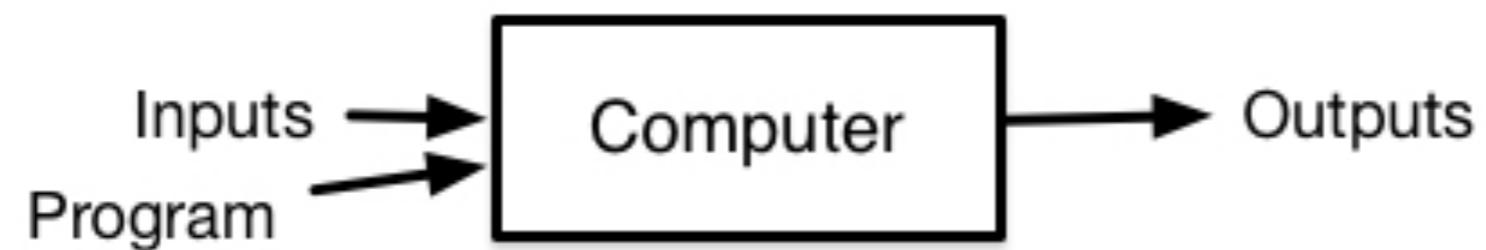
Interviewer: You're hired

- Your jokes - quite, too!

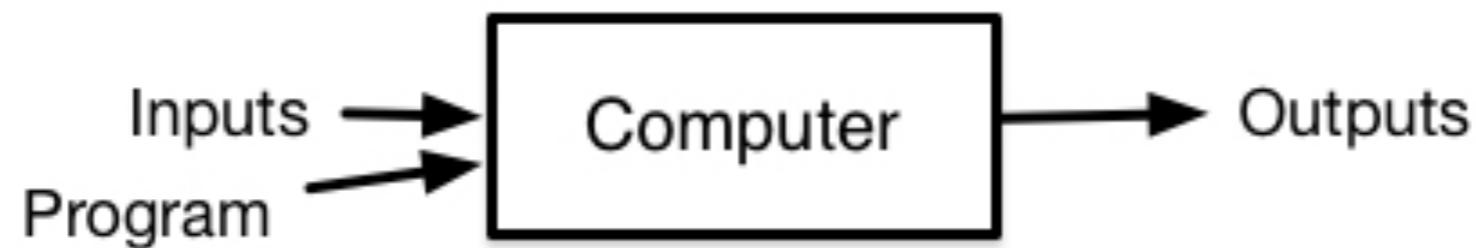


*"If you don't reveal some insights soon, I'm going
to be forced to slice, dice, and drill!"*

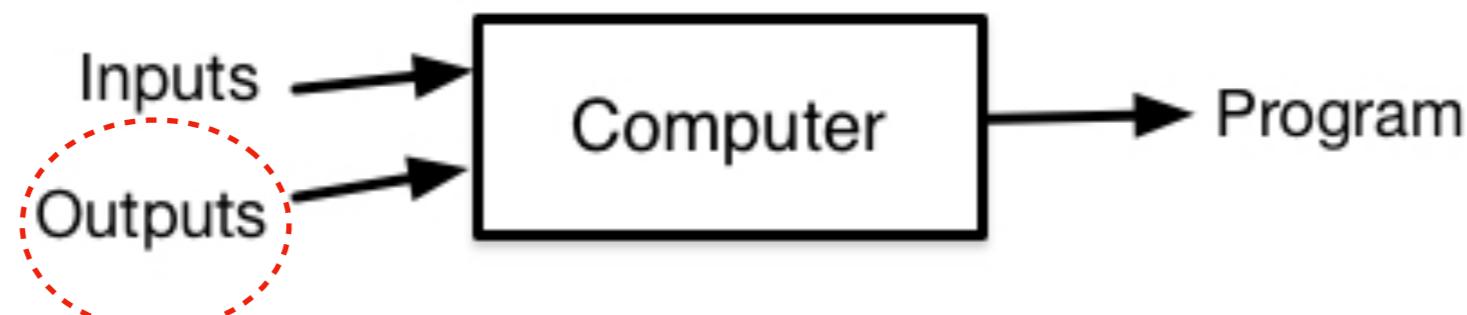
Traditional Programming



Traditional Programming



Machine Learning



Why (or when) we learn?

- Learning is used when:
 - Human expertise does not exist (navigating on Mars),
 - Humans are unable to explain their expertise (speech recognition),
 - Solution changes in time (routing on a computer network)
 - Solution needs to be adapted to particular cases (autonomous driving)

