

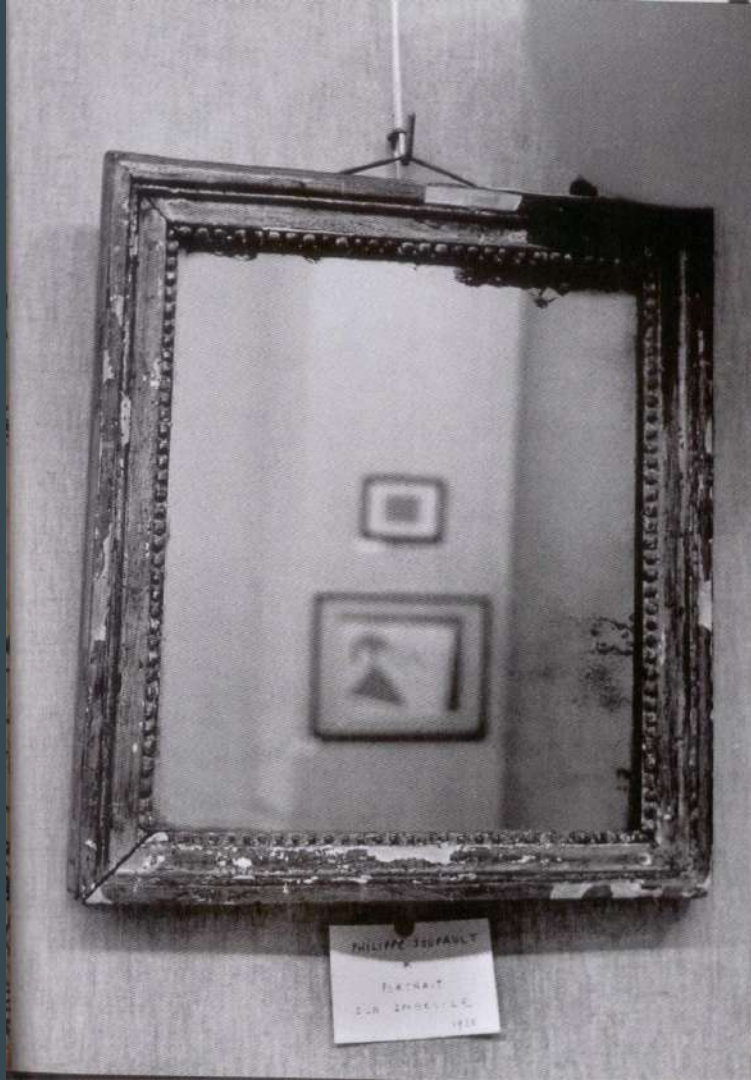
open talk

Machine Learning

...

opendot, Milano - 09.11.2016



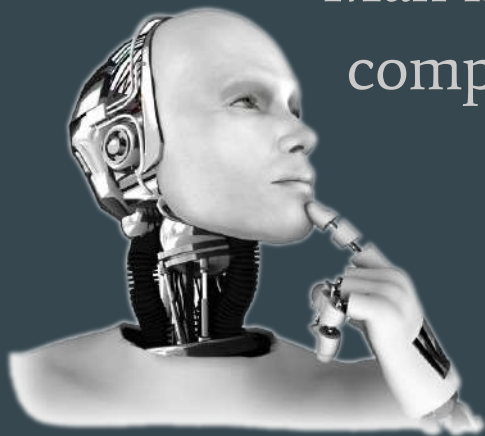


Philippe Soupault
Portrait of an Imbecile

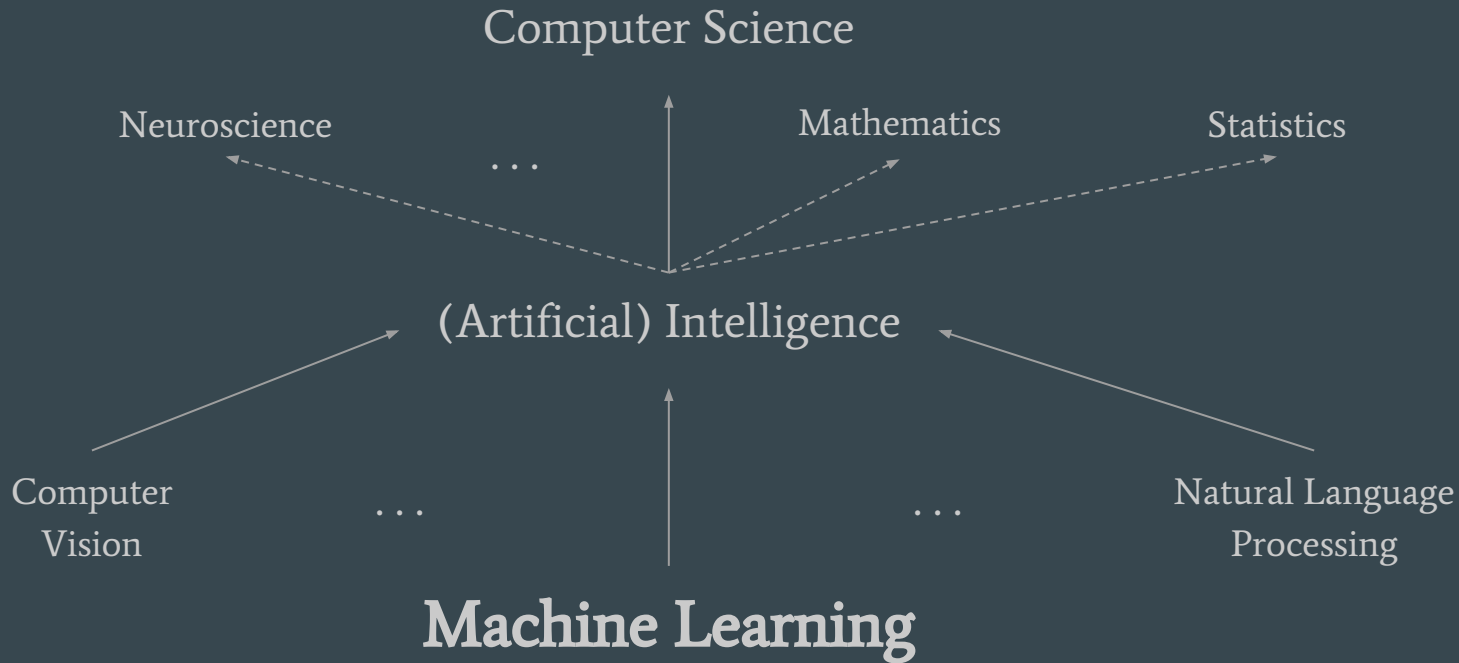
framed mirror exhibited at the Salon Dada, June
1921.

