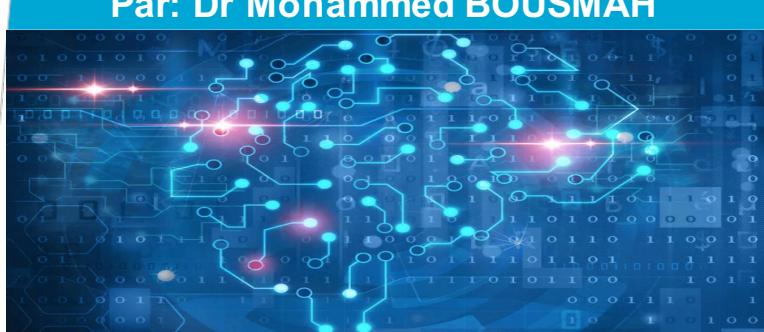


Développement Multiplateformes et Technologies émergentes

From Traditional Programming
To Machine Learning & Deep Learning

Par: Dr Mohammed BOUSMAH



What is Cross-Platform Development ?



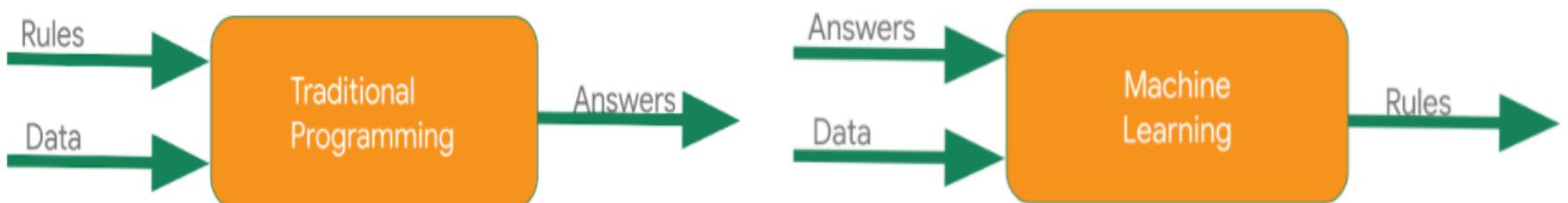
What is Cross-Platform Development ?

Development = Programming

Cross-platform = Multi-platform

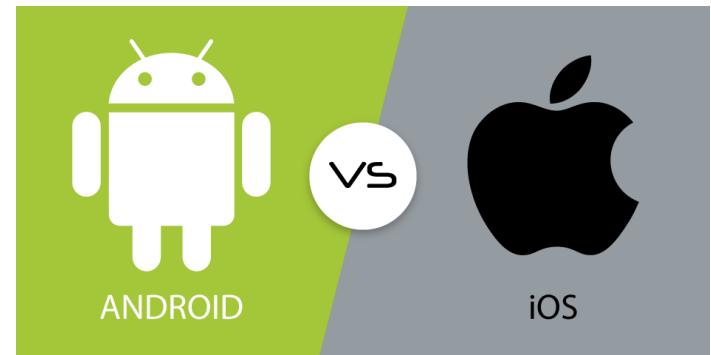
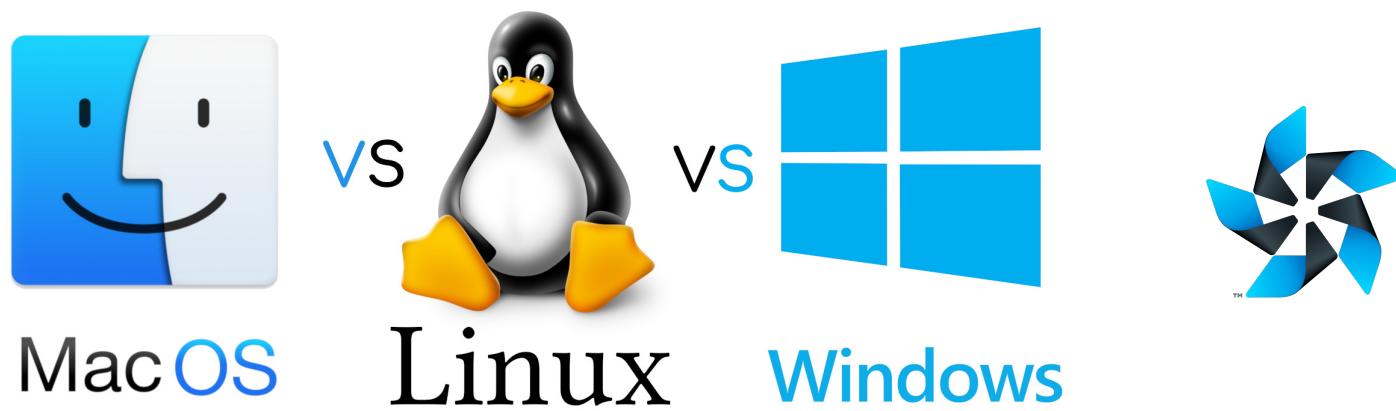
In 2021, Platform can refer to the:

- Type of OS (Linux, MacOS, Windows, Android, IOS) or other
- Type of Hardware, processor (CPU) or other
- Type of Programming Paradigms (Traditional Programming vs Machine Learning programming)



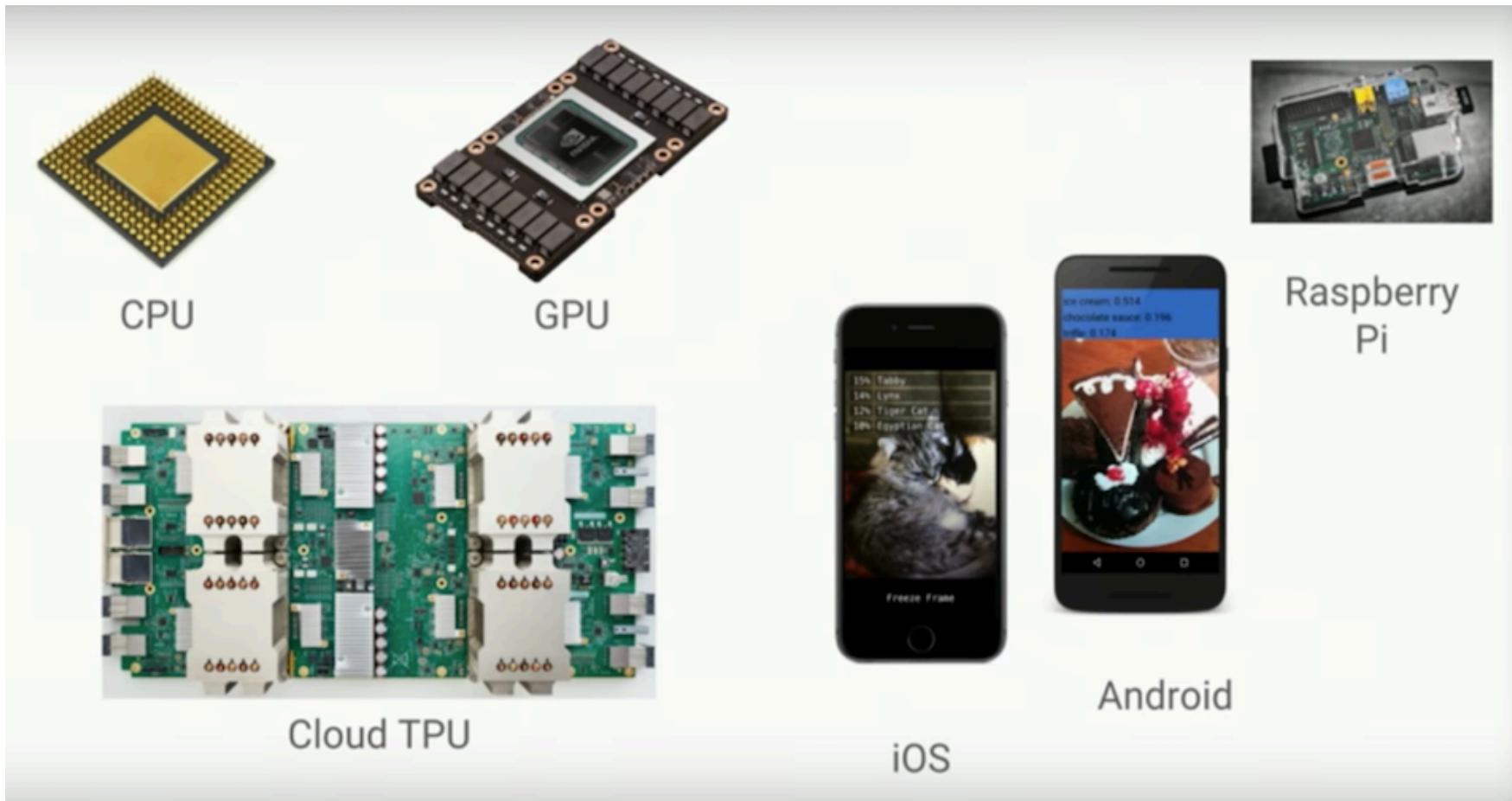
What is Cross-Platform Development ?

- ❑ Type of OS (Linux, MacOS, Windows, Android, IOS) or other



CPU GPU TPU

Platform can refer to the type of processor (CPU) or other hardware



System on Chip (SoC)

Platform can refer to the type of SoC



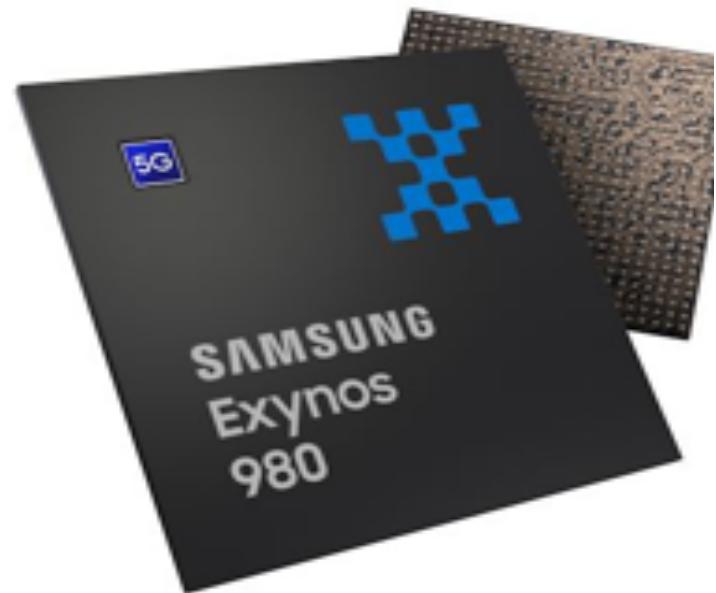
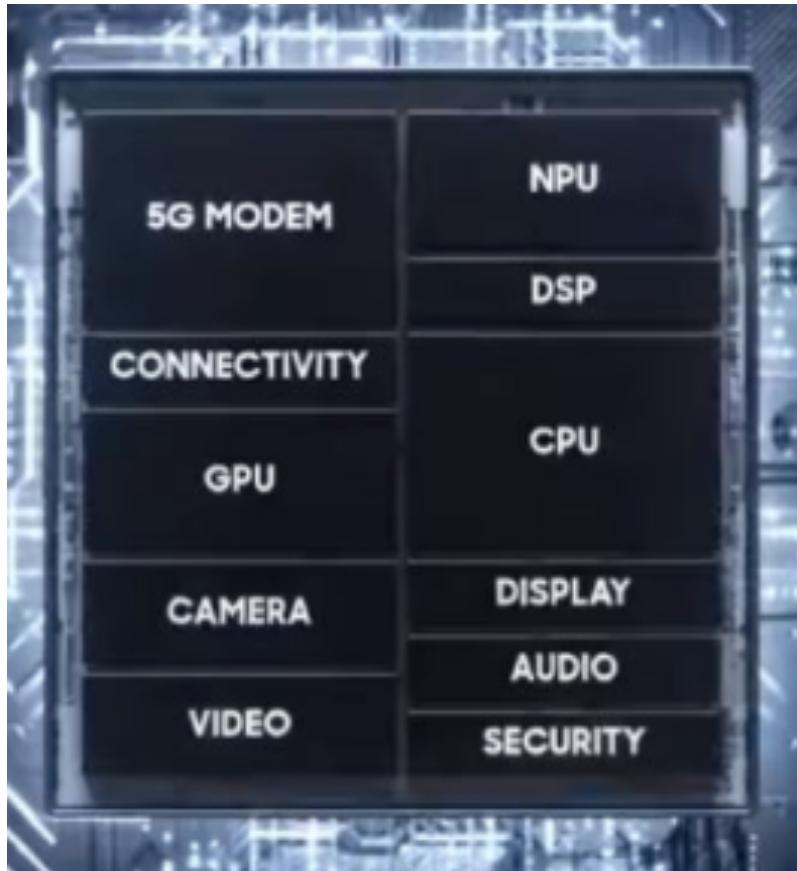
System on Chip (SoC)

Platform can refer to the type of SoC

	Snapdragon 865	Huawei Kirin 990 5G	Samsung Exynos 990 (Exynos 9830)	MediaTek Dimensity 1000
CPU	1xCortex A77 @2.84GHz + 3xCortex A77 @2.42GHz + 4x Cortex A55 @1.8GHz	Tri-cluster octa-core (2 x Cortex-A76 cores @2.86GHz 2x Cortex-A76 cores @2.36GHz 4x Cortex-A55 cores @1.95GHz)	2x Exynos M5 2x Cortex A76 4x Cortex A55	4x Cortex A77 @ 2.6GHz 4x Cortex A55 @ 2.0GHz
Process	TSMC 7nm N7P	TSMS 7nm+ EUV	7nm EUV	N7
GPU	Adreno 650 @? MHz	Mali-G76MP16@700MHz	Mali-G77 MP11	ARM Mali-G77 MC9 @ ? MHz
NPU/APU/AI Proc	Hexagon 698 15 TOPS AI	2 + 1 Da Vinci (three cores)	Dual-core NPU 10 TOPs	APU 3.0 6 cores (two big cores, three small cores and a single tiny core)

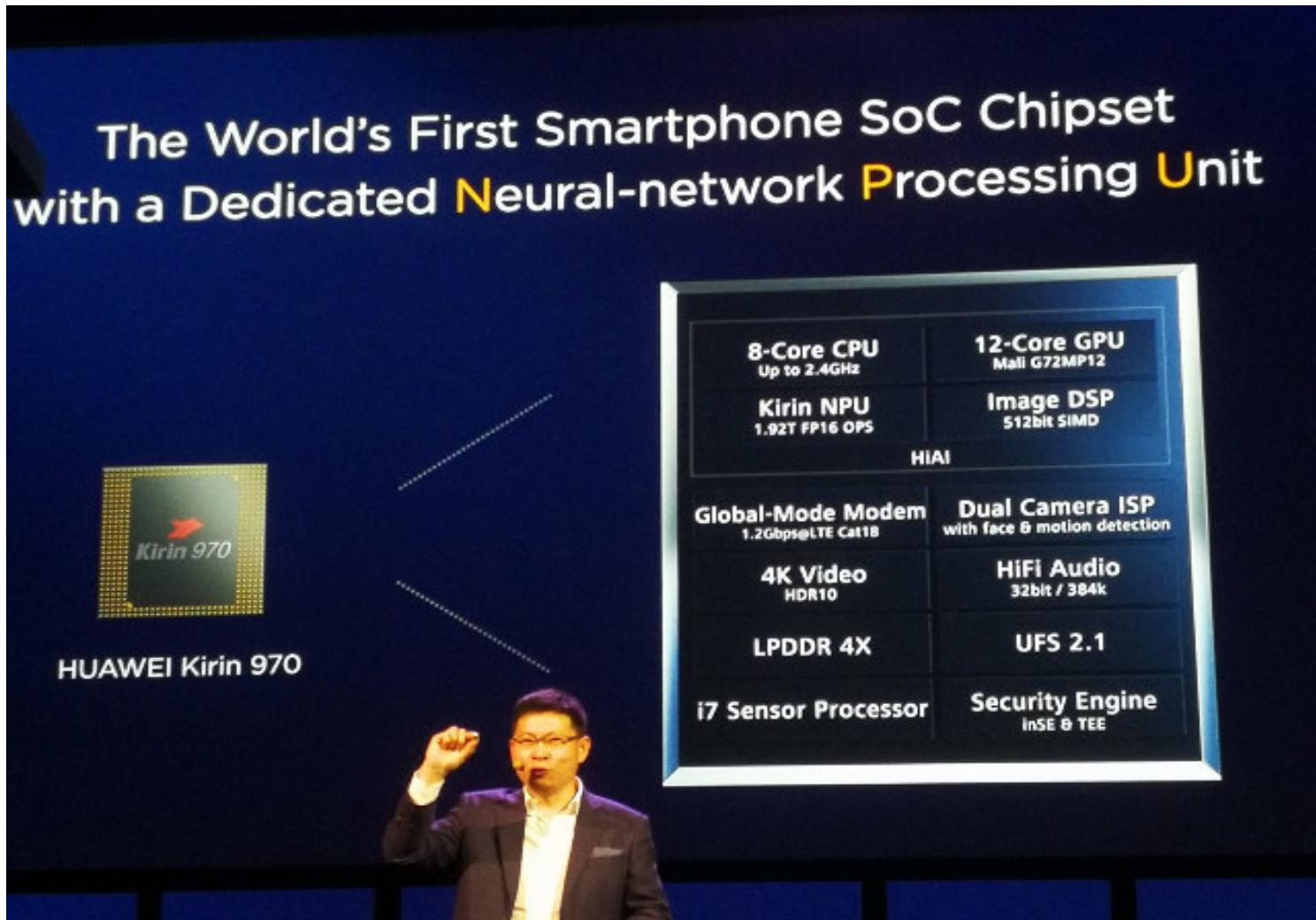
Neural Processing Unit (NPU)