Regression

Classification

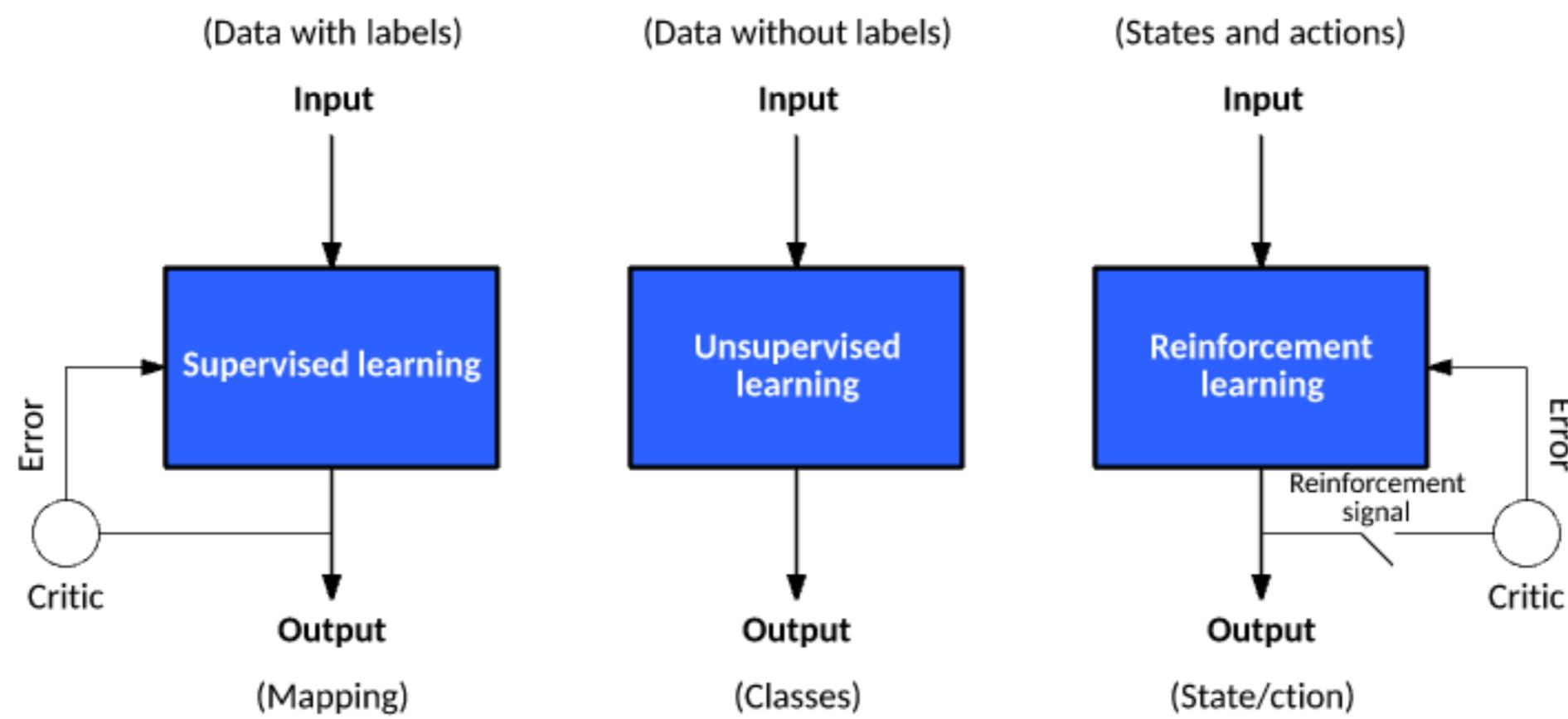
- Supervised Learning
- Unsupervised Learning
- Semi-supervised Learning
- Reinforcement Learning
-'deep learning'

Association

Optimisation

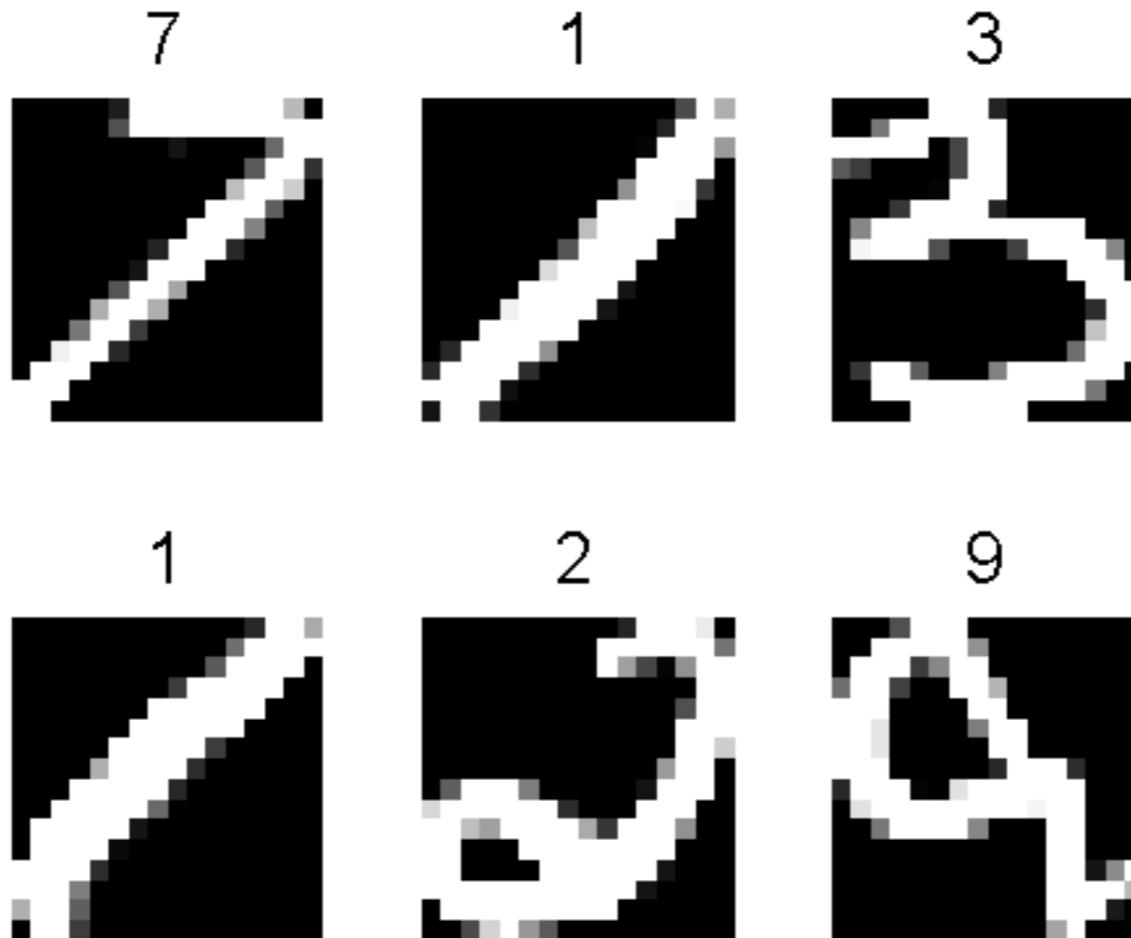
- Supervised Learning
- Unsupervised Learning
- Semi-supervised Learning
- Reinforcement Learning
-deep learning

IF AND ONLY IF



(some) Applications

- Identifying postcode from handwritten digits on an envelop.