“Man is a slow, sloppy, and brilliant thinker;
computers are fast, accurate, and stupid”

John Pfeiffer, *Fortune* (1961)



Intro



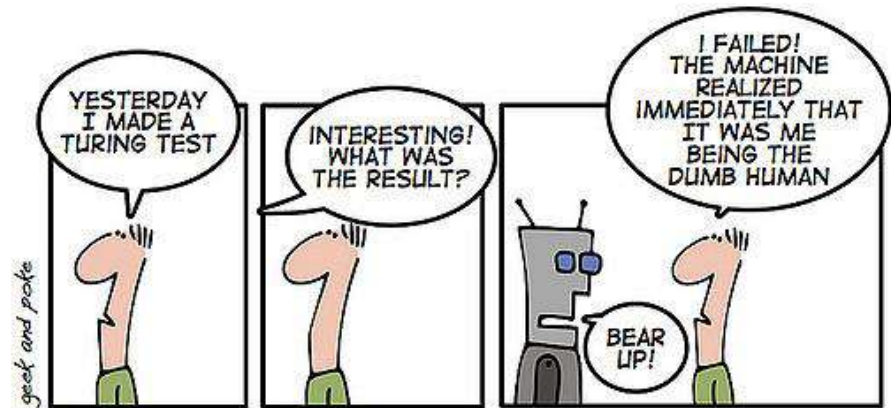
Intro

Definitions

- “[The automation of] activities that we associate with **human** thinking, activities such as decision-making, problem solving, learning ...” (Bellman, 1978)
- “The art of creating machines that perform functions that require intelligence when performed by **people**.” (Kurzweil, 1990)
- “The study of how to make computers do things at which, at the moment, **people** are better.” (Rich and Knight, 1991)

Artificial Intelligence

Artificial Intelligence



TURING TEST 2208

- “Field of study that gives computers the ability to learn without being explicitly programmed” (Samuel, **1959**)
- “A computer program is said to learn from experience E with respect to some class of tasks T and a performance measure P , if its performance at tasks in T , as measured by P , improves with experience E .” (Mitchell, 1997)

Machine Learning - What

When the system needs to:

- **adapt** to the working environment
- **enhance** its performance regarding a specific task
- **discover** new information from empirical data
- **acquire** new computational abilities

Machine Learning - When

Why not using a classical algorithmic approach?

- impossible or, very hard, to **formalize** the problem
- presence of **noise** and/or uncertainty
- high **complexity** in formulating a solution
- lack of **knowledge** "filled in" with respect to the problem