Platform can refer to the type of SoC



Neural Processing Unit (NPU)

Platform can refer to the type of SoC



Neural Processing Unit (NPU)

Platform can refer to the type of SoC

PLATFORM	OS	Android 10, One UI 2.5
	Chipset	Exynos 990 (7 nm+) - Global
		Qualcomm SM8250 Snapdragon 865+ (7 nm+) - USA
CPU		Octa-core (2x2.73 GHz Mongoose M5 & 2x2.50 GHz Cortex-A76 & 4x2.0 GHz Cortex-A55) - Global
		Octa-core (1x3.0 GHz Kryo 585 & 3x2.42 GHz Kryo 585 & 4x1.8 GHz Kryo 585) - USA
GPU		Mali-G77 MP11 - Global
		Adreno 650 - USA

Samsung Galaxy Note20 Ultra 5G pictures



Released 2020, August 21
 208g, 8.1mm thickness
 Android 10, One UI 2.5
 128GB/256GB/512GB storage, microSDXC

~ 7.4%
2,688,611 HITS

454
BECOME A FAN

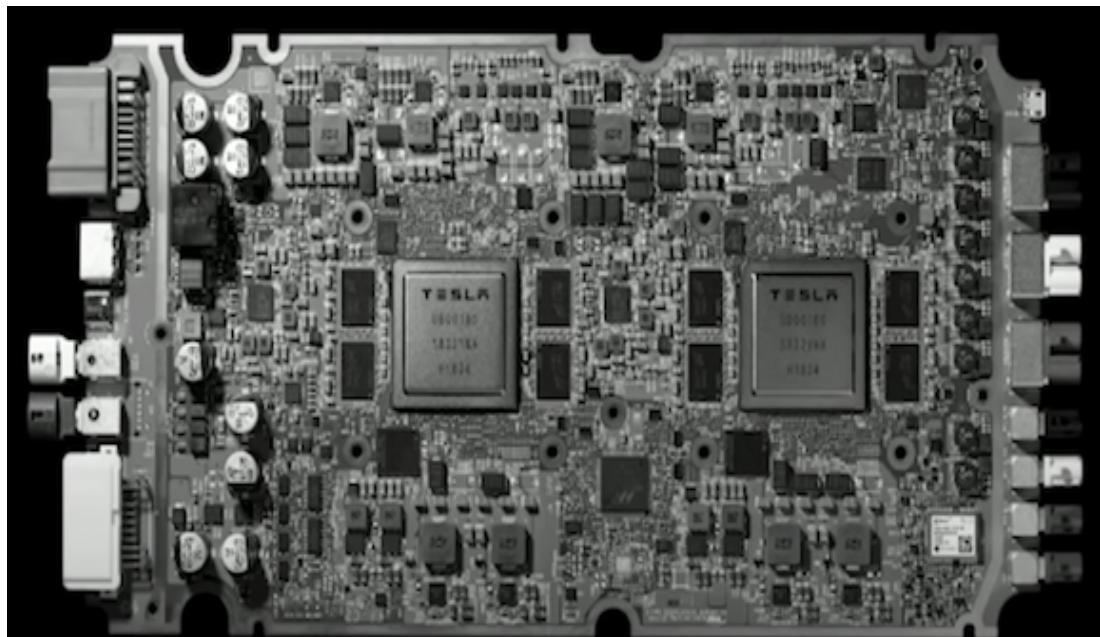
6.9"
1440x3088 pixels

108MP
4320p

12GB RAM
Exynos 990

4500mAh
Li-Ion

Example of Platform (TESLA FSDC)



FULL SELF-DRIVING COMPUTER



Copyright: bousmah@gmail.com

Camera Serial Interface

2.5 G pixel/s

Example of Platform (TESLA FSDC)

Full Self-Driving

360°

Rear, side and forward-facing cameras provide maximum visibility

160 m

Forward-facing radar provides a long-range view of distant objects

12 Ultrasonic Sensors

Detect nearby cars, prevent potential collisions and assist with parking

Autopilot

Future of Driving

Autopilot advanced safety and convenience features are designed to assist you with the most burdensome parts of driving.

Tesla, Inc.

Electric car company



TESLA

tesla.com

Tesla, Inc. is an American electric vehicle and clean energy company based in Palo Alto, California. Tesla's current products include electric cars, battery energy storage from home to grid scale, solar products and related products and services.

[Wikipedia](#)

Stock price: TSLA (NASDAQ)

\$442.30 +8.30 (+1.91%)

Oct 12, 16:00 EDT - Disclaimer

Founded: July 1, 2003, San Carlos, California, United States

CEO: Elon Musk (Oct 2008–)

Revenue: 24.58 billion USD (2019)

Owner: Elon Musk (20.8%)

Founders: Elon Musk, JB Straubel, Martin Eberhard, Marc Tarpenning, Ian Wright

This Is What Tesla's Autopilot Sees On The Road

Examples of Artificial Intelligence (AI)?



Industry	Robotics
Founded	1992; 26 years ago
Headquarters	Waltham, Massachusetts, United States
Owner	Independent (1992–2013) X (Google X-Lab) (2013–2017) Softbank Group Corp. (2017–present)
Website	www.bostondynamics.com

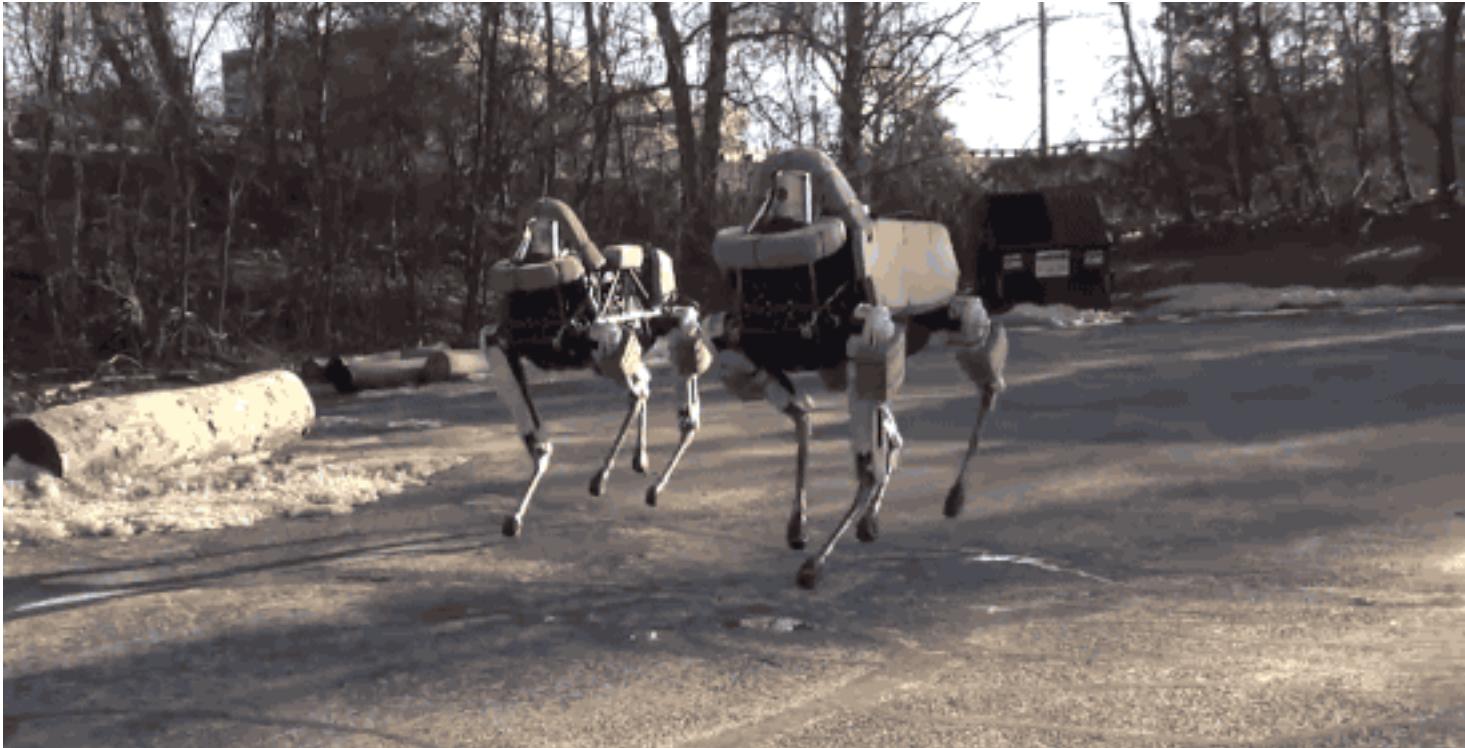
[BostonDynamics](#)

Examples of Artificial Intelligence (AI)?



BostonDynamics

Examples of Artificial Intelligence (AI)?

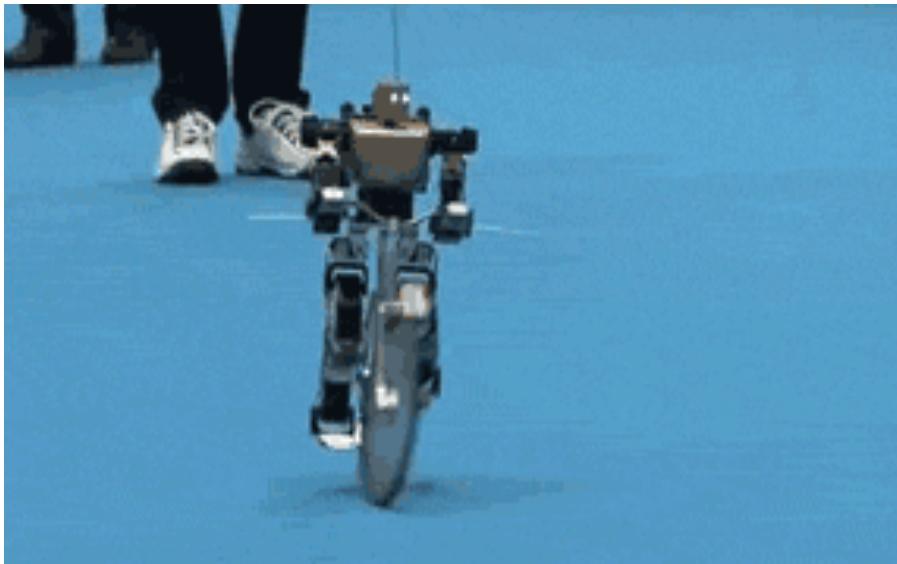


BostonDynamics

Examples of Artificial Intelligence (AI)?



Examples of Artificial Intelligence (AI)?

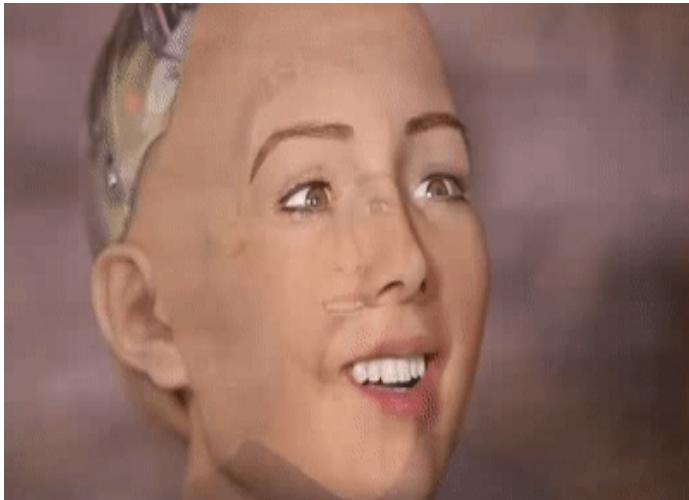


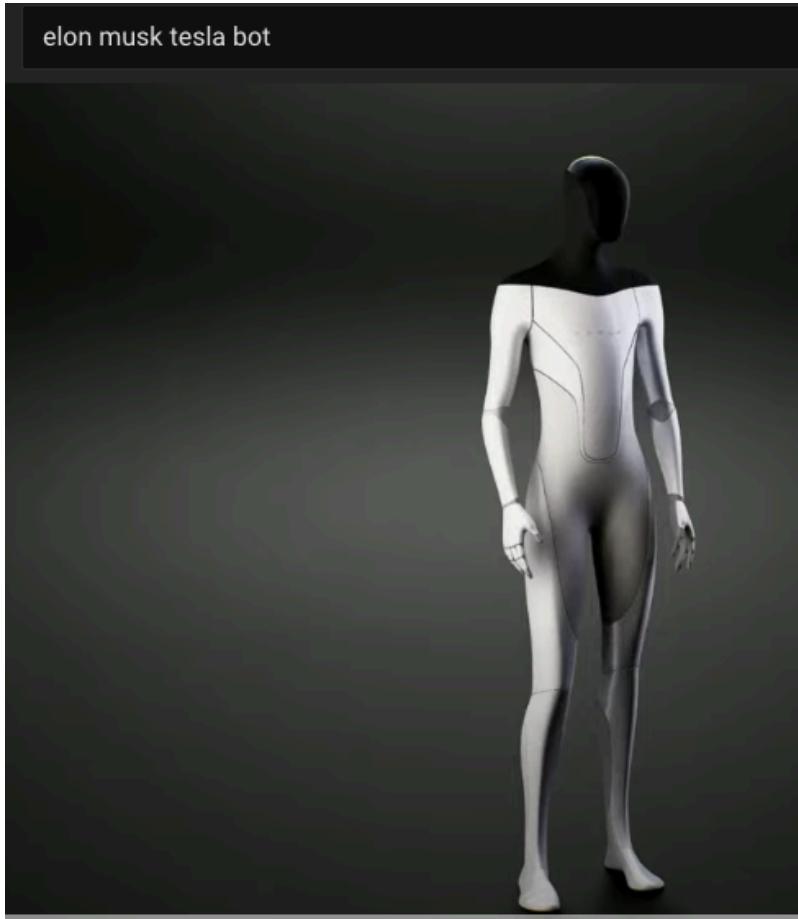
Examples of Artificial Intelligence (AI)?

Sophia, robot saoudienne et citoyenne

L'Arabie saoudite est devenu le premier pays à accorder la nationalité à un humanoïde. Ce « robot social » peut reconnaître les visages, et son propre faciès en silicone peut mimer 62 expressions humaines.

LE MONDE | 04.11.2017 à 08h00 | Par Violaine Morin





elon musk tesla bot

Elon Musk REVEALS Tesla Bot (full presentation)
4,344,541 views (30/09/2021) Aug 20, 2021

L'intelligence artificielle concurrence les programmeurs informaticiens

L'entreprise américaine OpenAI a annoncé la sortie de Codex, un logiciel capable de programmer à la demande.

Par David Larousserie

Publié le 24 août 2021 à 06h30 · ⏲ Lecture 5 min.

<https://openai.com/blog/openai-codex/>

Définition de l'IA

L'Intelligence Artificielle concerne la conception et la réalisation d'un **système matériel ou logiciel** capable de posséder ou produire les capacités et caractéristiques propres à un **cerveau humain ou animal**.

Deux types d'approches

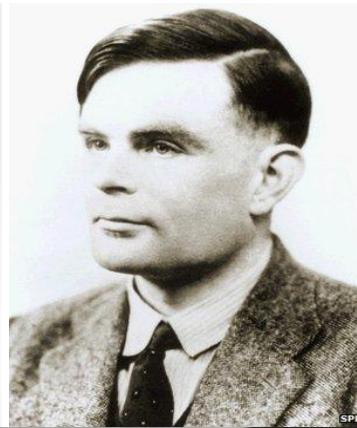
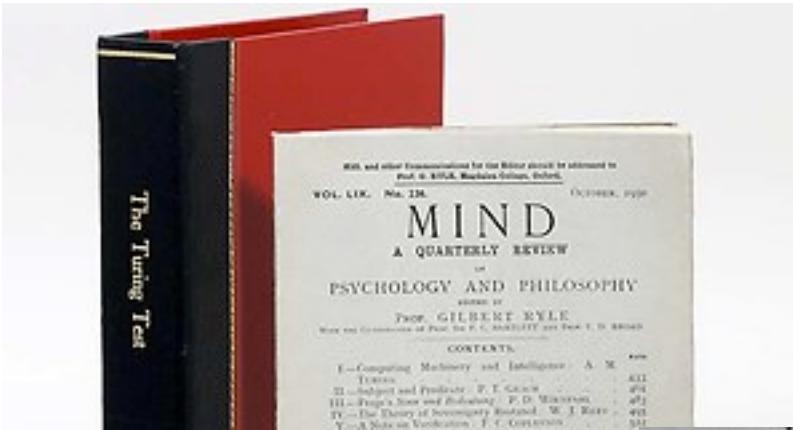
- IA Forte (approche cognitive)
 - La machine doit raisonner à la manière de l'homme (utiliser les mêmes mécanismes de fonctionnement)
- IA Faible (approche pragmatiste)
 - La machine doit aboutir aux mêmes solutions que l'homme ou l'animal (peu importe la méthode employée)
 - En fait l'IA reste difficile à définir car on ne sait pas vraiment définir la notion d'Intelligence (Qu'est ce qu'être intelligent ?)