(some) Applications

- Detecting fraudulent activity in credit card transactions.



(some) Applications





Re to ▾ Categories ▾ ...

Undo

AT

Alice Thomas <Alice@OReilly.co.uk>

Tue 16/01/2018 10:13

To: Hisham Ihshaish



Reply | ▾

This item will expire in 29 days. To keep this item for longer, apply a different label.

Label: Junk Email (delete after 30 days) (1 month) Expires: 15/02/2018 10:13

Hi Hisham,

Apologies for the delay getting back to you, I have been out of the office until today. I have arranged for the following titles to be sent to you for inspection:

Machine Learning and Security, 9781491979907

Hands-On Machine Learning with Scikit-Learn and TensorFlow, 9781491962299

Applied Text Analysis with Python, 9781491963043

R for Data Science, 9781491910399

Please note that Machine Learning and Security is due to published 28th Feb and Applied Text Analysis with Python is due to publish 31st March - both of these will be sent to you from our distributors as soon as they are available.

As with the other titles please let us know your feedback once you have had a chance to evaluate them.

All the best,

Alice

...

**Hisham Ihshaish**

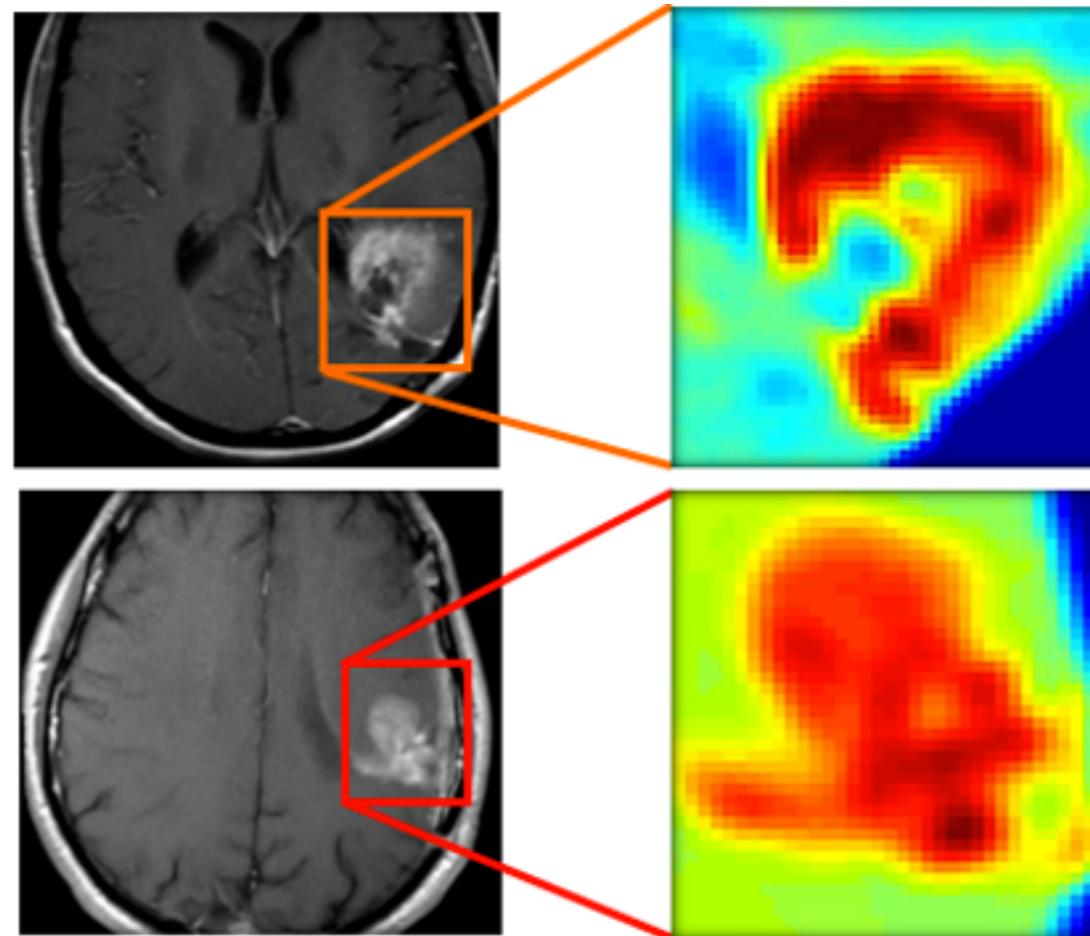
Hi Alice A gentle reminder :) I'd be so grateful if you could process my earlier request – sorry for writing again on th...