Machine Learning - Why

Spam email detection

View: All

Sender

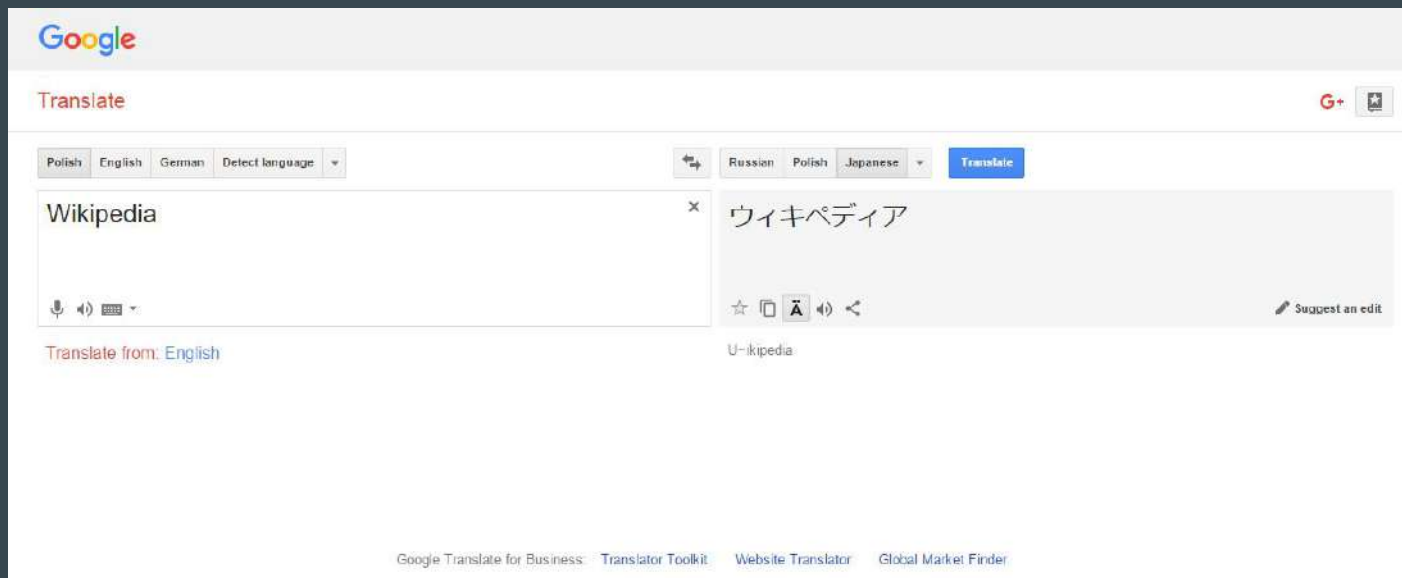
Size	Subject	Sender	Date
4KB	Feel the sweet taste of passion and s'e_xual po...	Megan Q. Escobar	12:30 AM
4KB	This unexampled remedy will bring bigger size ...	Megan O. Escobar	12:30 AM
11KB	הגיע ספר לימוד עצמי אי ביי בעברית חדש	נושא הבשורה	12:30 AM
4KB	Experience astonishing sensations in bed with ...	Megan B. Escobar	12:29 AM
4KB	Hurry to accept this unique offer, 'cuz It means ...	Megan C. Escobar	12:28 AM
4KB	Experience real masculine power with a bigger ...	Megan P. Escobar	12:27 AM
4KB	Experience real masculine power with a bigger ...	Megan Q. Escobar	12:27 AM
7KB	Potenzschwache - wir haben die Losung	Carissa Vazquez	12:17 AM
3KB	ilike others, allows	Nikki Shultz	10/28/2007 11:58 PM
3KB	ilike others, allows	Nikki Shultz	10/28/2007 11:58 PM
3KB	Purchase medications with CanadianPharmacy ...	Mayra Norwood	10/28/2007 11:52 PM
3KB	Quality watches at 25% discount	Bretling Watches	10/28/2
5KB	Energy fur Ihren Schwanz, kaufen und 85% spa...	Angelita Cuevas	10/28/2
3KB	Replica watches	Watches	10/28/20
3KB	Exqulsite Replica	Exqulsite Replica	10/28/2
4KB	Viagra	Sex can	10/28/2
4KB	Cialls	Enjoyable	10/28/2
4KB	\$e>< was never so crazy before! Manster is yo...	Nanette Stroud	10/28/2
5KB	Stop complaining about small penls - change It!	Damian X. Pitts	10/28/2
5KB	Give your s'e_xual life a boost	Damian K. Pitts	10/28/2

Unread:



Machine Learning - Examples

Google Translate (Machine translation)



Machine Learning - Examples

Amazon Recommendations

Customers Who Bought This Item Also Bought



[Abbey Road](#) ~ The Beatles

★★★★☆ (1,106) \$13.99



[Help! \[UK\]](#) ~ The Beatles

★★★★☆ (240) \$14.99



[Please Please Me](#) ~ The Beatles

★★★★☆ (229) \$14.99



[With the Beatles](#) ~ The Beatles

★★★★☆ (186) \$13.97



[The Beatles 1](#) ~ The B

★★★★☆ (1,144) \$12.

Machine Learning - Examples

Shazam



Machine Learning - Examples

Facebook Tag Suggest

We've Suggested Tags for Your Photos
We've automatically grouped together similar pictures and suggested the names of friends who might appear in them. This lets you quickly label your photos and notify friends who are in this album.

Tag Your Friends
This will quickly label your photos and notify the friends you tag. Learn more

Who is this? Who is this? Who is this?

Who is this? Who is this? Who is this?

Francis Lau

Skip Tagging Friends **Save Tags**

Back to Privacy **Preview My**

Customize who can see and comment on things you share, things on your Wall and things you're tagged in.

Things I share **Posts by me** (Default setting for posts, including some videos and photos) **Friends Only**

Photos and videos I'm tagged in
The new Facebook profile puts a row of recently tagged photos of you at the top of your profile. Please note that your privacy settings have not changed. Only people you've allowed to view photos you've tagged in will see these photos on your profile.
Who can see photos and videos I'm tagged in: **Friends Only** **Okay**

Religious and political views **Friends Only**

Birthday **Friends Only**

Places I check in to **Friends Only**

Include me in "People Here Now" after I check in (Shows to friends and groups checked in nearby. See an example) Enable

Edit album privacy for existing photos.

Things others share **Photos and videos I'm tagged in** **Edit Settings**

Can comment on posts (Includes video uploads, Events, Wall posts, and photos) **Friends Only**