Définition de l'IA

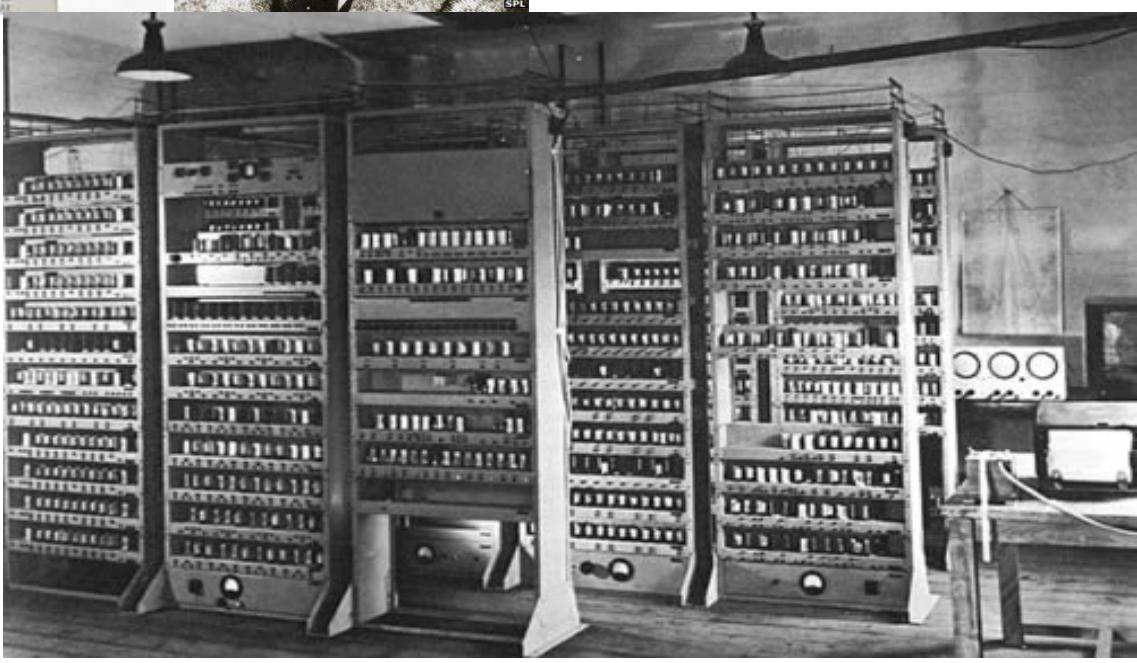
Les ordinateurs ne sont pas intelligents, toute l'ingéniosité du chercheur ou ingénieur en IA consiste à vous faire croire qu'ils le sont !

Origine de l'intelligence artificielle

1950 : Alan Turing imagine la machine intelligente



**Chercheur britannique,
célèbre pour avoir
décrypté le code Enigma
des nazis, s'est évertué à
démontrer que les
machines seraient un jour
capables de penser.**



Histoire de l'intelligence artificielle

1957 : le Perceptron, première machine apprenante



Frank Rosenblatt (July 11, 1928 – July 11, 1971) was an American psychologist notable in the field of Artificial Intelligence.

1973 : le premier « hiver » arrive sur l'IA



Lors d'un débat à la BBC, un mathématicien expose ses doutes sur l'intelligence artificielle. Conséquence : un gel brutal des financements.

Histoire de l'intelligence artificielle

1997 : Kasparov s'incline face à Deep Blue



En 19 coups, le plus grand joueur d'échecs a été terrassé par la machine

2011 : Avec Watson, IBM remporte « Jeopardy ! »



En gagnant le plus célèbre jeu télévisé aux Etats-Unis, IBM fait franchir à l'ordinateur une étape dans sa course contre l'être humain.

Histoire de l'intelligence artificielle

2013 : les GAFA se ruent sur le « machine learning »



A coups de centaines de millions de dollars, les géants de la Silicon Valley font main basse sur les spécialistes de l'intelligence artificielle.

2016 : Google devient maître du Go



A Séoul, le logiciel AlphaGo bat le champion Lee Sedol sur un score sans appel

Quels sont les acteurs de l'IA?

GAFA et BATX

- Baidu = Google
- Alibaba = Amazon
- Tencent (Wechat) = Facebook
- Xiomni = Apple

Amazon, Apple, Facebook, IBM and Microsoft are investing huge sums to develop their AI capabilities **\$21.3bn**

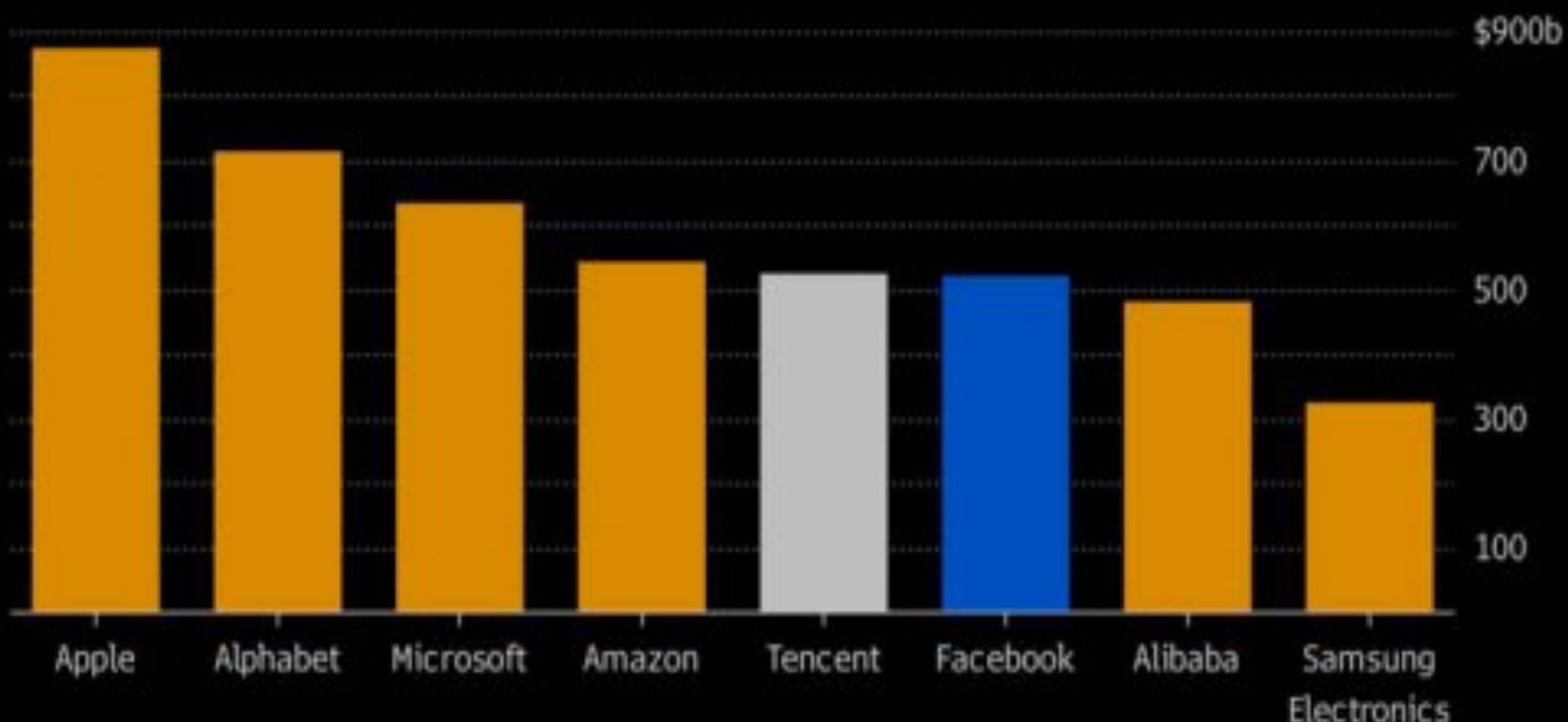


China seeks dominance of global AI industry
for investing in artificial intelligence — creating a **\$150bn** industry by 2030 —
underlines its desire to beat the US.

Quels sont les acteurs de l'IA?

Membership Approved

Tencent overtakes Facebook to cement place in \$500 billion market cap club

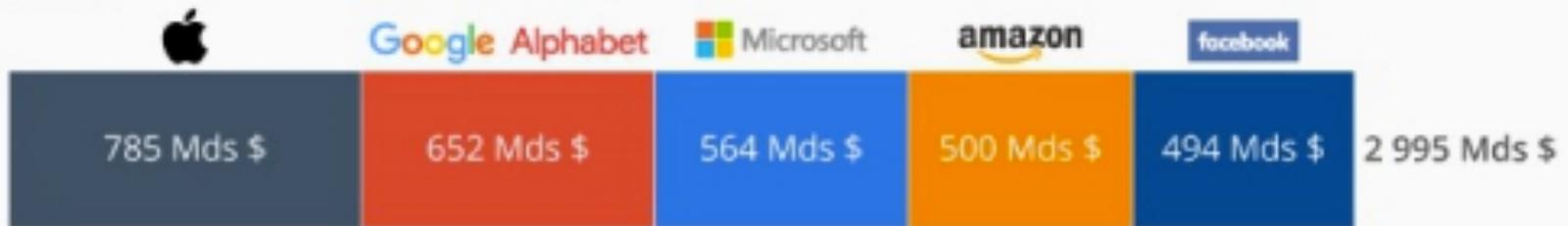


Source: Bloomberg

Bloomberg

Quels sont les acteurs de l'IA?

GAFAM



Le PIB (Produit intérieur brut) du Maroc est des 120 milliards de dollars en 2017



* Estimation du FMI.



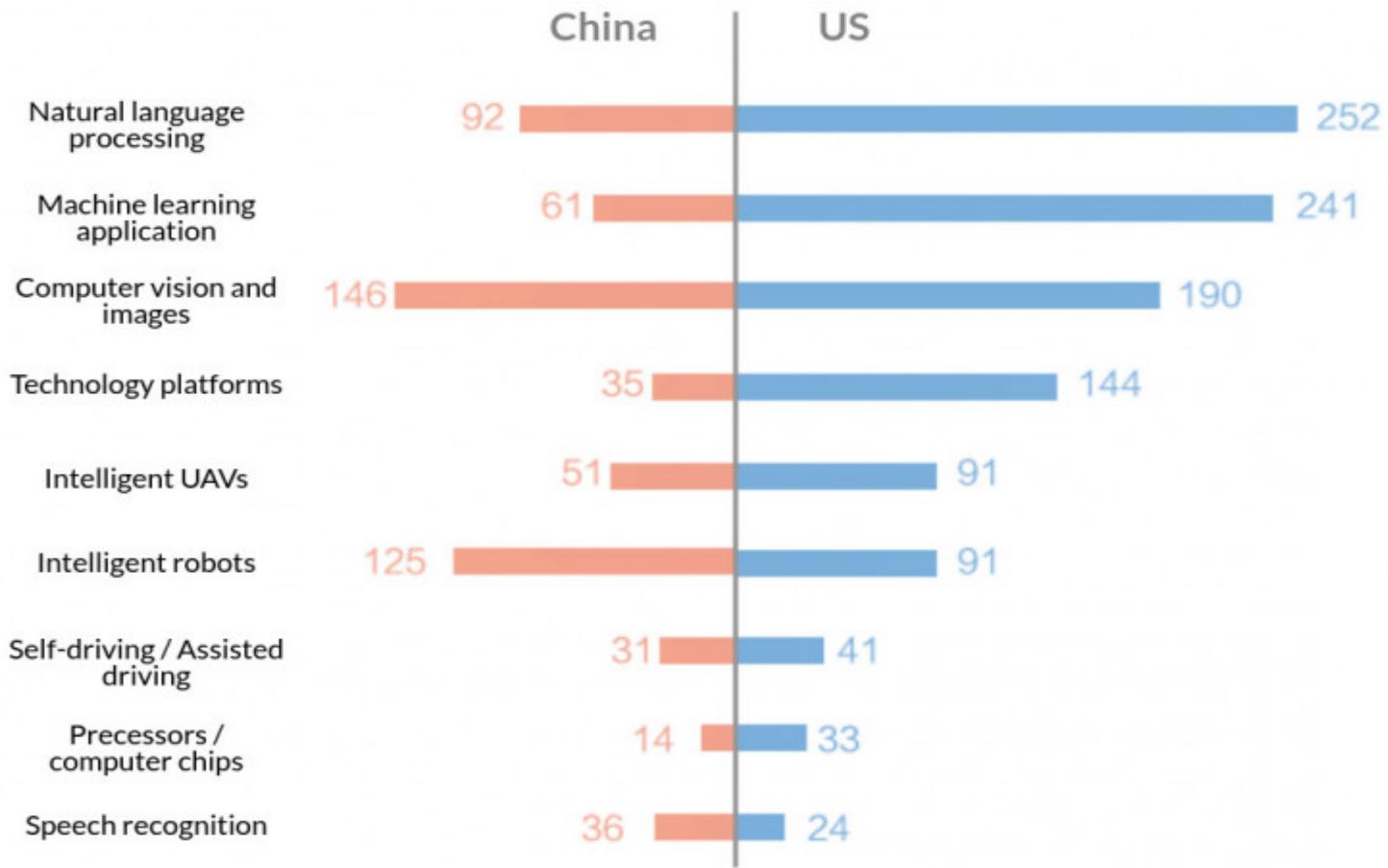
Données arrondies

Cours de clôture du 27 juillet 2017.

Sources : Yahoo! Finance, FMI

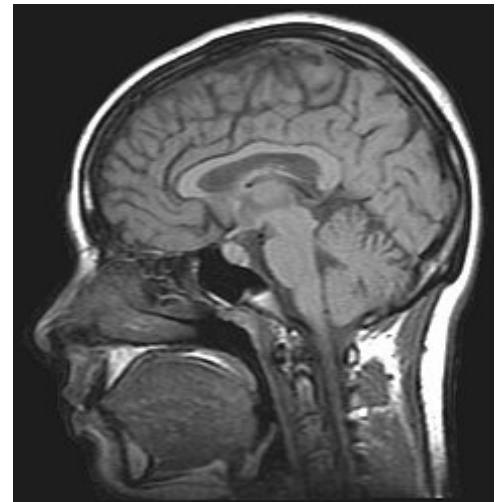
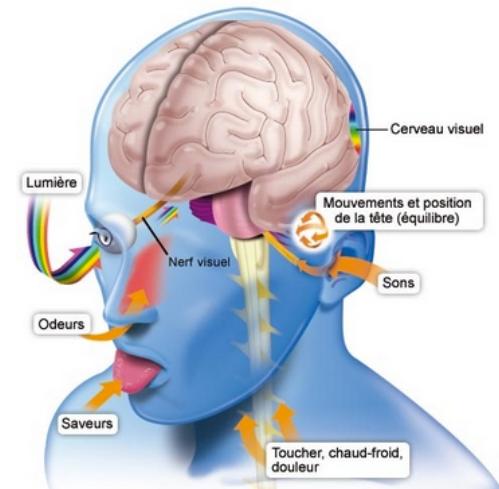
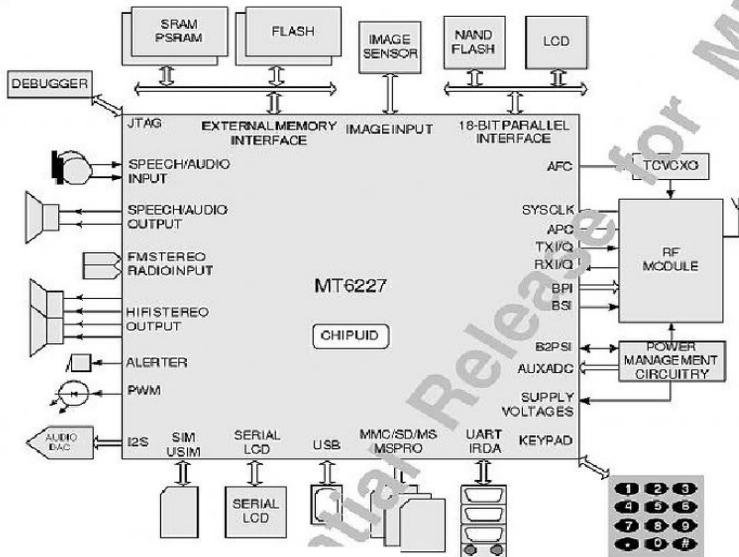
statista

Quels sont les acteurs de l'IA?