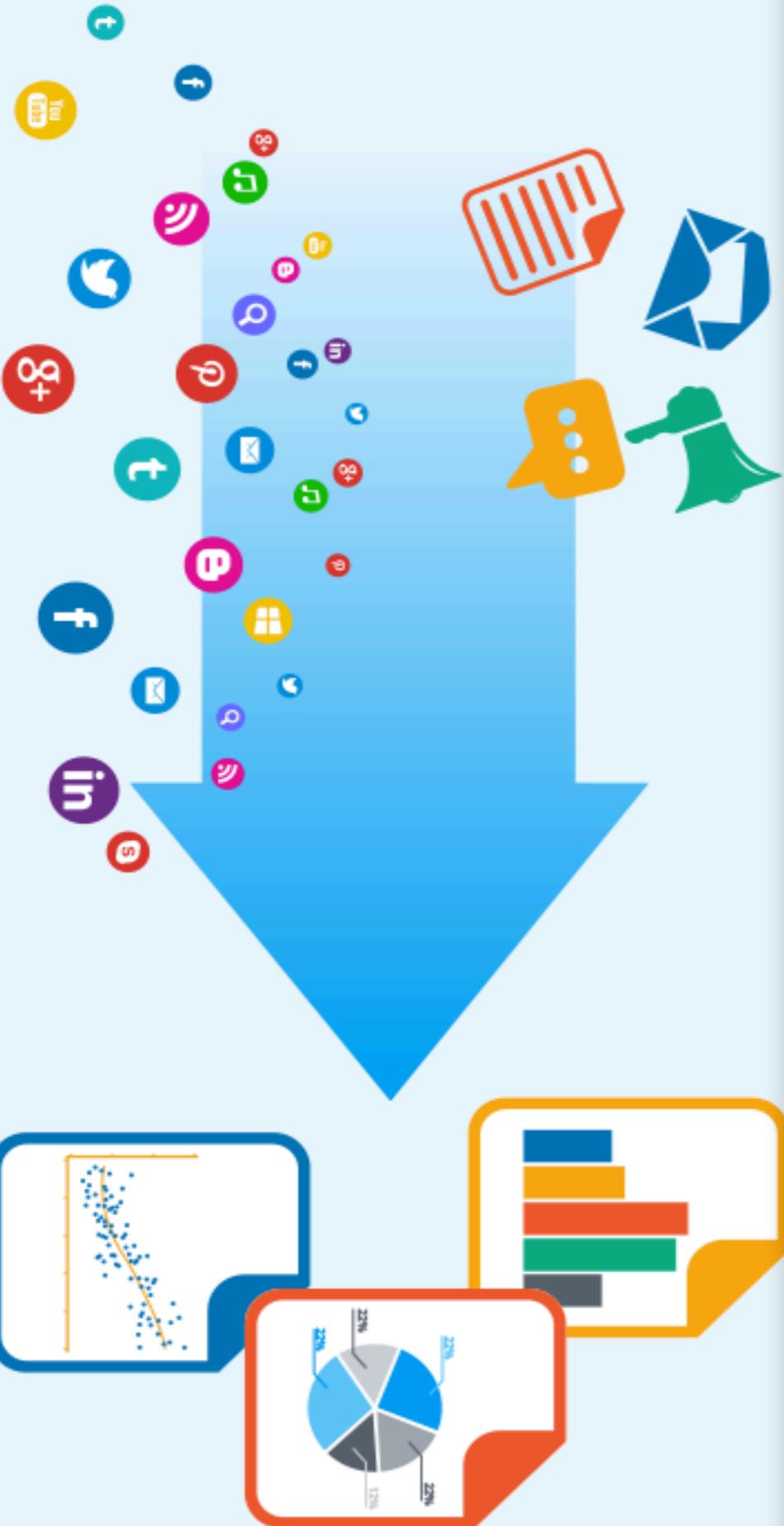
Mon 15/01, 14:14

(some) Applications

- Determining whether a tumour is benign based on a medical image.

DIAGNOSTICS





Numbers nerd Nate Silver's forecasts prove all right on election night

FiveThirtyEight blogger predicted the outcome in all 50 states, assuming Barack Obama's Florida victory is confirmed



One big winner of US election night was the statistical guru and unashamed numbers nerd [Nate Silver](#), who correctly predicted not only Barack Obama's victory but the outcome of the presidential contest in all 50 states.

Silver, the political forecaster at the New York Times, infuriated Republicans in the closing days of the race by arguing on his blog [FiveThirtyEight.com](#) that Obama's chances of winning were steadily increasing. His final forecast gave Obama a 90.9% chance of victory.

Silver also forecast 332 electoral college votes for Obama against 206 for Romney.



GOVERNMENT SHUTDOWN

The Government Shutdown Effect: Big In The Short Term, Small After That

By Harry Enten

POLITICS PODCAST



Emergency Politics Podcast:

- ▶ <http://fivethirtyeight.com/>
- ▶ <https://github.com/fivethirtyeight>

THE LATEST

JAN. 20

Emergency Politics Podcast: Shutdown!

JAN. 20

The Government Shutdown Effect: Big In The Short Term, Small After That

JAN. 19

Political Parties Not

JAN. 1

The V Doon Hope

JAN. 1

What Case Better Else

JAN. 1

INTERACTIVES

How Popular Is Donald Trump?

UPDATED 2 DAYS AGO



A screenshot of the GitHub organization page for FiveThirtyEight. It shows basic information like the URL (https://github.com/fivethirtyeight) and email (andrei.scheinkman@fivethirtyeight.com). There are also links for Features, Business, Explore, Marketplace, and Pricing.

[Features](https://github.com/fivethirtyeight) [Business](#) [Explore](#) [Marketplace](#) [Pricing](#)[This organization](#) [Search](#) FiveThirtyEight<http://fivethirtyeight.com> andrei.scheinkman@fivethirtyeight.com[Repositories 15](#)[People 10](#)

Search repositories...

[data](#)

Data and code behind the stories and interactives at FiveThirtyEight

[Jupyter Notebook](#) [7,182 stars](#) [2,916 forks](#) [MIT license](#) Updated 25 days ago[nfl-elo-game](#)