Friends can post on my Wall Enable

Can see Wall posts by friends **Friends Only**

Friends can check me in to Places **Edit Settings**

Machine Learning - Examples

Google Home / Now



Machine Learning - Examples

Facebook Automatic Alt Text



Machine Learning - Examples

Facebook Automatic Alt Text



Machine Learning - Examples

Machine Learning

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graph TD; ML[Machine Learning] --- H[ ]; H --- U[Unsupervised]; H --- S[Supervised]; H --- R[Reinforcement]
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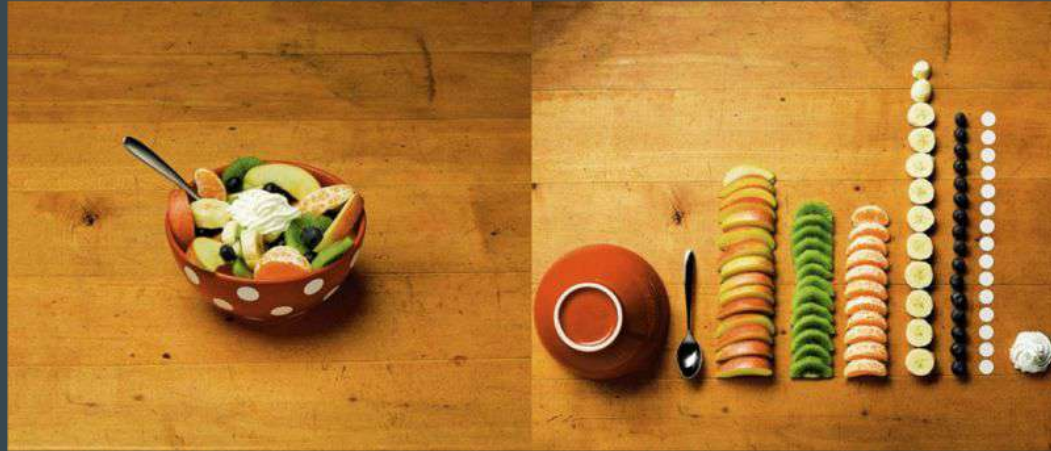
Unsupervised

Supervised

Reinforcement

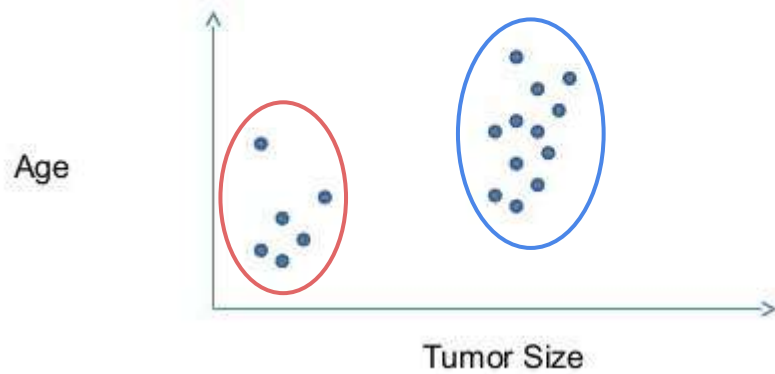
Machine Learning - Paradigms

Unsupervised learning is when you only have input data and **no corresponding labels**.
The goal for unsupervised learning is to model the **underlying structure** or distribution in the data in order to learn more about the data.