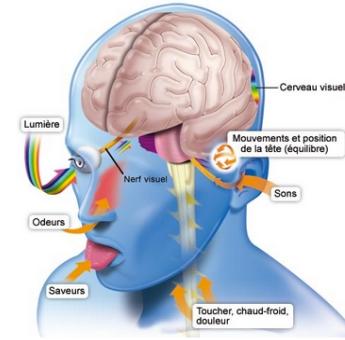


(Numbers indicate the number of enterprises)

Perception du Monde Machine vs Human



Perception du Monde Machine vs Human



Character	ASCII
a	97
b	98
c	99
d	100
e	101
f	102
g	103
h	104
i	105
j	106
k	107
l	108
m	109

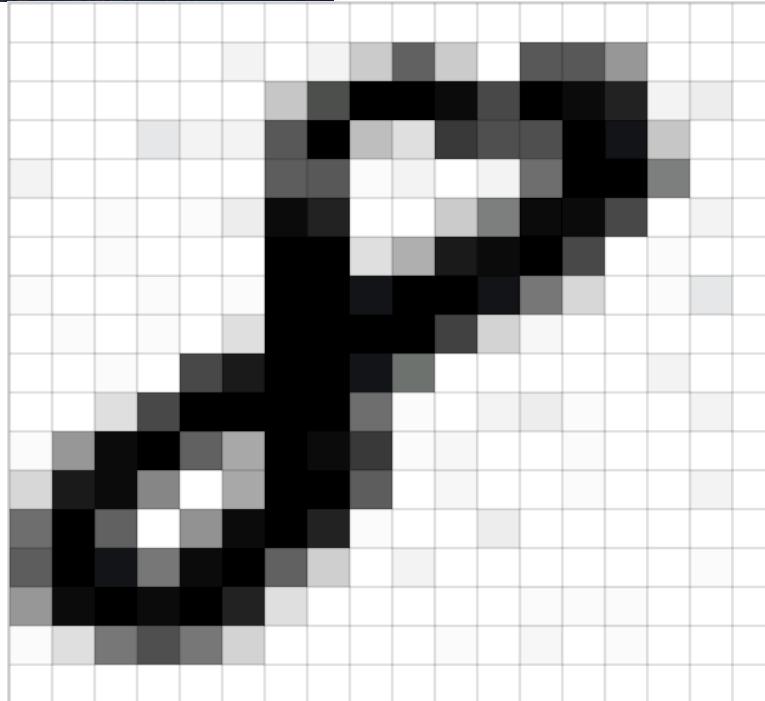
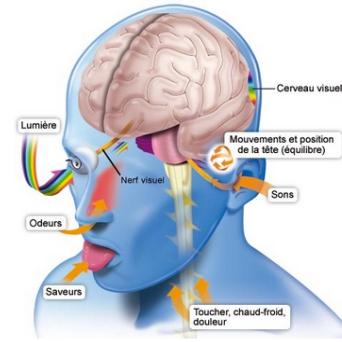
Character	ASCII
n	110
o	111
p	112
q	113
r	114
s	115
t	116
u	117
v	118
w	119
x	120
y	121
z	122

Character	ASCII
A	65
B	66
C	67
D	68
E	69
F	70
G	71
H	72
I	73
J	74
K	75
L	76
M	77

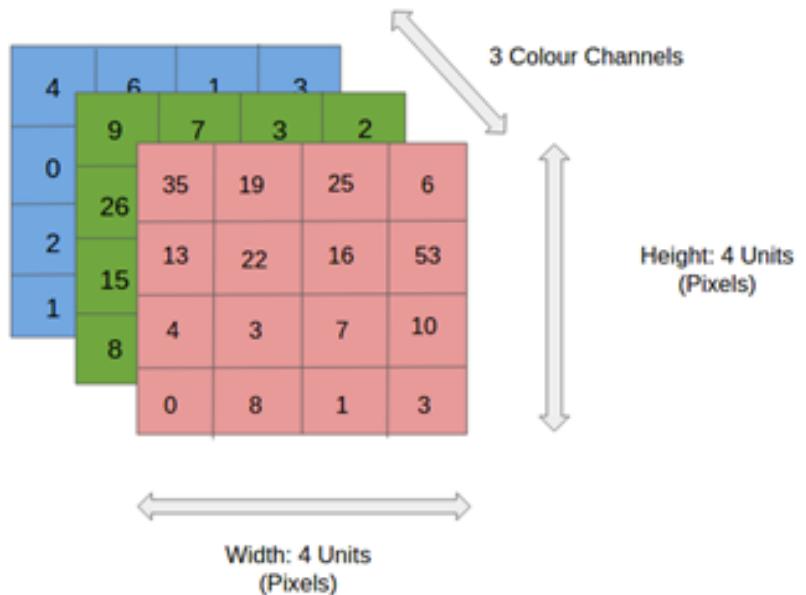
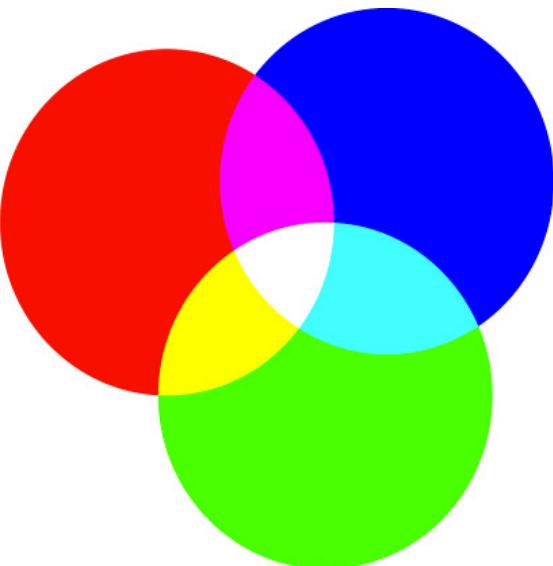
Character	ASCII
N	78
O	79
P	80
Q	81
R	82
S	83
T	84
U	85
V	86
W	87
X	88
Y	89
Z	90

Character	ASCII
0	48
1	49
2	50
3	51
4	52
5	53
6	54
7	55
8	56
9	57

Perception du Monde Machine vs Human



Perception du Monde Machine vs Human



Original



Red

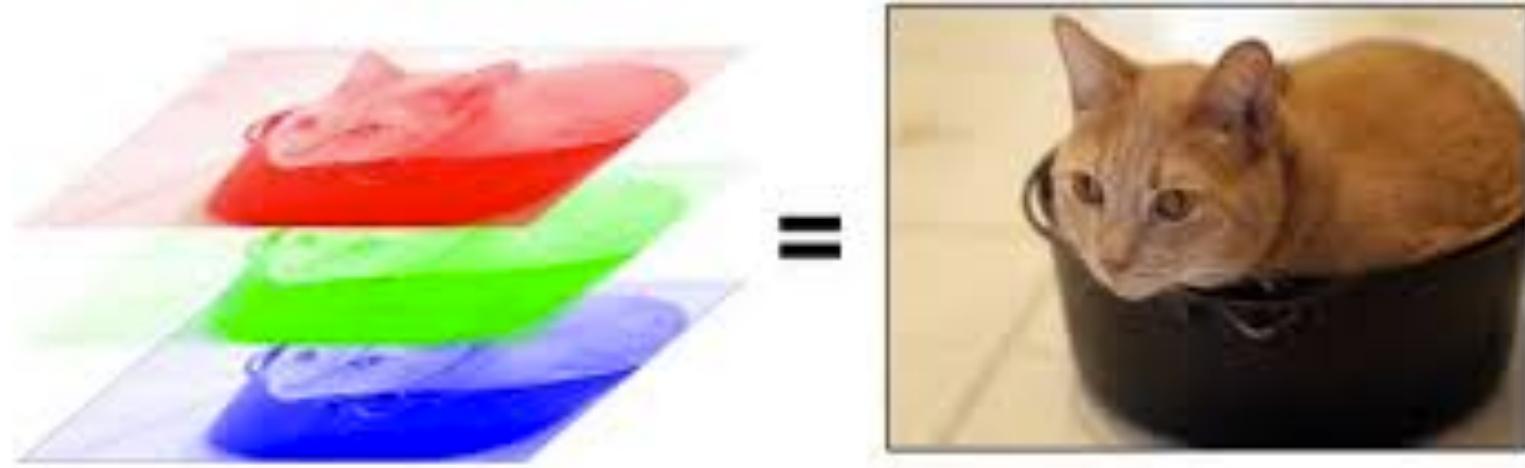


Green

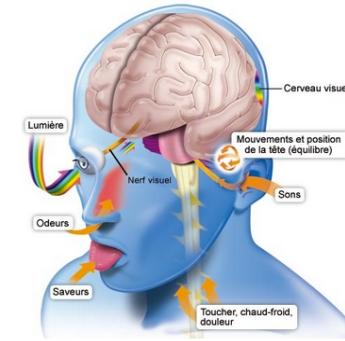


Blue

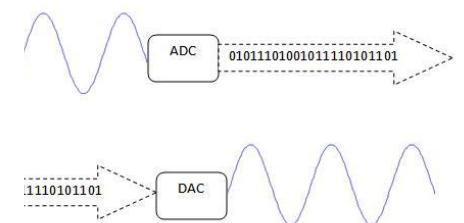
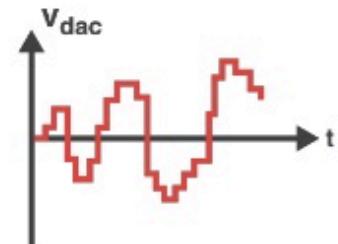
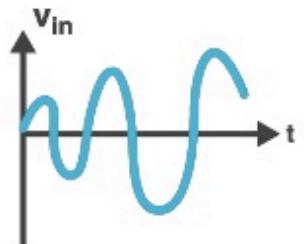
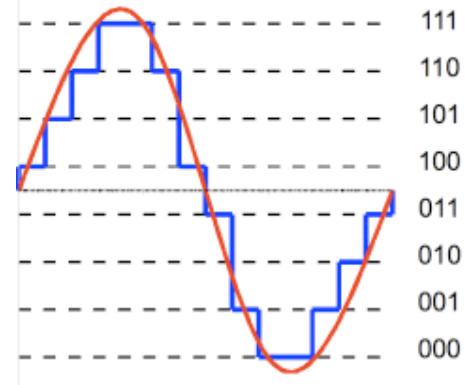
Perception du Monde Machine vs Human



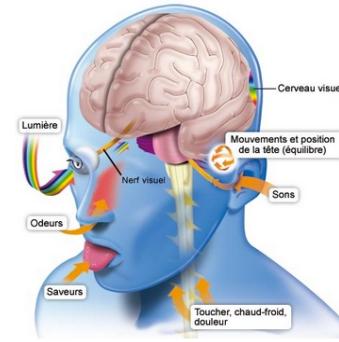
Perception du Monde Machine vs Human



Need of conversion



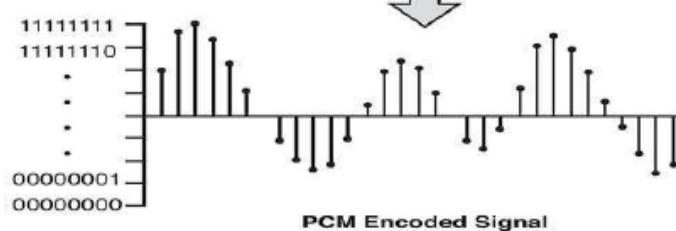
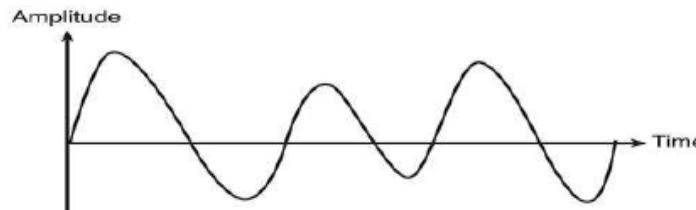
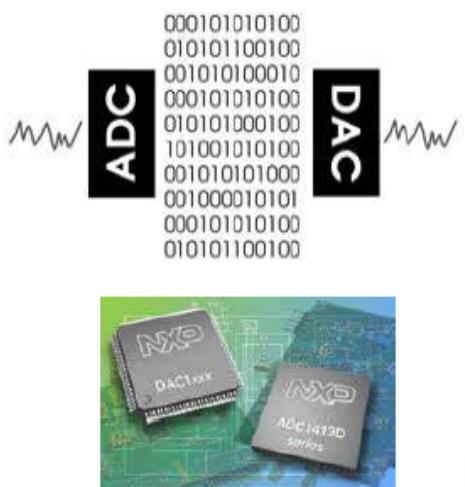
Perception du Monde Machine vs Human



Source
Discrète Brute

Les sources discrètes brutes fournissent des données numériques qui sont en général une séquence de bits.

NB: Un Signal analogique peut être numérisé (par exemple PCM, ADC)



QU'EST-CE QUE MACHINE LEARNING?



QU'EST-CE QUE MACHINE LEARNING?

Machine Learning ou apprentissage automatique est la science de programmer les ordinateurs de sorte qu'ils puissent apprendre à partir de données.

Voici une définition un peu plus générale :

« [L'apprentissage automatique est la] discipline donnant aux ordinateurs la capacité d'apprendre sans qu'ils soient explicitement programmés. »

Arthur Samuel, 1959

En voici une autre plus technique :

« Étant donné une tâche T et une mesure de performance P , on dit qu'un programme informatique apprend à partir d'une expérience E si les résultats obtenus sur T , mesurés par P , s'améliorent avec l'expérience E . »

Tom Mitchell, 1997

QU'EST-CE QUE MACHINE LEARNING?

Apprentissage et Machine Learning

- Apprentissage supervisé
- Apprentissage non supervisé
- Apprentissage renforcé

QU'EST-CE QUE MACHINE LEARNING?

La différence distinct entre l'apprentissage supervisé à l'apprentissage non-supervisé est le fait que l'apprentissage non-supervisé cherche à trouver des partitions de modèles par lui-même, l'extraction des données est donc descriptive.

L'apprentissage supervisé est utilisé quand l'utilisateur sait labelliser les informations, l'extraction des données est donc prédictive.

QU'EST-CE QUE MACHINE LEARNING?

Apprentissage **Supervisé** vs *Non-supervisé*

Classification

- Nombre de classes connues
 - Sur entraînement
 - Utilisé pour classifier des données futures

Clustering

- Nombre de classes inconnues
- Pas de connaissance préalable
 - Utilisé pour comprendre et explorer les données

QU'EST-CE QUE MACHINE LEARNING?

Dans le cas de l'**apprentissage supervisé**, la robustesse de l'algorithme dépendra de la précision de son entraînement. Un algorithme apprenant des contenus supervisés produit une carte interne qui permet sa réutilisation pour classifier de nouvelles quantités de données.

QU'EST-CE QUE MACHINE LEARNING?

L'apprentissage par renforcement (RL pour Reinforcement Learning) fait référence à une classe de problèmes d'apprentissage automatique, dont le but est d'apprendre, à partir d'expériences successives, ce qu'il convient de faire de façon à trouver la meilleure solution.

Cette méthode est particulièrement adaptée aux problèmes nécessitant un compromis entre la quête de récompenses à court terme et celle de récompenses à long terme. Parmi les exemples de problèmes traités de cette façon, on peut évoquer : apprendre à un robot à marcher en terrain difficile, à conduire (cas de la voiture autonome) ou à accomplir une tâche spécifique (comme jouer au jeu de go), piloter un agent à travers un labyrinthe, etc.

QU'EST-CE QUE MACHINE LEARNING?