Data and code for FiveThirtyEight's NFL game

[Python](#) [41 stars](#) [24 forks](#) [MIT license](#) Updated on 18 Sep 2017

- Generative AI



Ernest Duncan Mogg MP
Somerpool

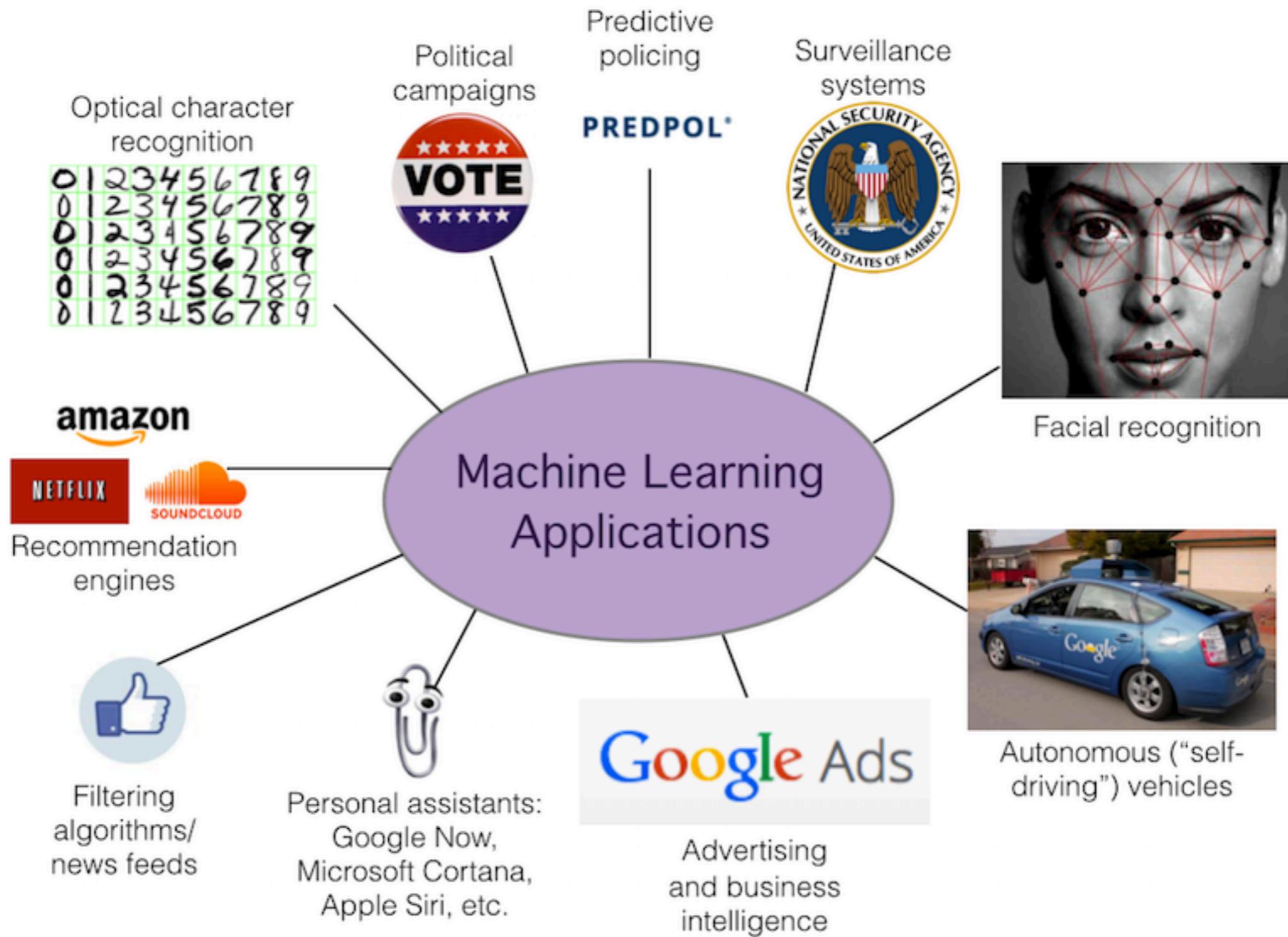


Tulip Dobbin MP
Batdon and Winminster

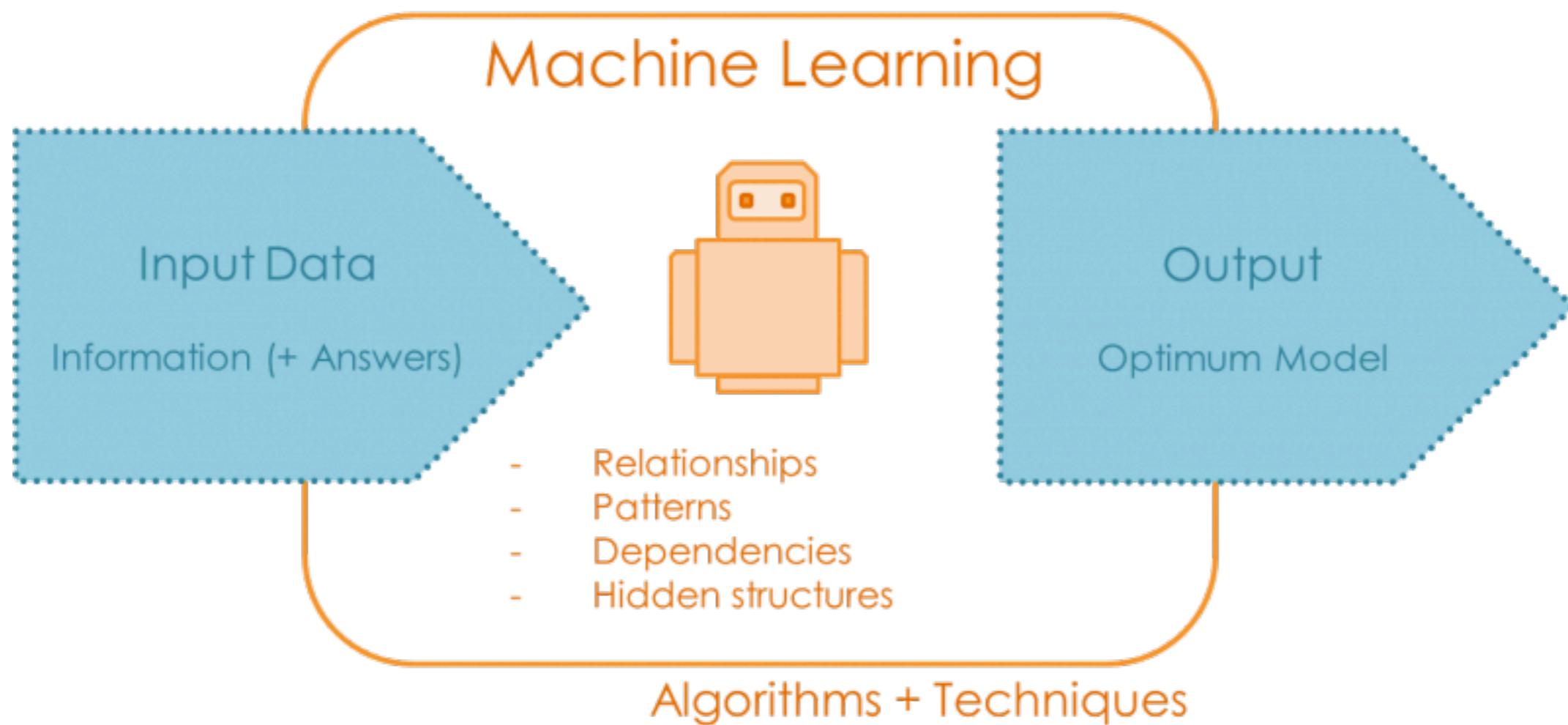
HATCH ANOTHER ONE

- page: <https://vole.wtf/this-mp-does-not-exist/>
- paper: <https://arxiv.org/pdf/1812.04948.pdf>

Applications



(a) schematic view





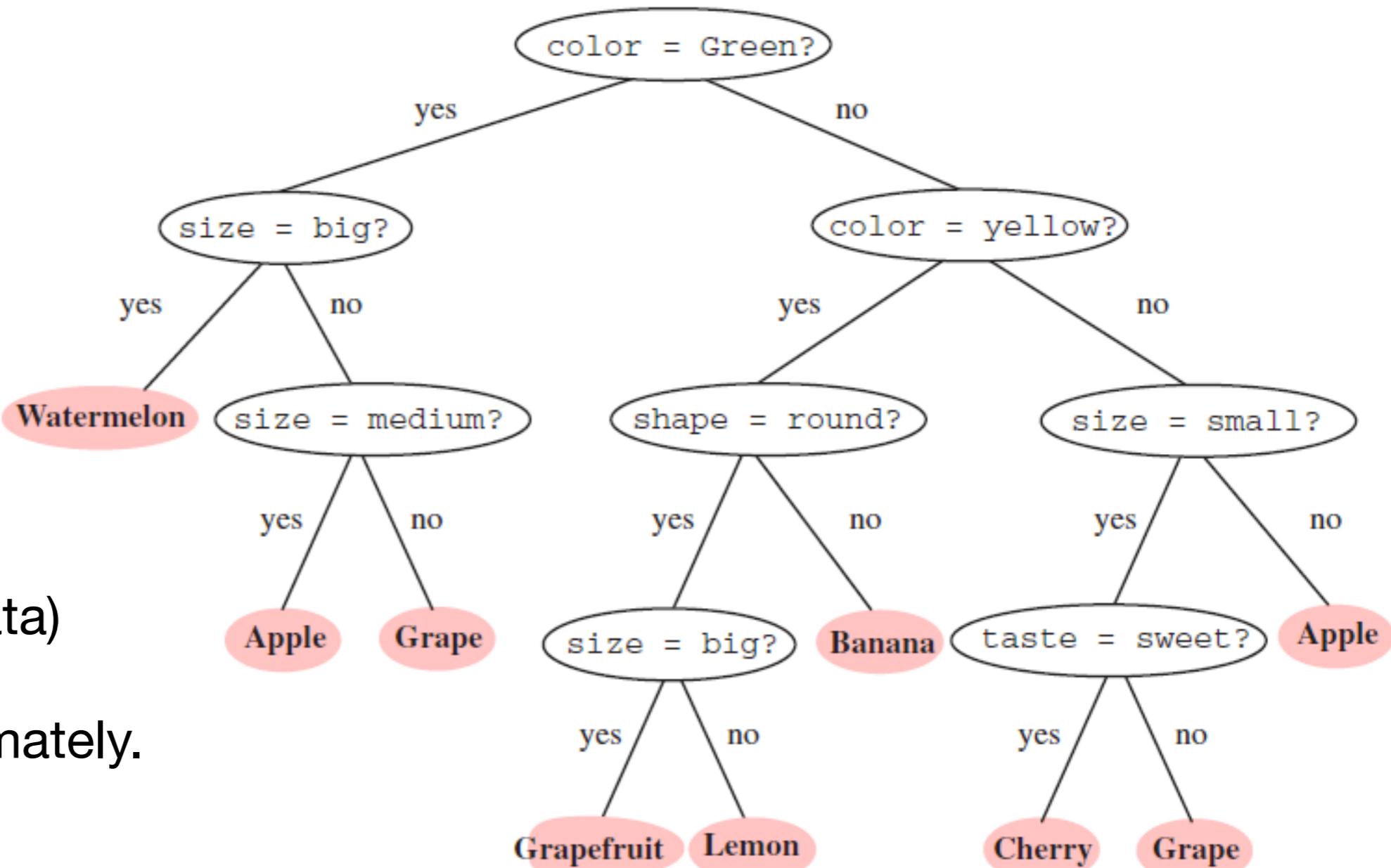


Data of
interest
(new)



Modelling

- Train on data
- Find “the” model
- Test it (on new data)
- Generalise - ultimately.



This simple yet tricky!

Interviewer: What's your biggest strength?

Me: I'm an expert in machine learning.

Interviewer: What's $9 + 10$?

Me: Its 3.

Interviewer: Not even close. It's 19.

Me: It's 16.

Interviewer: Wrong. Its still 19.

Me: It's 18.

Interviewer: No, it's 19.

Me: it's 19.

Interviewer: You're hired

- What if interviewer had it wrong?
- What if interviewee is asked what $13+2$ was?