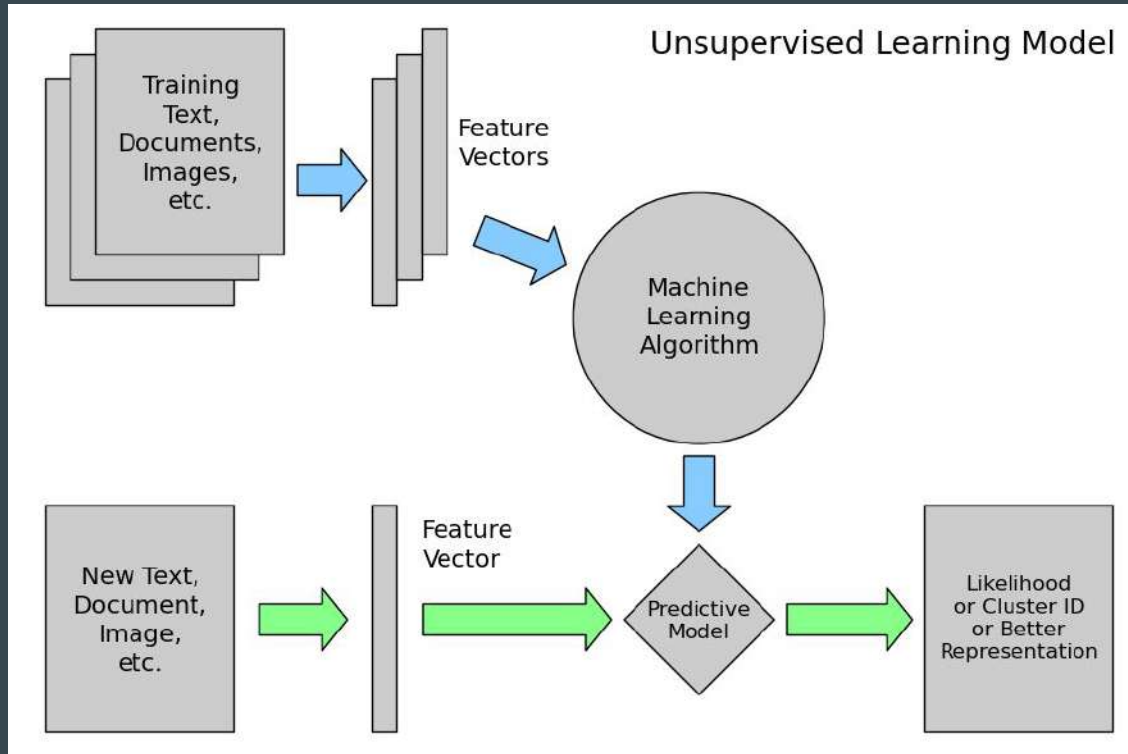


Machine Learning - Unsupervised

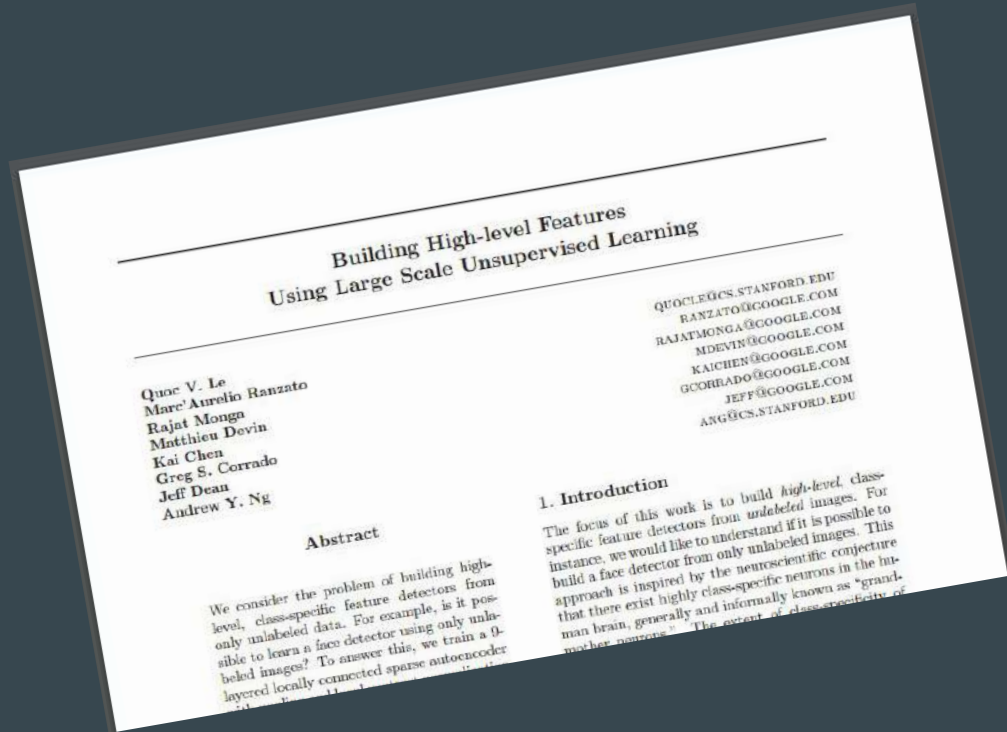
Clustering



Machine Learning - Unsupervised



Machine Learning - Unsupervised



Dataset of **10 million 200x200**
unlabeled images from
YouTube/Web

Train on **1000 machines** (16000
cores) for **1 week**

1.15 billion parameters

Le, Quoc V. "Building high-level features using large scale unsupervised learning." 2013 *IEEE international conference on acoustics, speech and signal processing*. IEEE, 2013.

Machine Learning - Unsupervised - Case history



Human faces



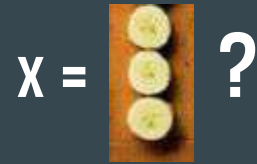
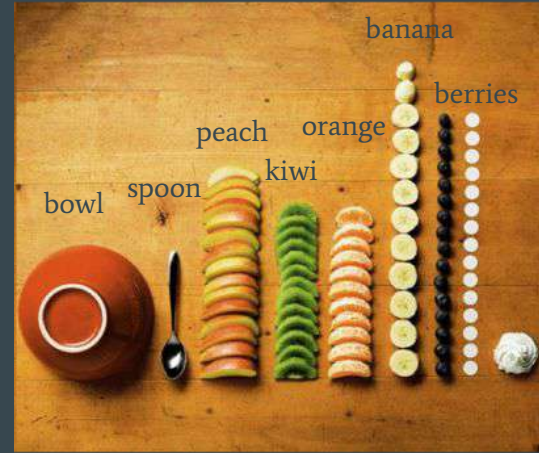
Cat faces

Machine Learning - Unsupervised - Case history

Supervised learning is when you have **input variables** (X) and an **output labels** (Y) and you use an algorithm to learn the **mapping function** from the input to the output.

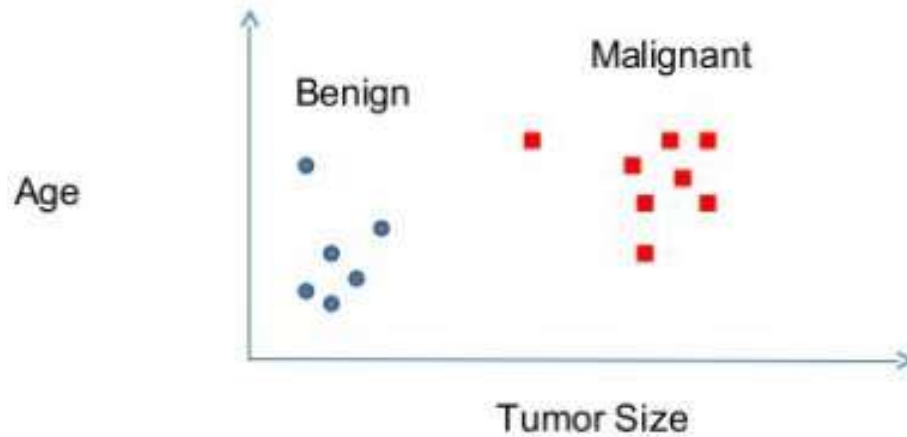
$$Y = f(X)$$

The goal is to approximate the mapping function so well that when you have new input data (x) that you can **predict** the output variables (Y) for that data.