Machine Learning



Supervised

- Classification
 - Naïve Bayes
 - SVM
 - Random Decision Forests
- Regression
 - Linear
 - Logistic



Label

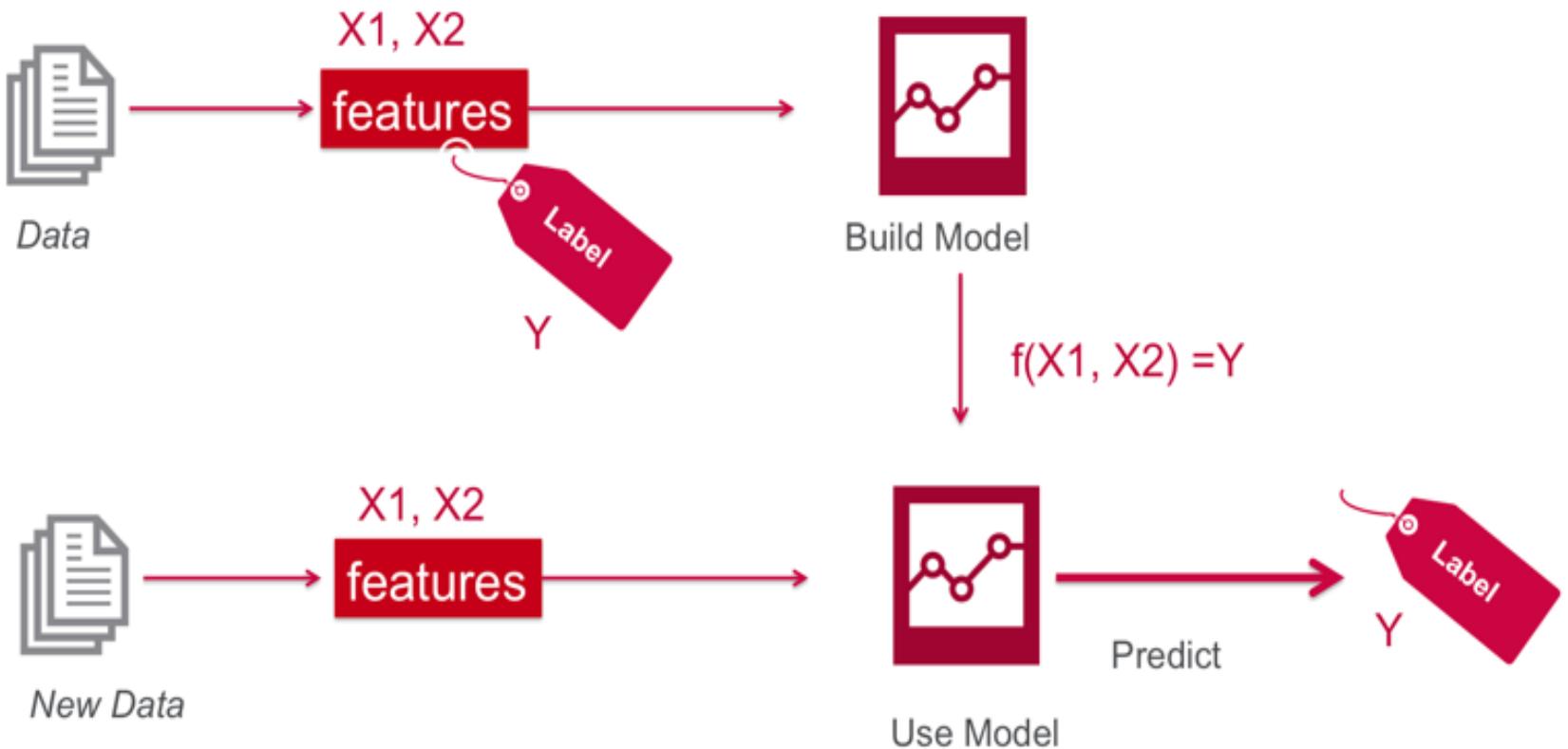
Unsupervised

- Clustering
 - K-means
- Dimensionality reduction
 - Principal Component Analysis
 - SVD



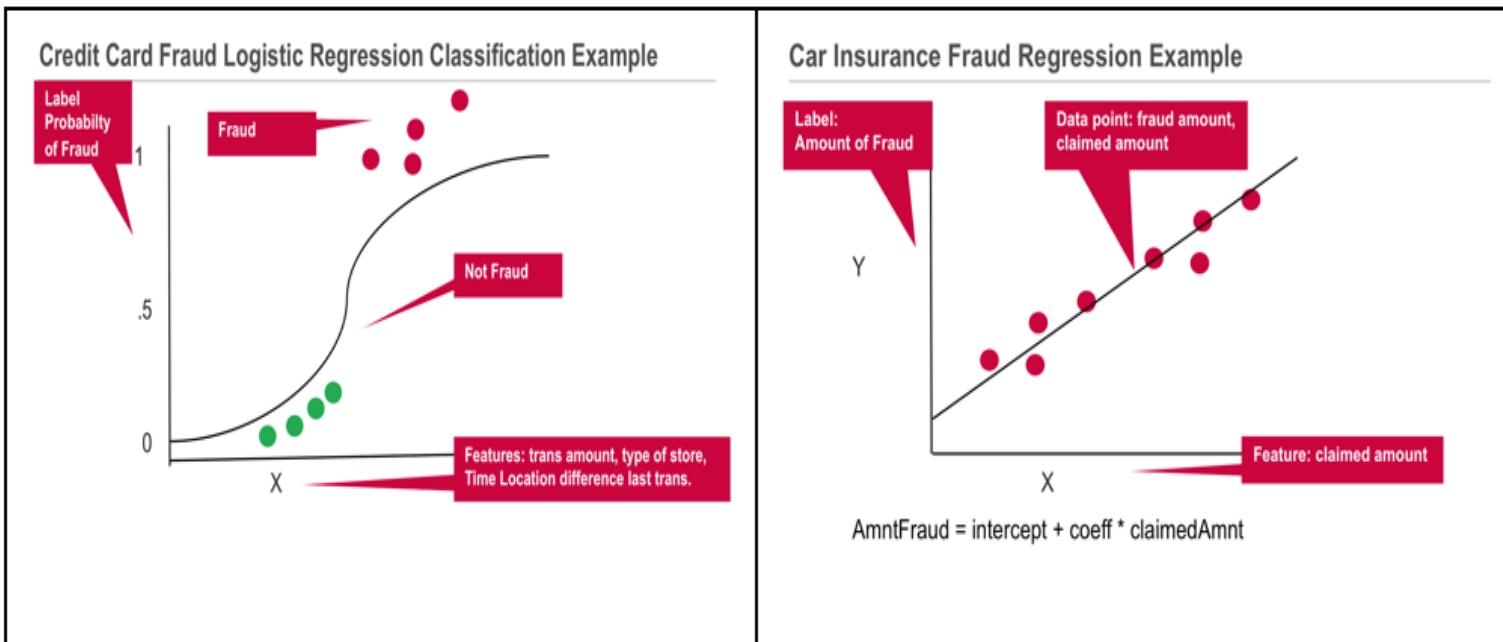
Supervised Learning

Supervised algorithms use labeled data in which both the input and target outcome, or label, are provided to the algorithm.



Supervised Learning

Supervised Learning is also called predictive modeling or predictive analytics, because you build a model that is capable of making predictions. Some examples of predictive modeling are classification and regression. Classification identifies which category an item belongs to (for example whether a transaction is fraud or not fraud), based on labeled examples of known items (for example transactions known to be fraud or not). Logistic regression predicts a probability, for example the probability of fraud. Linear regression predicts a numeric value, for example the amount of fraud.



Supervised Learning

Some examples of **Classification** include:

- credit card fraud detection (fraud, not fraud)
- credit card application (good credit, bad credit)
- email spam detection (spam, not spam)
- text sentiment analysis (happy, not happy)
- Predicting patient risk (high risk patient, low risk patient)
- classifying a tumor as malignant or not

Some examples of **logistic regression** (or other algorithms) include:

- given historical car insurance fraudulent claims and features of the claims such as age of the claimant, claimed amount, severity of the accident, predict the probability of fraud.
- given patient characteristics predict the probability of congestive heart failure.

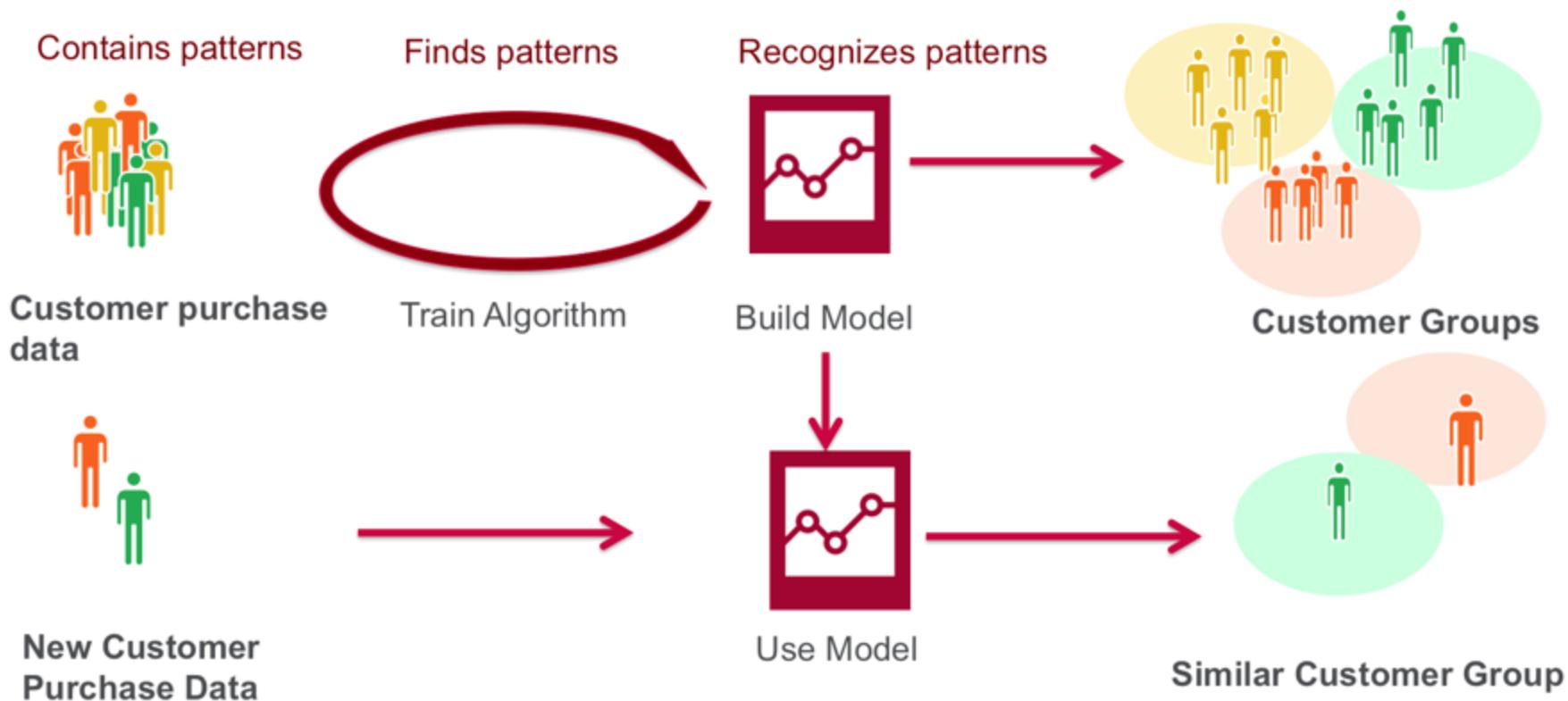
Supervised Learning

Some examples of linear regression include:

- Given historical car insurance fraudulent claims and features of the claims such as age of the claimant, claimed amount, severity of the accident, predict the amount of fraud.
- Given historical real estate sales prices and features of houses (square feet, number of bedrooms, location..) predict a house's price.
- Given historical neighborhood crime statistics, predict crime rate.

Unsupervised Learning

Unsupervised learning, also sometimes called descriptive analytics, does not have labeled data provided in advance. These algorithms discover similarities, or regularities in the input data. An example of unsupervised learning is grouping similar customers, based on purchase data.



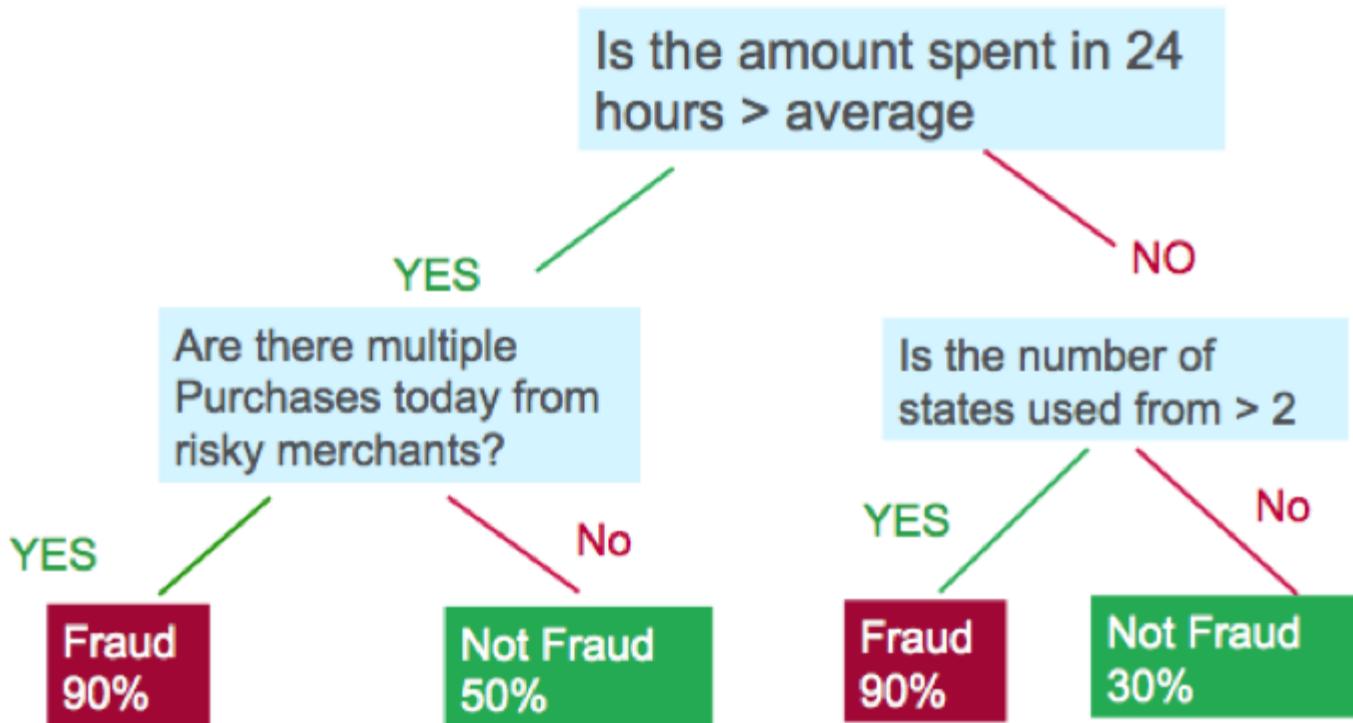
Decision Trees

Decision trees create a model that predicts the class or label, based on several input features. Decision trees work by evaluating a question containing a feature at every node and selecting a branch to the next node, based on the answer. A possible decision tree for predicting debit card fraud is shown below. The feature questions are the nodes, and the answers “yes” or “no” are the branches in the tree to the child nodes. (Note that a real tree would have more nodes).

Decision trees are popular because they are easy to visualize and explain. The accuracy of models can be improved by combining algorithms with ensemble methods. An ensemble example is Random forest, which combines multiple random subsets of decision trees.