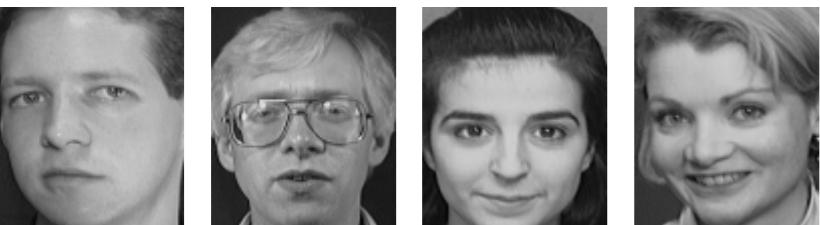
What we mean when we talk about “Learning”

- Learning general models from a data of particular examples
- Data is cheap and abundant (data warehouses, data marts); knowledge is expensive and scarce.
- Example in retail: Customer transactions to consumer behaviour:
 - People who bought “Blink” also bought “Outliers” (www.amazon.com)
- Build a model that is **a good and useful approximation** to the data.

Training examples of a person



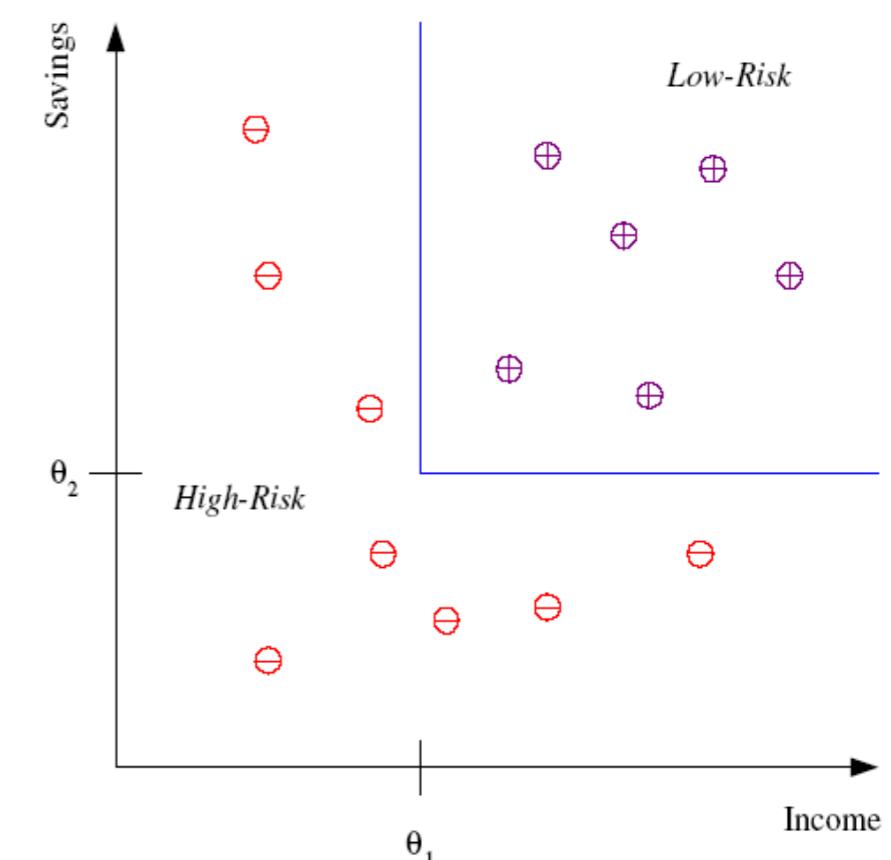
Test images



ORL dataset,
AT&T Laboratories, Cambridge UK

- Example: Credit scoring
- Differentiating between **low-risk** and **high-risk** customers from their *income* and *savings*