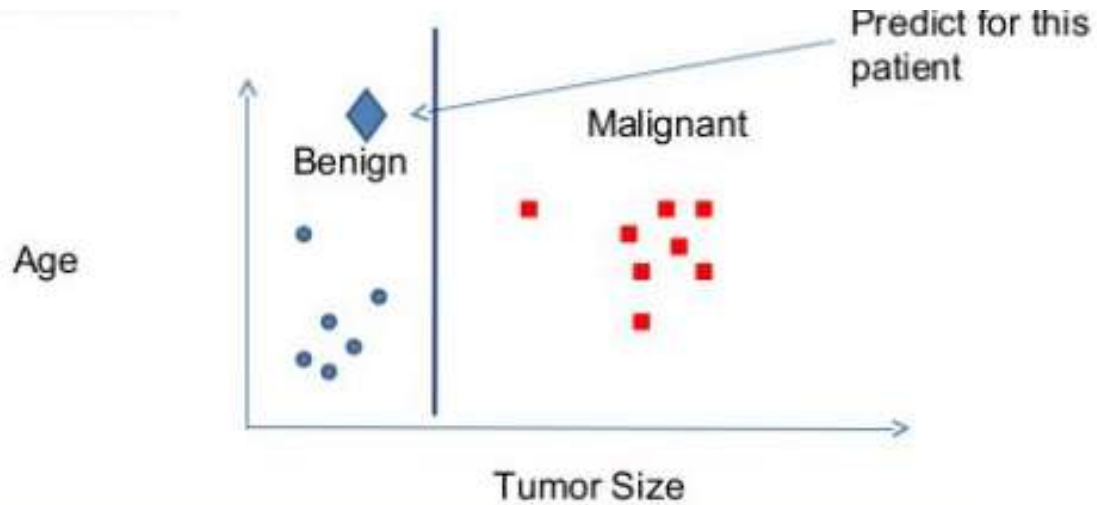


Y= banana!