Decision Trees

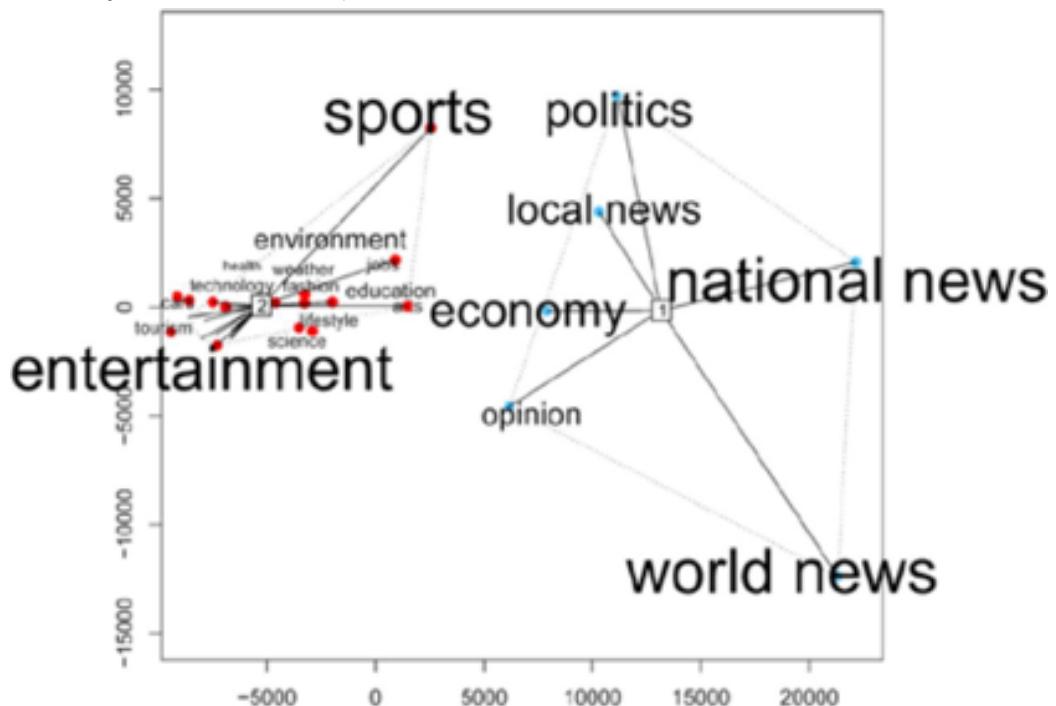
- Q1: Is the amount spent in 24 hours > average Yes
- Q2: Are there multiple purchases today from risky merchants?
 - Yes Fraud 90%
 - Not Fraud 50%



Clustering

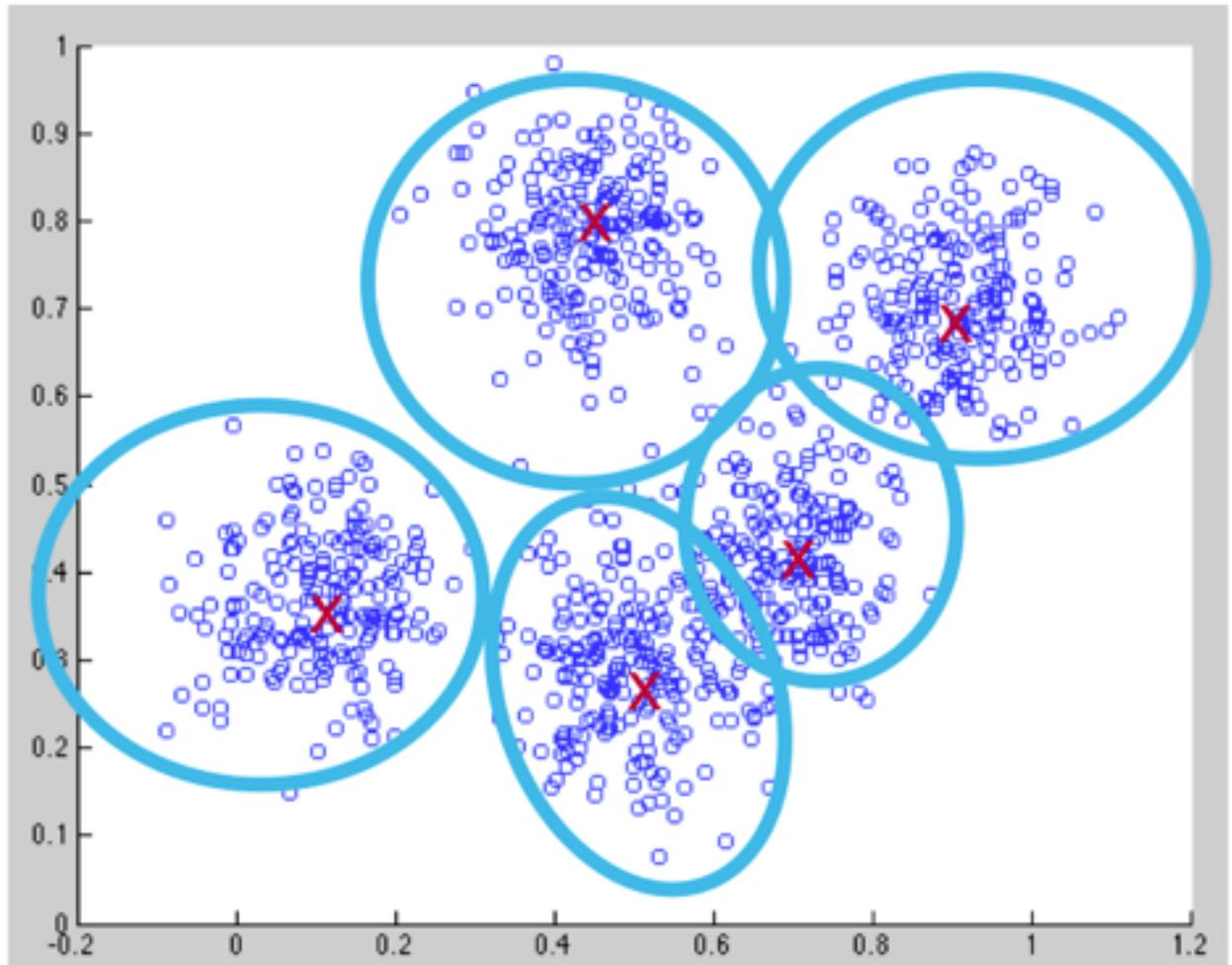
In clustering, an algorithm classifies inputs into categories by analyzing similarities between input examples. Some clustering use cases include:

- ✓ search results grouping
- ✓ grouping similar customers
- ✓ grouping similar patients
- ✓ Text categorization
- ✓ Network Security Anomaly detection (finds what is not similar, the outliers from clusters)



Clustering

The K-means algorithm groups observations into K clusters in which each observation belongs to the cluster with the nearest mean from its cluster center.



Clustering

An example of clustering is a company that wants to segment its customers in order to better tailor products and offerings. Customers could be grouped on features such as demographics and purchase histories. Clustering with unsupervised learning is often combined with Supervised learning in order to get more valuable results. For example in this [banking customer 360](#) use case, customers were first segmented based on answers to a survey. The customer groups were analyzed and labeled with customer personas. These labels were then linked by customer Id with features such as types of accounts and purchases. Finally supervised machine learning was applied and tested with the labeled customers, allowing to link the survey customer personas with their banking actions and provide insights.

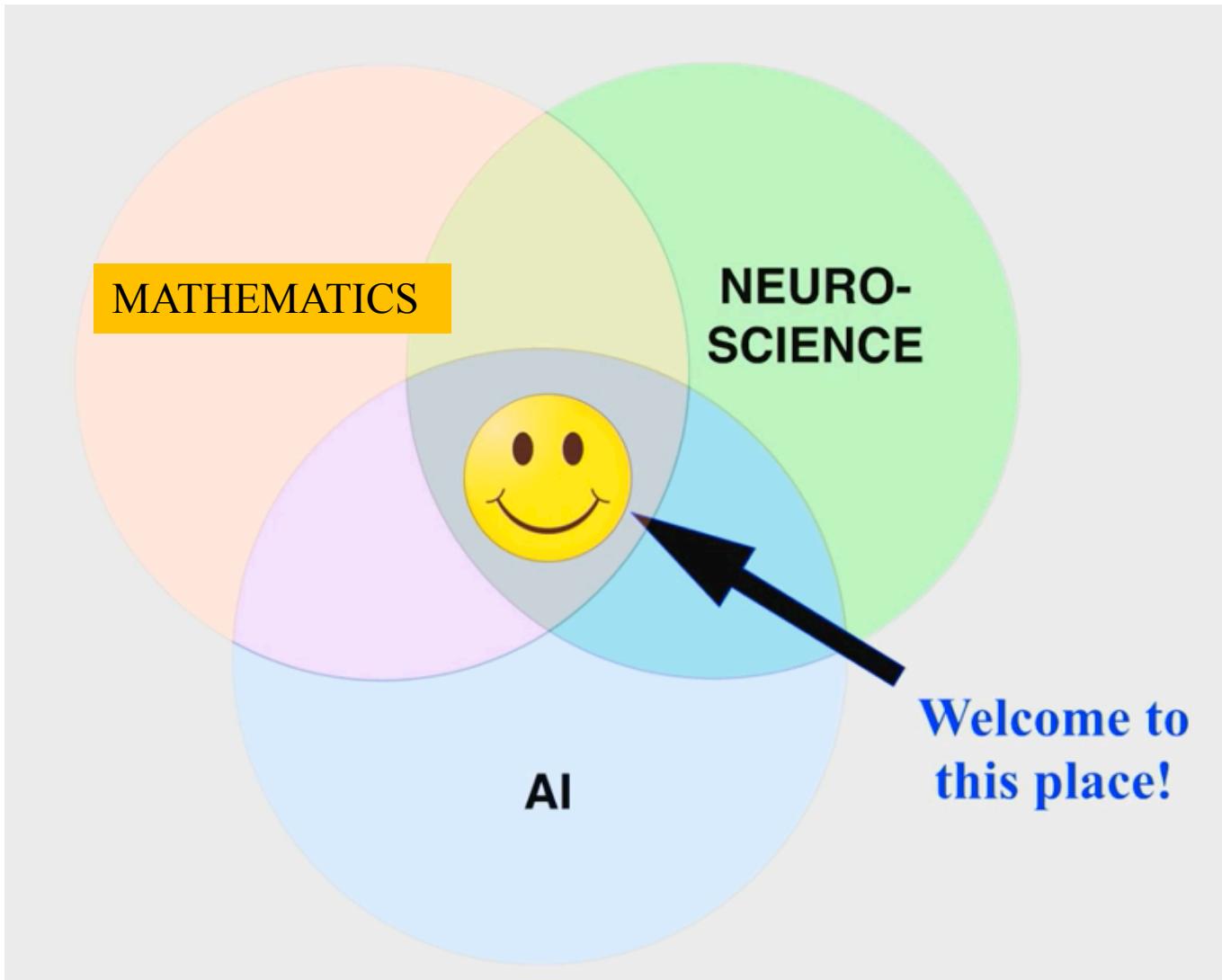
Clustering



Machine Learning Examples

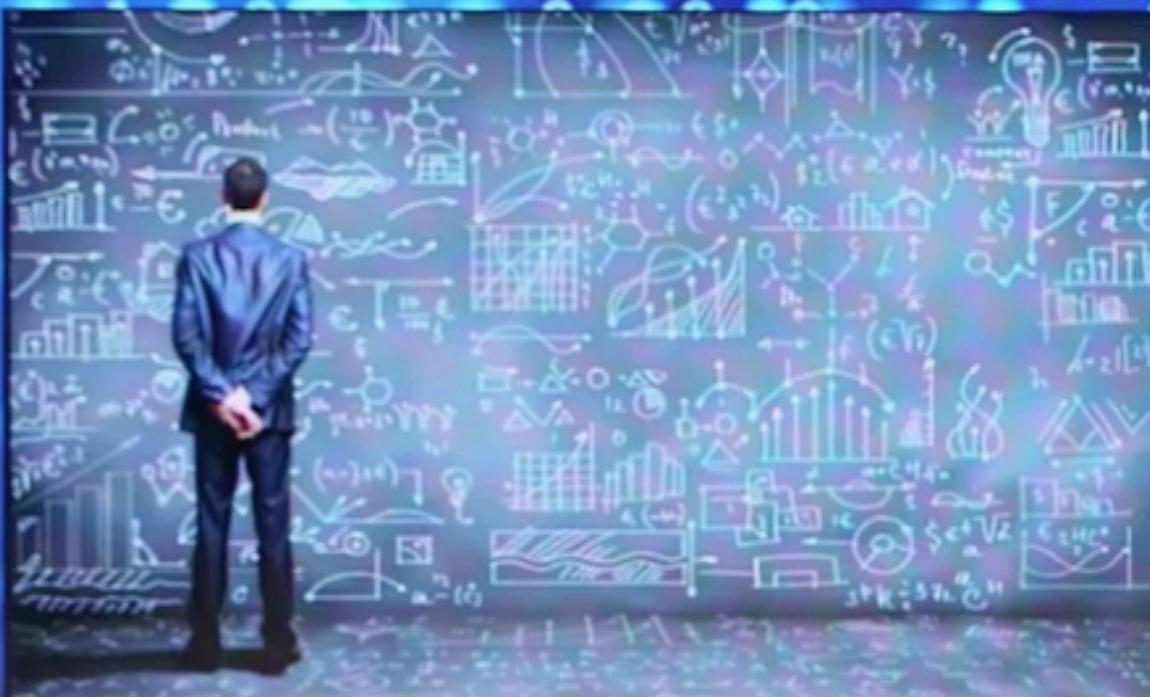
Retail	Marketing	Healthcare	Telco	Finance
<ul style="list-style-type: none">• Demand forecasting• Supply chain optimization• Pricing optimization• Market segmentation and targeting• Recommendations	<ul style="list-style-type: none">• Recommendation engines & targeting• Customer 360• Click-stream analysis• Social media analysis• Ad optimization	<ul style="list-style-type: none">• Predicting Patient Disease Risk• Diagnostics and Alerts• Fraud	<ul style="list-style-type: none">• Customer churn• System log analysis• Anomaly detection• Preventative maintenance• Smart meter analysis	<ul style="list-style-type: none">• Risk Analytics• Customer 360• Fraud• Credit scoring

QU'EST-CE QUE MACHINE LEARNING?



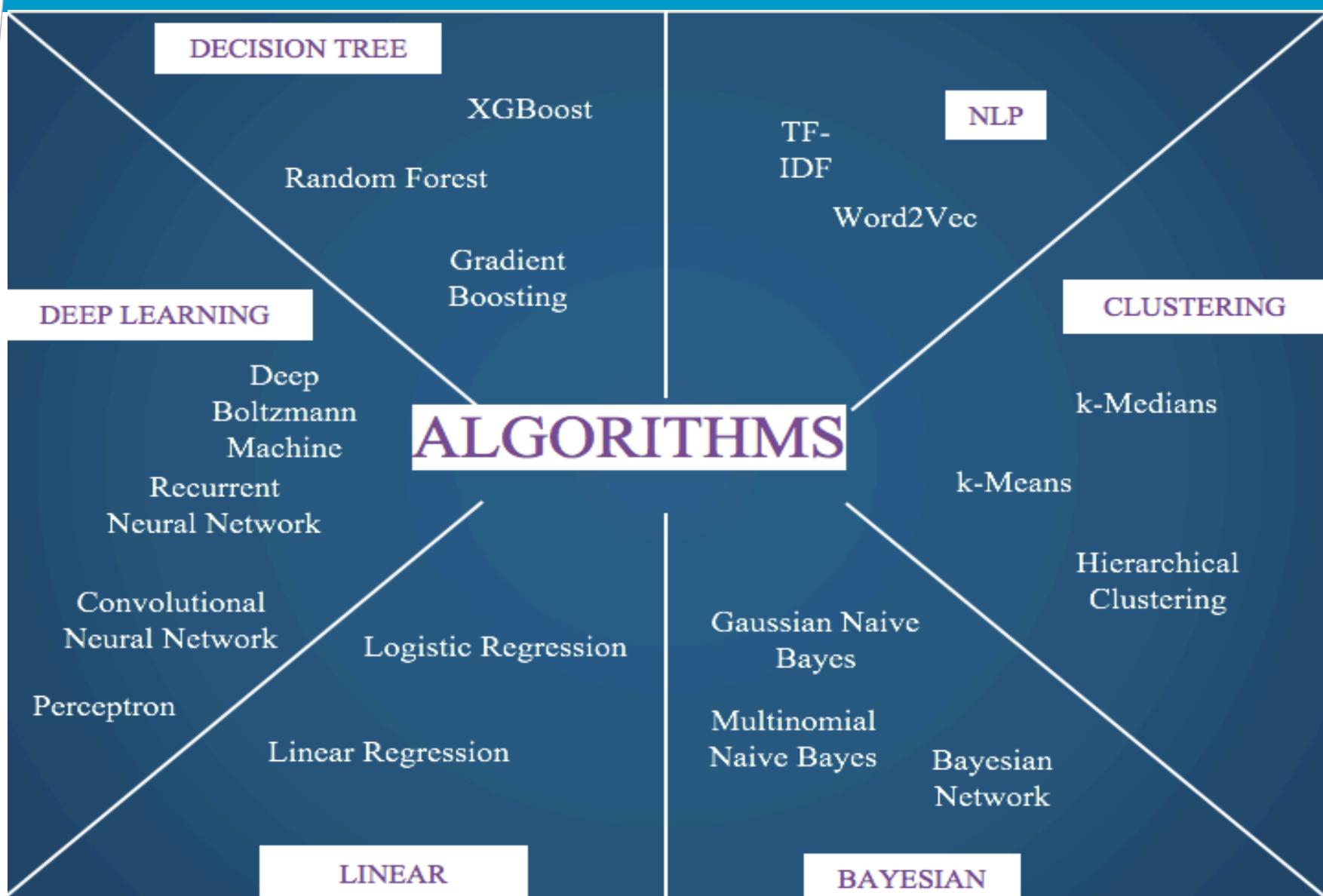
What Algorithms?

Basically, we need very sophisticated
Algorithms



Intelligence Artificielle

Quels Algorithmes?