‘Classification’ problem

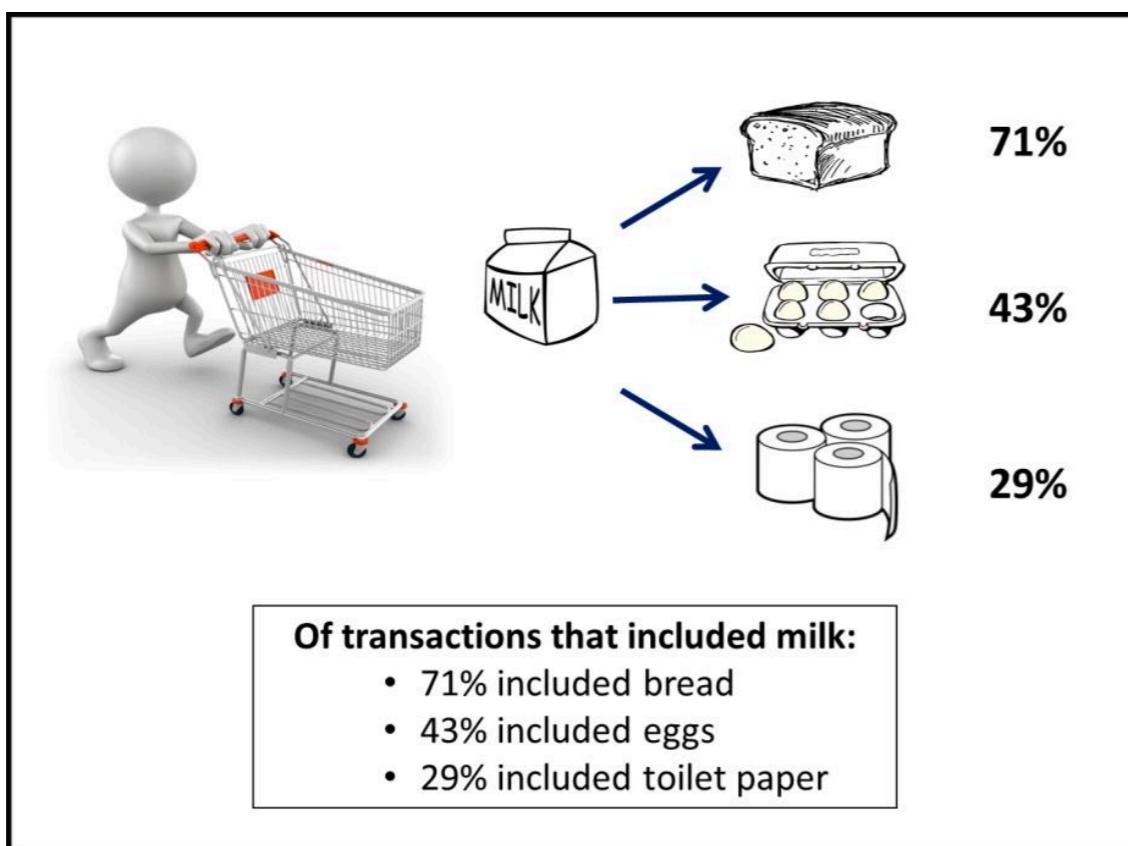


Discriminant: IF $income > \theta_1$ AND $savings > \theta_2$

THEN **low-risk** ELSE **high-risk**

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‘Association’ problem

- Basket analysis:

$P(Y | X)$ probability that somebody who buys X also buys Y where X and Y are products/services.

Example: $P(\text{bread} | \text{milk}) = 0.71$

What we mean when we talk about “Learning”

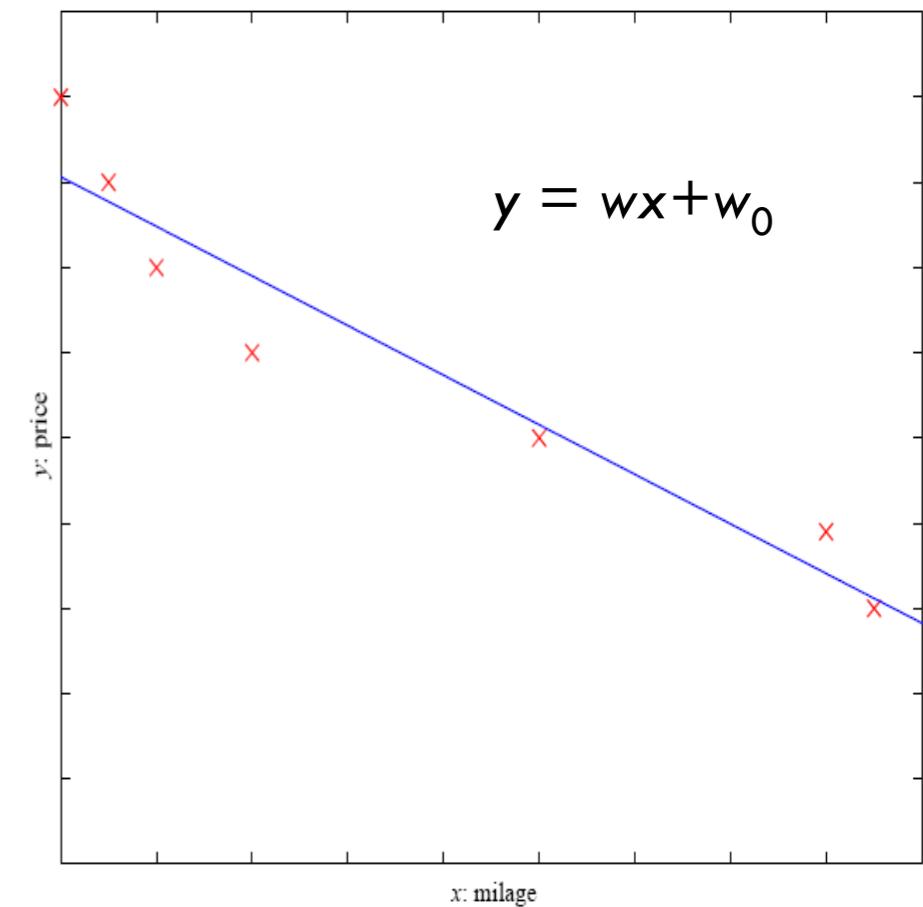
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ML Applications

- Supervised Learning
 - Classification
 - Regression
- Unsupervised Learning
- Reinforcement Learning

- Example: Price of a used car
- x : car attributes
 y : price
 $y = g(x | \theta)$
 $g(\cdot)$ model,
 θ parameters

‘Regression’ problem



..., the Kit

DATA

ASSUMPTIONS

DOMAIN EXPERTISE

Algebra

STATISTICS

The Module

Syllabus

Structure [generic]

 Week 1: Introduction >

 Week 2: ML Concepts >

 Week 3 - 10: Methods and Learning Problems ▾

- Feature Engineering.
- Supervised Learning, methods and practicals.
- Unsupervised Learning, methods and practicals.
- Reinforcement Learning, methods and practicals.
- Optimisation.

 Info

Sessions will involve tutorials (hands-on workshops) from Week 3 onward. **Ryan** (my PhD student) and **Sami** (AL) will be helping you.

 Week 11: Deep Learning >

 Week 12: Ethics ▾

- Motives and considerations

Indicative Reading List

I recommend the following books for beginners (foundation and application):

- Machine Learning from Scratch – Joel Grus (1st or 2nd Ed.)
- Hands-On Machine Learning with Scikit-Learn and TensorFlow – Aurélien Géron

Resources on theory:

- The Elements of Statistical Learning – T Hastie, R Tibshirani, J Friedman (available online)
- Introduction to Machine Learning – Ethem Alpaydin (3d or 4th Ed.)

Tools (for the module)



Tools (for the module)

Essential libraries

Numpy, Scipy, Matplotlib, pandas and Jupyter Notebook



..., a good book for starters of ML in Python:
***'Data Science from Scratch'* - Joel Grus 1st Ed. 2015**

Exam and Assignment

50% + 50%

Next Week!

- Practical concepts for ML.