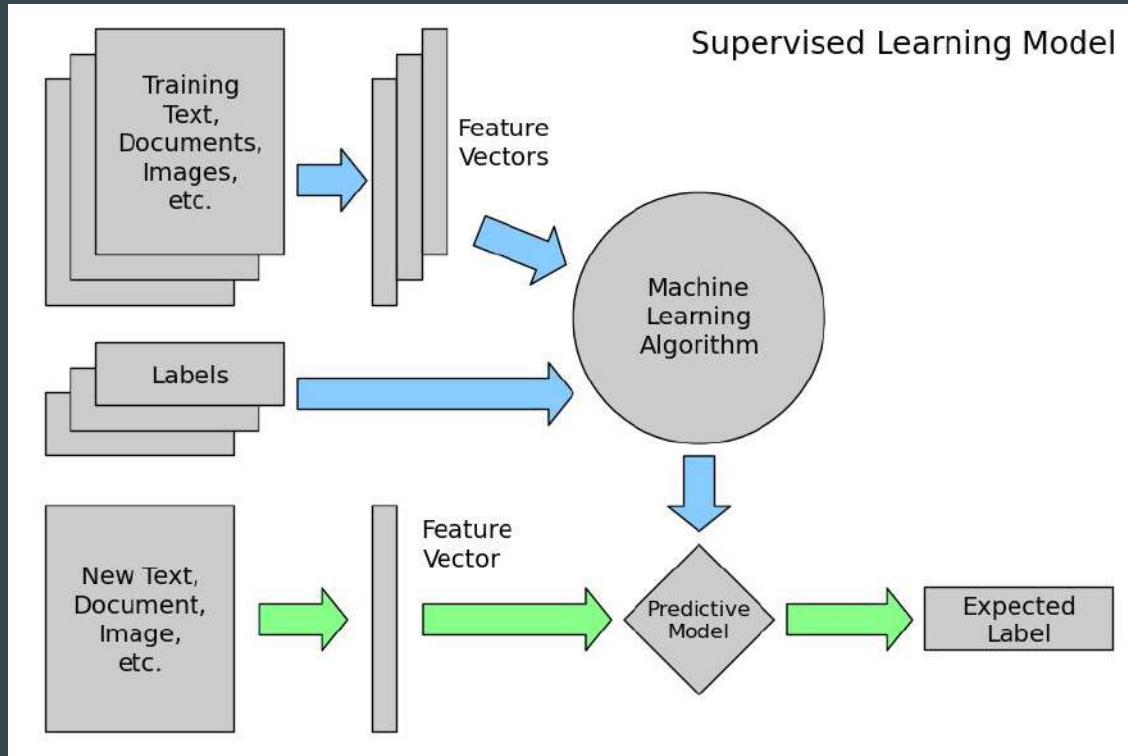
Machine Learning - Supervised



Machine Learning - Supervised



Machine Learning - Supervised



Machine Learning - Supervised

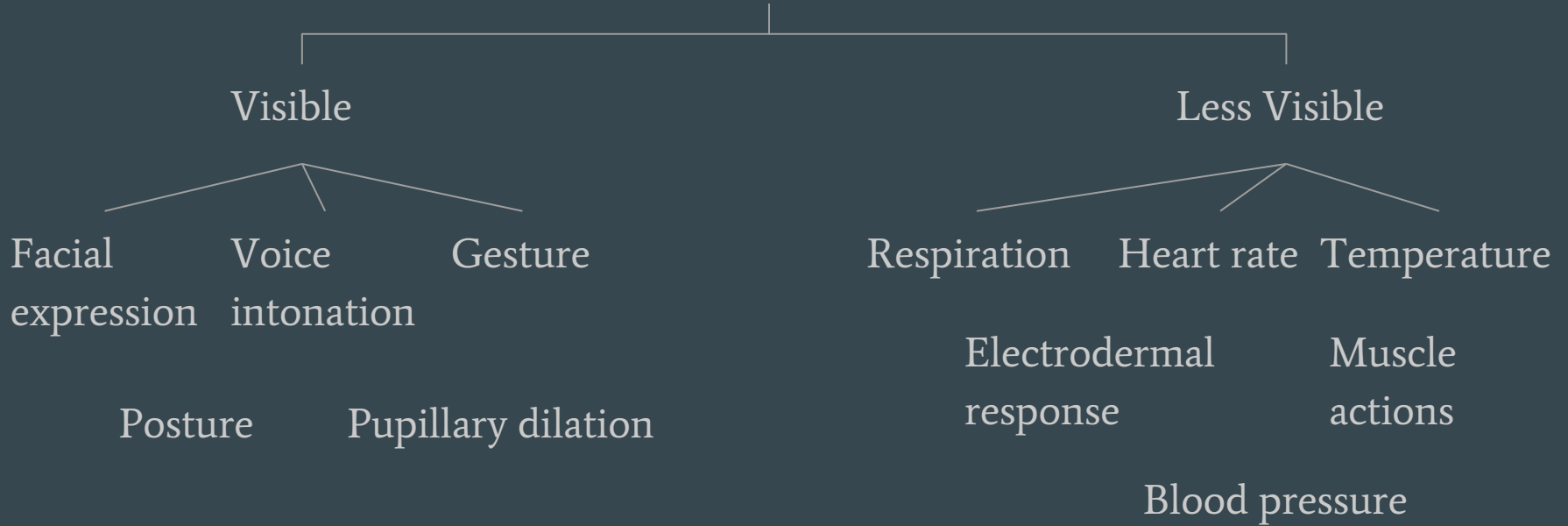
Affective Computing (AC) is an interdisciplinary field spanning computer science, psychology, and cognitive science.

“AC is computing that relates to, arises from, or deliberately influences emotion or other affective phenomena” (Picard, 1997)

The machine should interpret the emotional state of humans and adapt its behaviour to them, giving an appropriate response for those emotions.

Affective computing

Emotional cues



Affective computing

CV1 [cs.CV] 16 May 2015

The color of smiling: computational synaesthesia of facial expressions

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² Dipartimento di Informatica Università di Milano
via Comelico 39/41, Italy
{lanzarotti,boccignone}@di.unimi.it

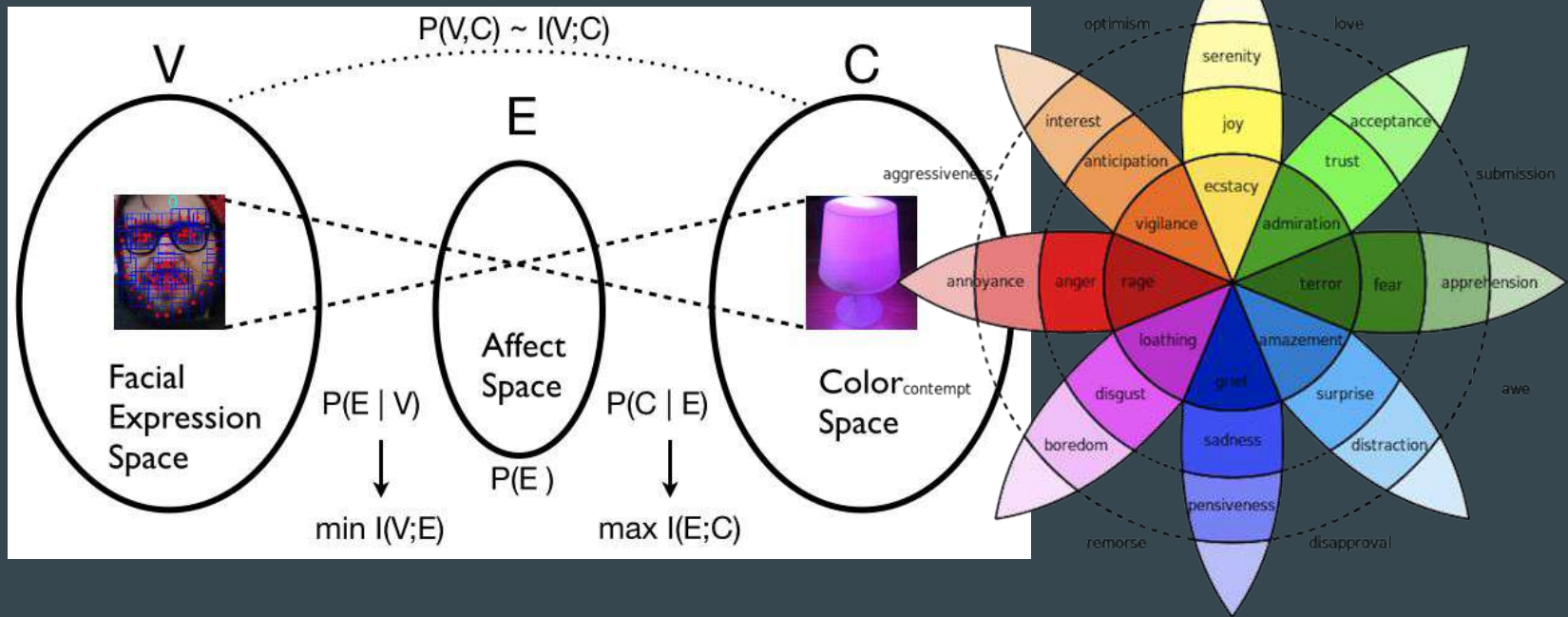
Abstract. This note gives a preliminary account of the transcoding or rechanneling problem between different stimuli as it is of interest for a natural interaction or affective computing fields. By the consideration of a simple example, namely the color response of an affective information-sensed facial expression, we frame the problem within an information-theoretic perspective. A full justification in terms of the Information-Bottleneck principle promotes a latent affective space, hitherto surmised as an appealing and intuitive solution, as a suitable mediator between the different stimuli.