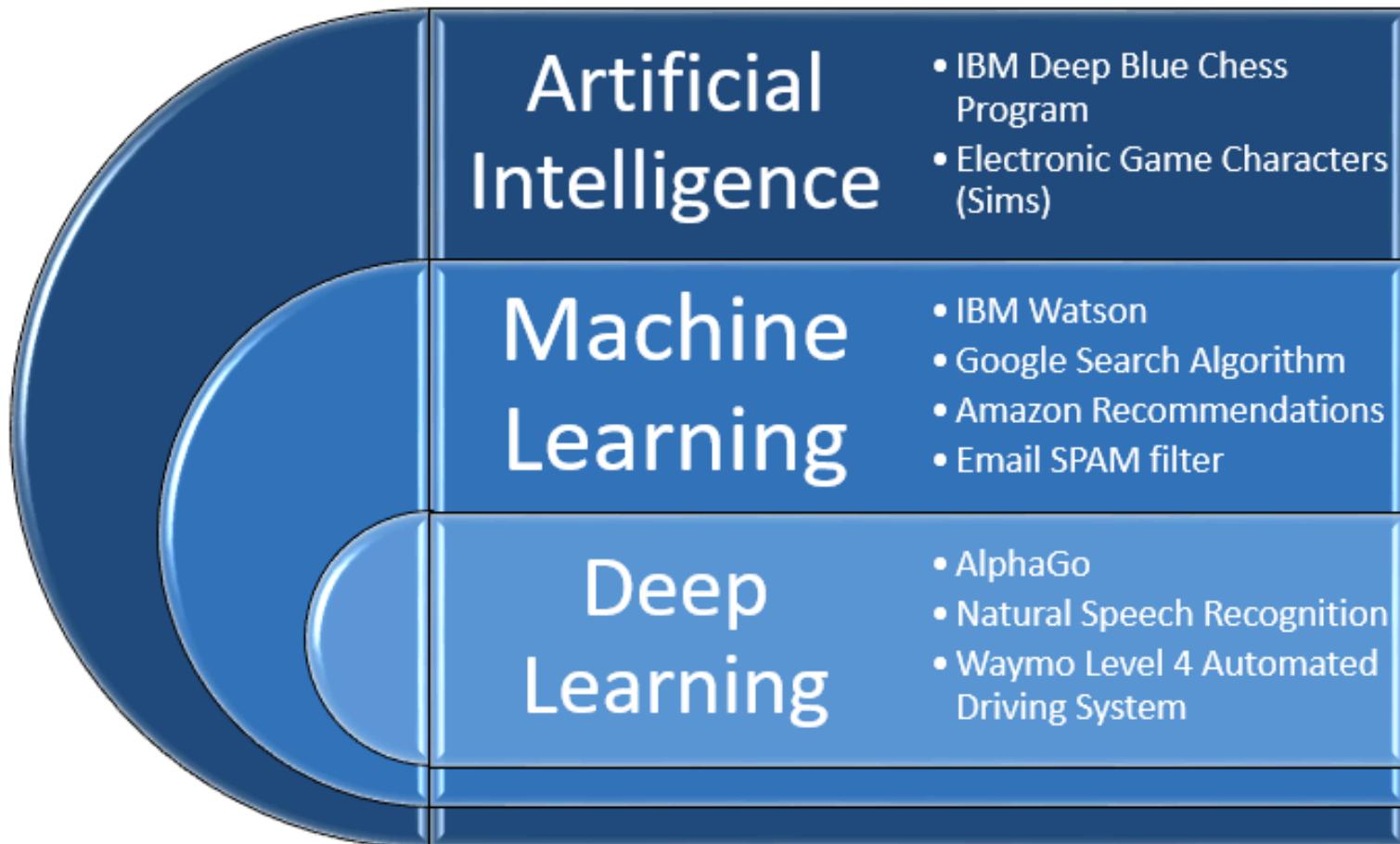
Intelligence Artificielle

From Machine Learning to Deep Learning



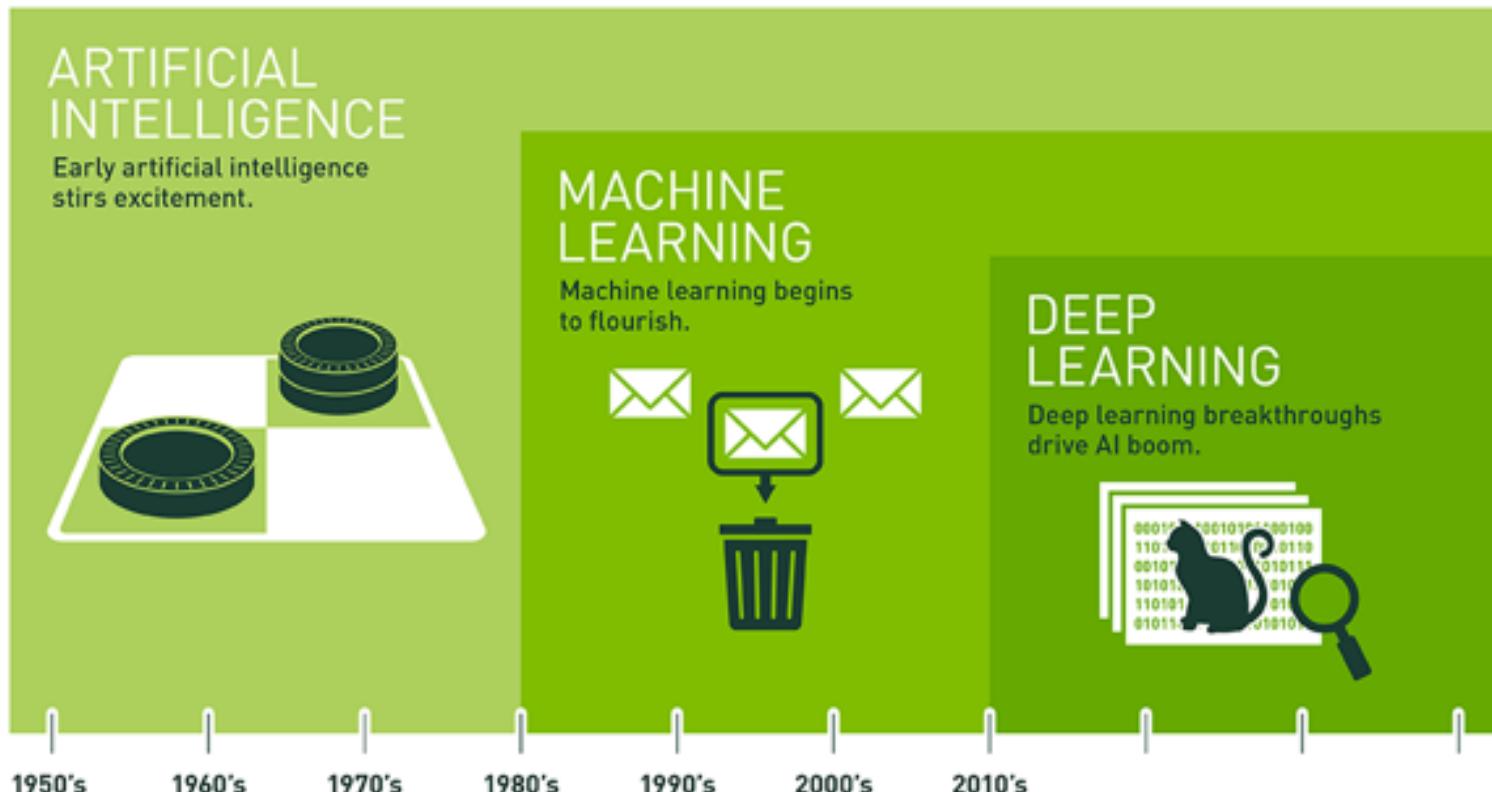
Intelligence Artificielle

From Machine Learning to Deep Learning



QU'EST-CE QUE MACHINE LEARNING?

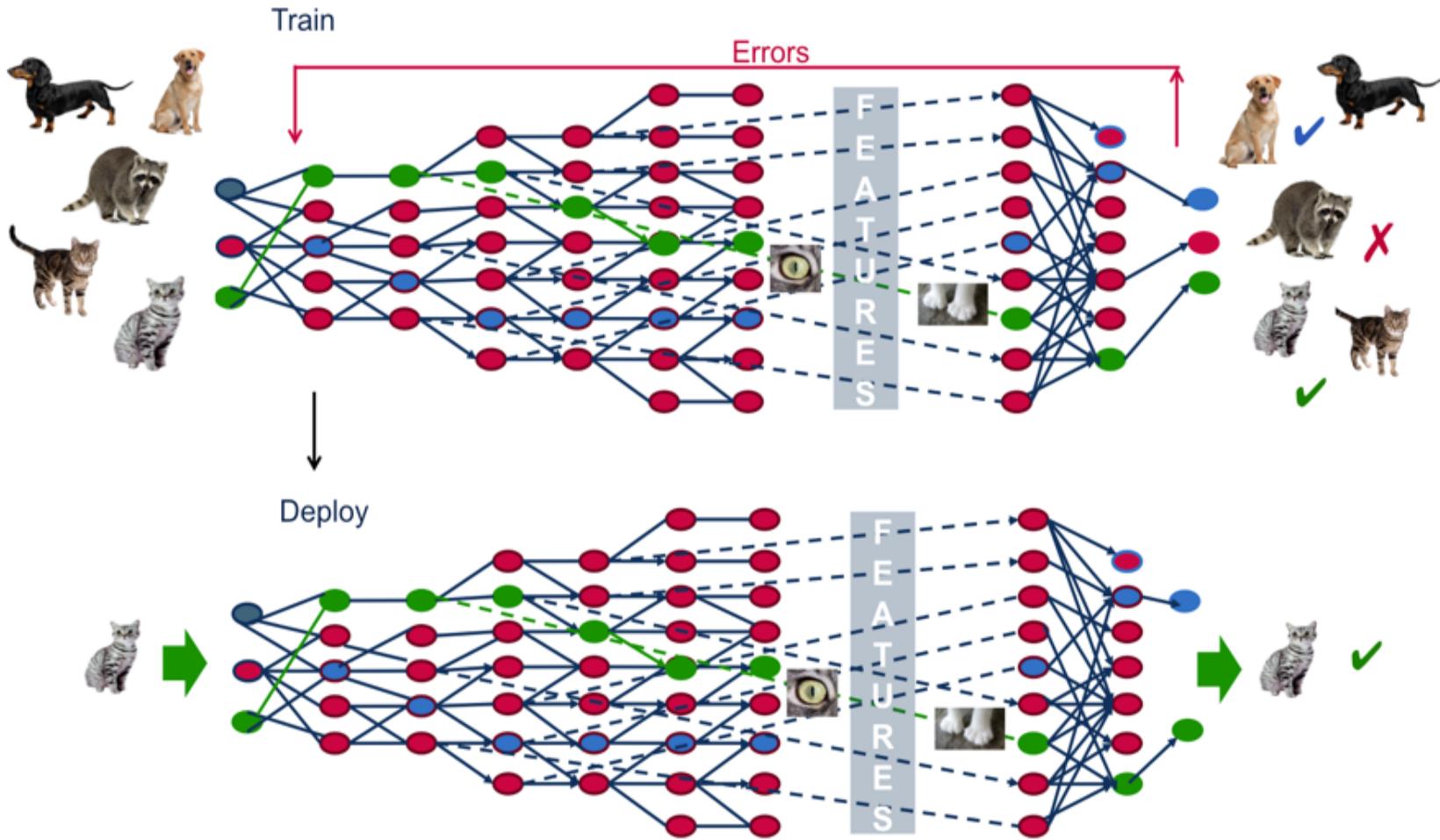
Throughout the history of AI the definition has been continuously redefined. AI is an umbrella term, the idea started in the 50s, machine learning is a subset of AI and deep learning is a subset of ML.



Since an early flush of optimism in the 1950s, smaller subsets of artificial intelligence – first machine learning, then deep learning, a subset of machine learning – have created ever larger disruptions.

Deep Learning

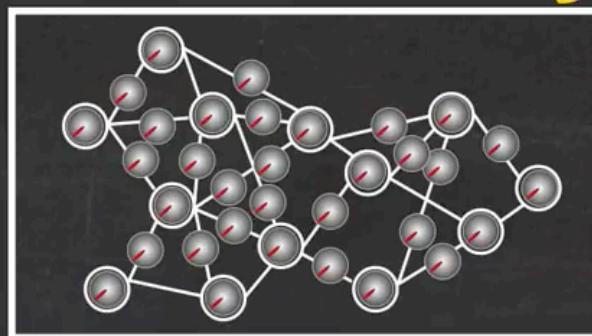
Deep learning is the name for multilayered neural networks, which are networks composed of several “hidden layers” of nodes between the input and output



QU'EST-CE QUE MACHINE LEARNING?

Phase d'apprentissage

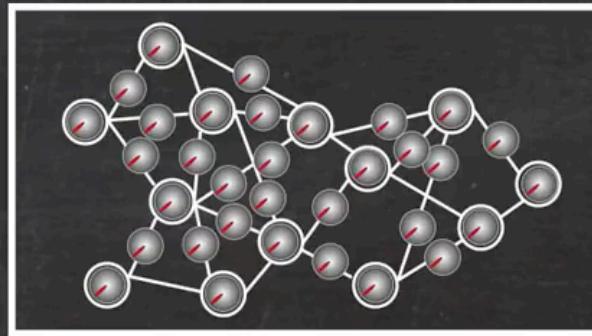
Entrées
 X



Sorties
 Y

Phase de prédiction

Nouvelle
Entrée
 X



Prédiction
de Y

What is Learning?

La descente de gradient consiste à itérativement faire une petite modification des paramètres dans une direction qui réduit l'erreur du modèle (plus précisément, dans la direction opposée au gradient).

En quoi consiste l'algorithme qu'a inventé Geoffrey Hinton afin d'améliorer graduellement les paramètres d'un réseau de neurones?

À faire de petites modifications sur chaque paramètre du réseau simultanément

La rétropropagation du gradient permet de calculer la dérivée de tous les paramètres du réseau dans un temps comparable à celui nécessaire pour:

Calculer la dérivée d'un seul paramètre

Calculer la réponse du modèle pour un exemple donné

Quelle tâche accomplit l'algorithme de rétropropagation du gradient?

Calculer le grad efficacement en Trouvant les minimums locaux

What is Learning?

How neural networks are trained?

http://ml4a.github.io/ml4a/how_neural_networks_are_trained/

The gradient descent method + Backpropagation

Recall that our weight update formula in standard gradient descent is given by the following:

$$W_t := W_t - \alpha \nabla J(W_t)$$

$\nabla J(W_t)$ is the gradient of the loss, and must be computed in some form across all of the gradient descent varieties we surveyed. Recall that the gradient is a vector which contains each of the individual partial derivatives of the cost function with respect to each parameter, and is given by the following (t is omitted for brevity).

$$\nabla J(W) = \left(\frac{\partial J}{\partial w_1}, \frac{\partial J}{\partial w_2}, \dots, \frac{\partial J}{\partial w_N} \right)$$

How can we calculate each $\frac{\partial J}{\partial w_i}$? The most obvious way to do this would be to compute it with the equation for a derivative from ordinary calculus:

$$\frac{\partial J}{\partial w_i} \approx \frac{J(W + \epsilon e_i) - J(W)}{\epsilon}$$

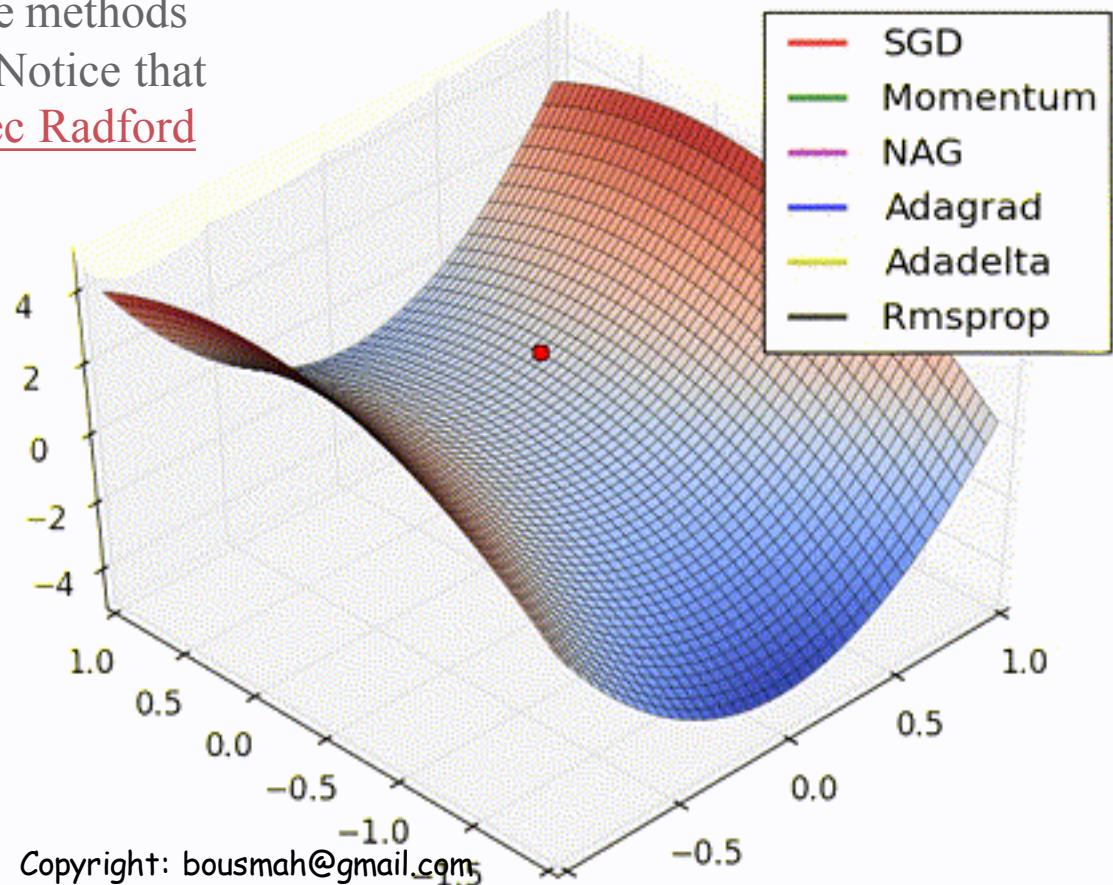
What is Learning?