Machine Learning - Supervised - Affective computing

X

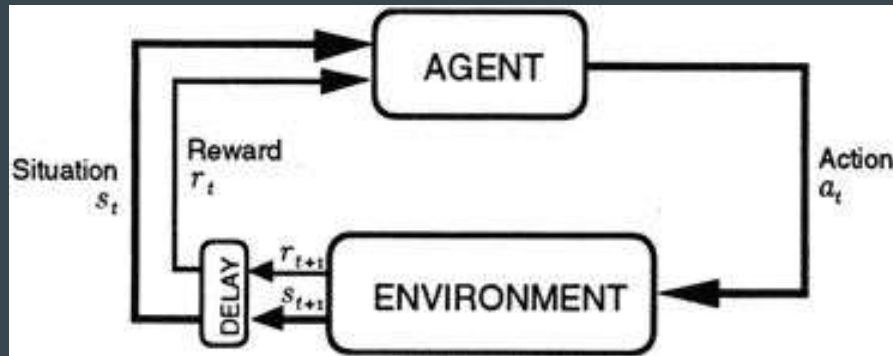
Y



Machine Learning - Supervised - Affective computing

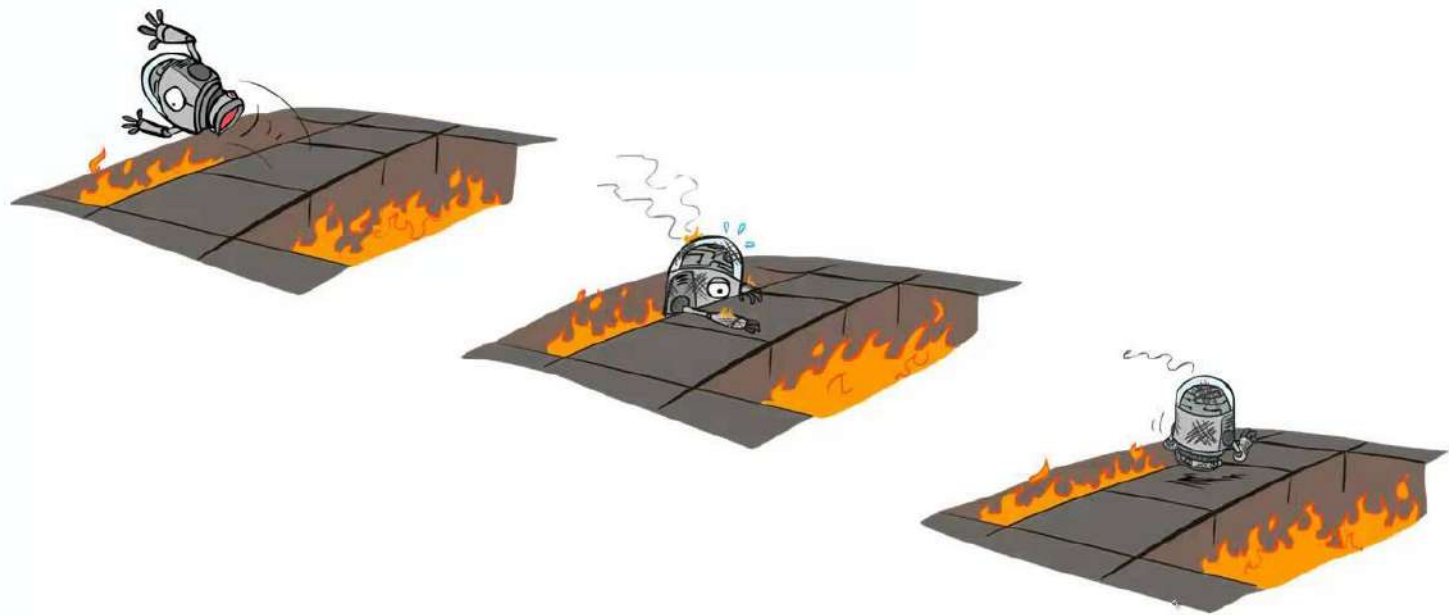
Reinforcement learning is learning by interacting with an environment.

An RL agent learns from the consequences of its actions, rather than from being explicitly taught and it selects its actions on basis of its past experiences (**exploitation**) and also by new choices (**exploration**), which is essentially trial and error learning.



- a set of environment states **S**
- a set of actions **A**
- rules of transitioning between states
- rules that determine the scalar immediate reward of a transition
- rules that describe what the agent observes.

Machine Learning - Reinforcement



Machine Learning - Reinforcement

Self-driving car (Reinforcement Learning)

old_momentum = 0.9
new_momentum = -
epsilon = 1
alpha = 0.01
gamma = 0.99
Exploration

headWay1 = 0.733	reward1 = 0.133	v1 = 94	a1 = 0.6
headWay2 = 1.262	reward2 = -5.105	v2 = 91	a2 = -0.9
headWay3 = 1.842	reward3 = -5.154	v3 = 84	a3 = -1.2
headWay4 = 1.258	reward4 = 0.19	v4 = 106	a4 = 0.6
headWay5 = -	reward5 = -	v5 = 111	a5 = 0

Machine Learning - Reinforced - Autonomous cars

Thanks!

I THINK
THE INTER-
NET IS
TRYING TO
KILL ME.



WE
CALL IT
"MACHINE
LEARNING."



Vittorio Cuculo

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