How neural networks are trained?

http://ml4a.github.io/ml4a/how_neural_networks_are_trained/

The gradient descent method + Backpropagation

Comparison of gradient update methods
escaping from a saddle point. Notice that
SGD gets stuck. Figure by [Alec Radford](#)



What is Learning?

How neural networks are trained?

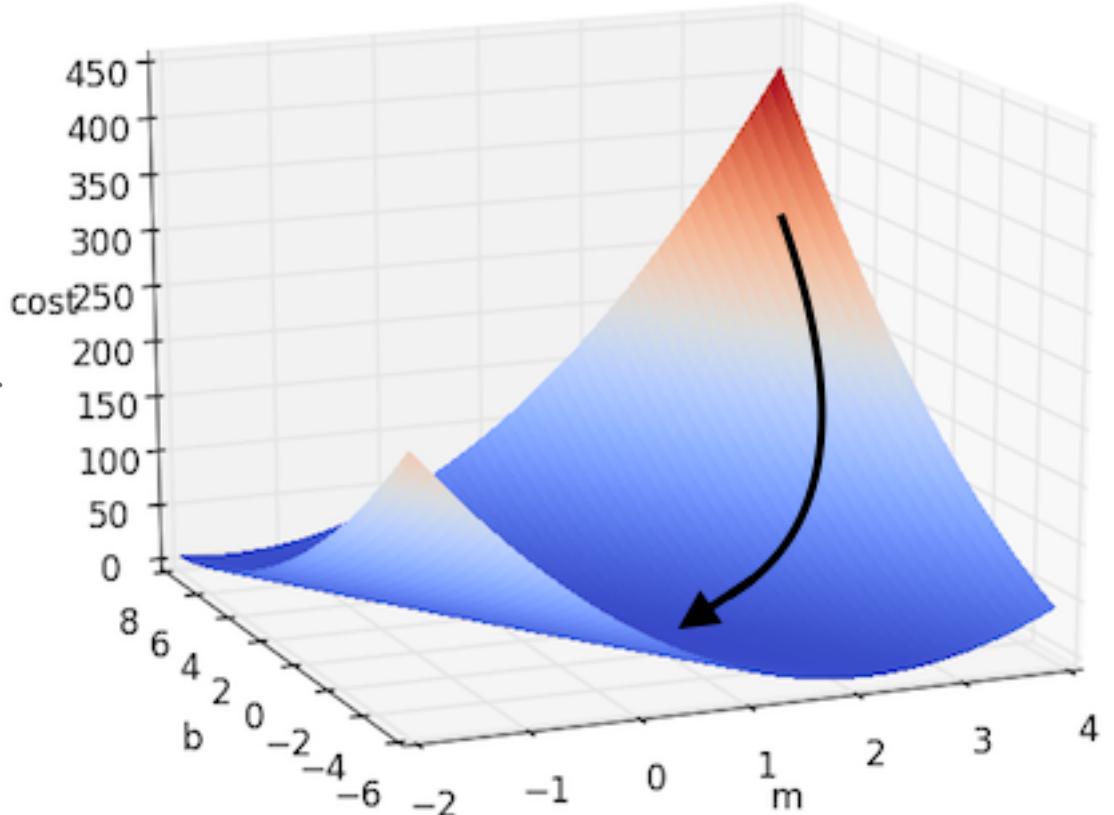
http://ml4a.github.io/ml4a/how_neural_networks_are_trained/

The gradient descent method + Backpropagation

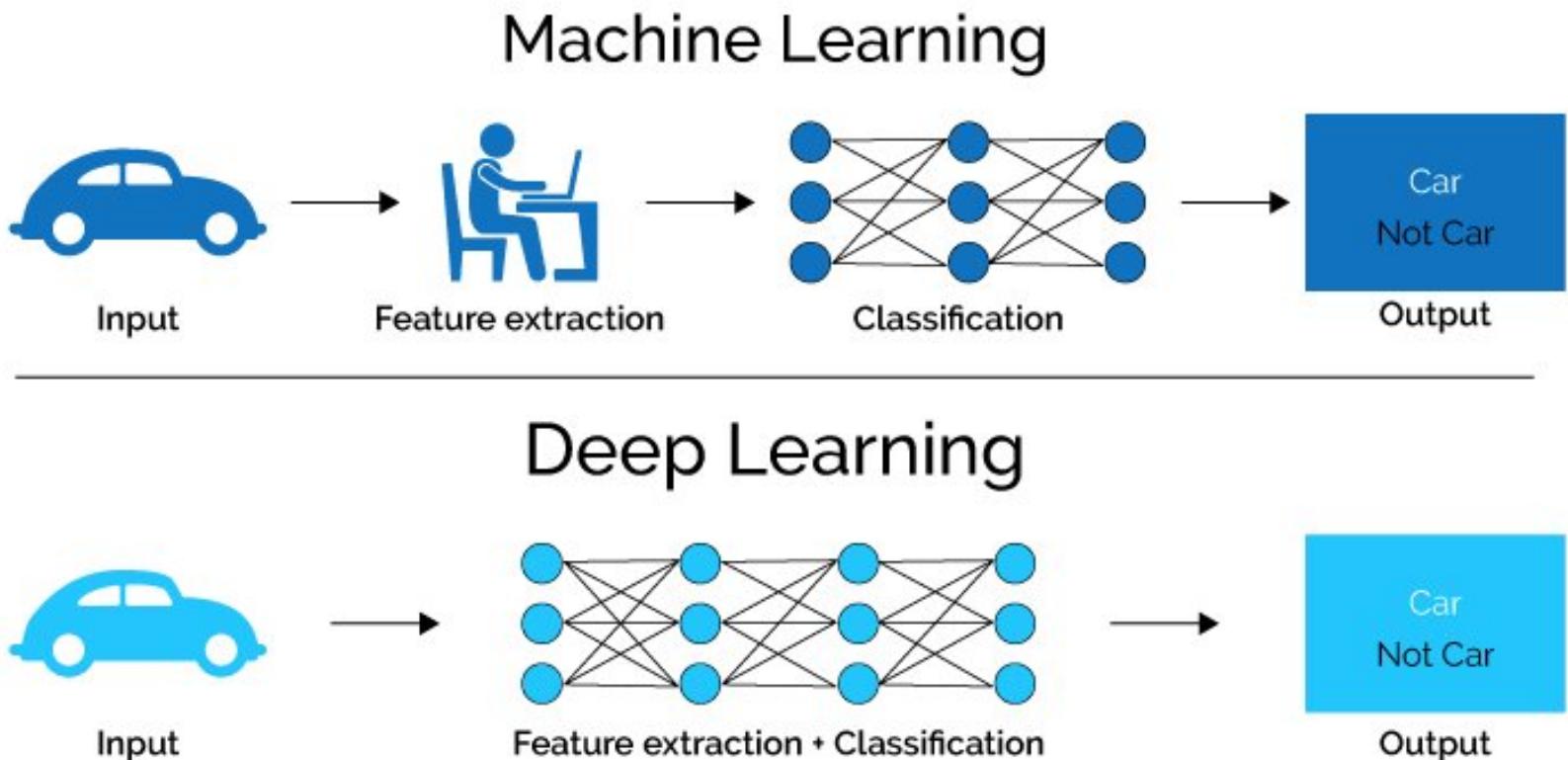
Example of gradient descent for linear regression with two parameters. We take a random guess at the parameters, and iteratively update our position by taking a small step against the direction of the gradient, until we are at the bottom of the loss function.

$$m := m - \alpha \cdot \frac{\partial J}{\partial m}$$

$$b := b - \alpha \cdot \frac{\partial J}{\partial b}$$



What is Deep Learning?



Machine Learning vs. Deep Learning: Feature Engineering

Quelles sont les domaines d'application du Machine Learning?

Machine Learning is used everywhere

- Wherever there is data, there is Machine Learning.
- Search: Ranking results according to the likelihood of user click
- Information Retrieval: does this news item match this text query?
- Content filtering: spam detection, offensive content detection
- Newsfeed ranking: selecting what you see on Facebook
- Ad Ranking: Is this person likely to click on this ad?
- Recommendation: will this customer buy this item?
- Collaborative Filtering: Other customer who bought this also bought that
- Classification: Does this text talk about international politics?
- Sentiment Analysis: is this business news about company X positive?
- Time-series prediction: stock, commodities, power consumption....

- Techniques:
 - ▶ Logistic regression, Linear Regression
 - ▶ Trees, Boosted trees, and Random Forests

Quelles sont les domaines d'application du Machine Learning?

- Systèmes de détection
 - Personnes
 - Objets
 - Anomalies
 - Pannes
 - Fraudes
 - ...
- Systèmes de classification
 - Segmentation
 - Usage du Web
 - Usage des réseaux sociaux
 - ...
- Systèmes de Recommandation
 - Marketing personnalisé (ciblage ou targeting)
 - Connaissance du marché
 - Analyse des tendances
 - Satisfaction des clients
 - ...
- Systèmes de Prédiction
 - Trafic
 - Consommation
 - Ventes
 - ...

Quelles sont les domaines d'application du Machine Learning?

Any data can be segmented and understood if it can be presented as a matrix of numbers, where every row is a data item and column is a parameter.



Stock market
transactions



Text



Medical and
DNA profiling



Customer
Activities



Sensor signals



System Logs



Images



Sound

Quelles sont les domaines d'application du Machine Learning?



Cloud Service Providers



Financial Services



Healthcare



Automotive

- Personal assistant
- Automatic Speech recognition
- Natural language processing
- Image & Video recognition/tagging
- Targeted Ads
- Fraud / face detection
- Gaming, check processing
- Computer server monitoring
- Financial forecasting and prediction
- Network intrusion detection
- Recommender systems

Deep Learning

Deep Neural Networks for Improved Traditional Algorithms

- Finance: Enhanced Fraud Detection through identification of more complex patterns
- Manufacturing: Enhanced identification of defects based on deeper anomaly detection

Convolutional Neural Networks for images

- Retail: in-store activity analysis of video to measure traffic
- Satellite images: labeling terrain, classifying objects
- Automotive: recognition of roadways and obstacles
- Healthcare: diagnostic opportunities from x-rays, scans, etc.
- Insurance: estimating claim severity based on photographs

Recurrent Neural Networks for sequenced data

- Customer satisfaction: transcription of voice data to text for NLP analysis
- Social media: real-time translation of social and product forum posts
- Photo captioning: search archives of images for new insights
- Finance: Predicting behavior based via time series analysis (also enhanced recommendation systems)

Deep Learning

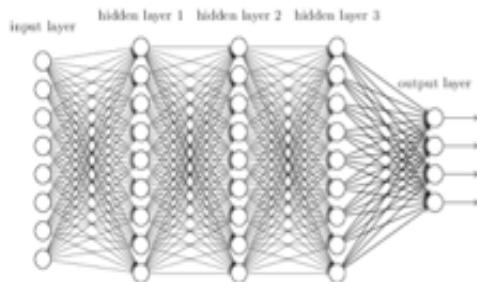
Deep Learning Algorithms

providing lift for classification and forecasting models

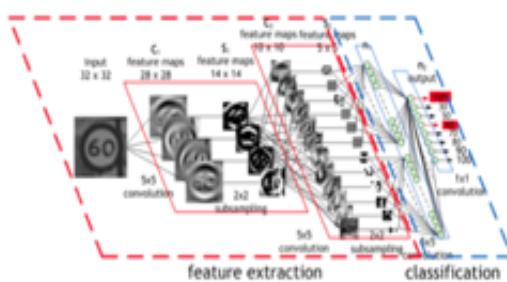
feature extraction and classification of images

for sequence of events, language models, time series, etc.

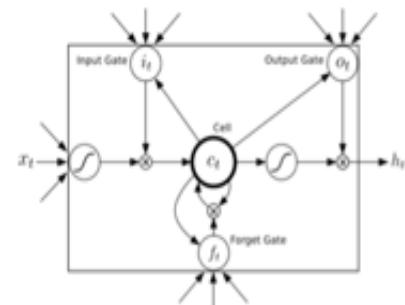
Deep Neural Networks



Convolutional Neural Networks

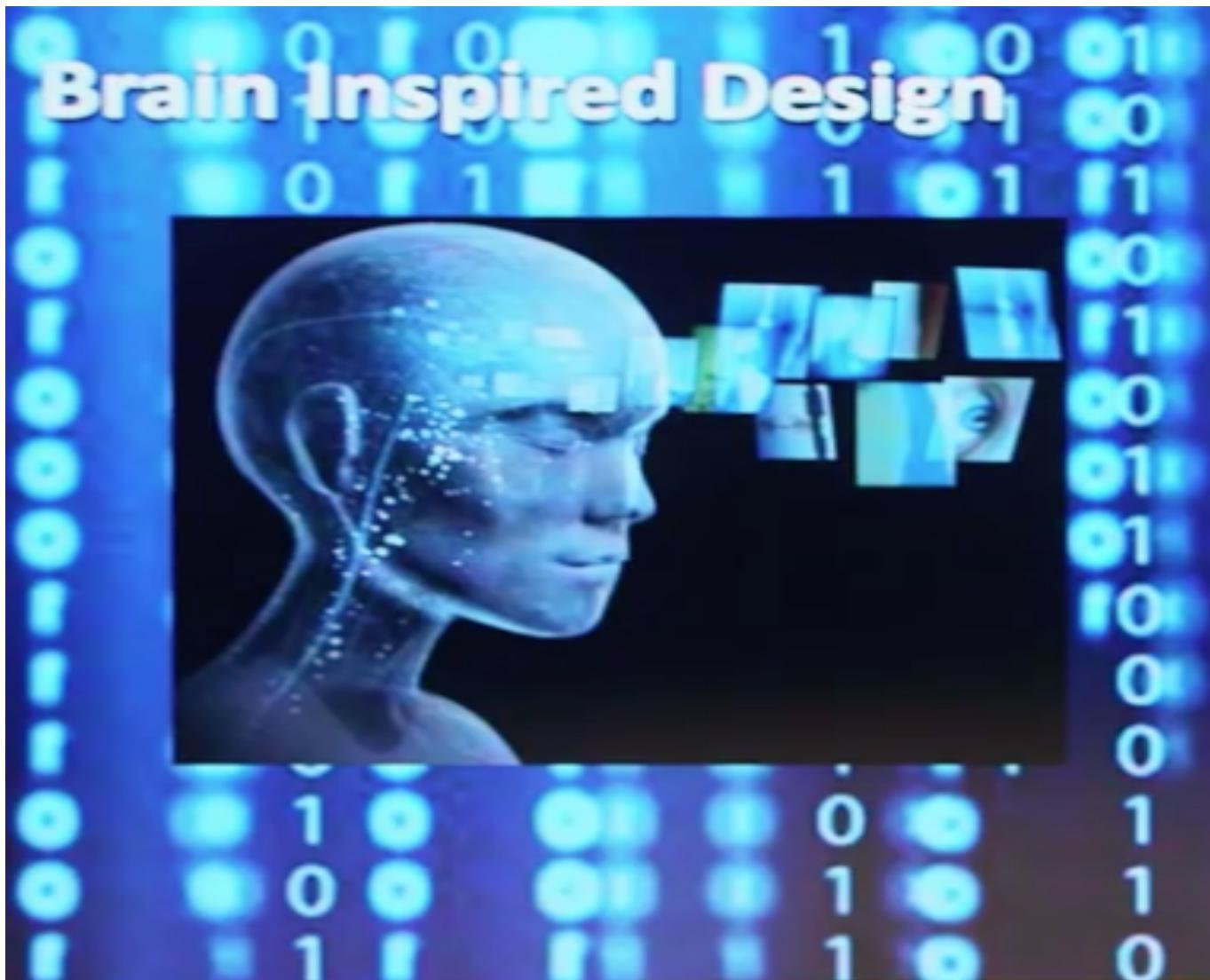


Recurrent Neural Networks



Intelligence Artificielle

From Machine Learning to Deep Learning



QU'EST-CE QUE MACHINE LEARNING?



Number of Neurons

Animal	Number of Neurons
Common Jellyfish	5,600
Ant	250,000
Frog	16,000,000
Cat	760,000,000
Humans	86,000,000,000
African Elephant	257,000,000,000



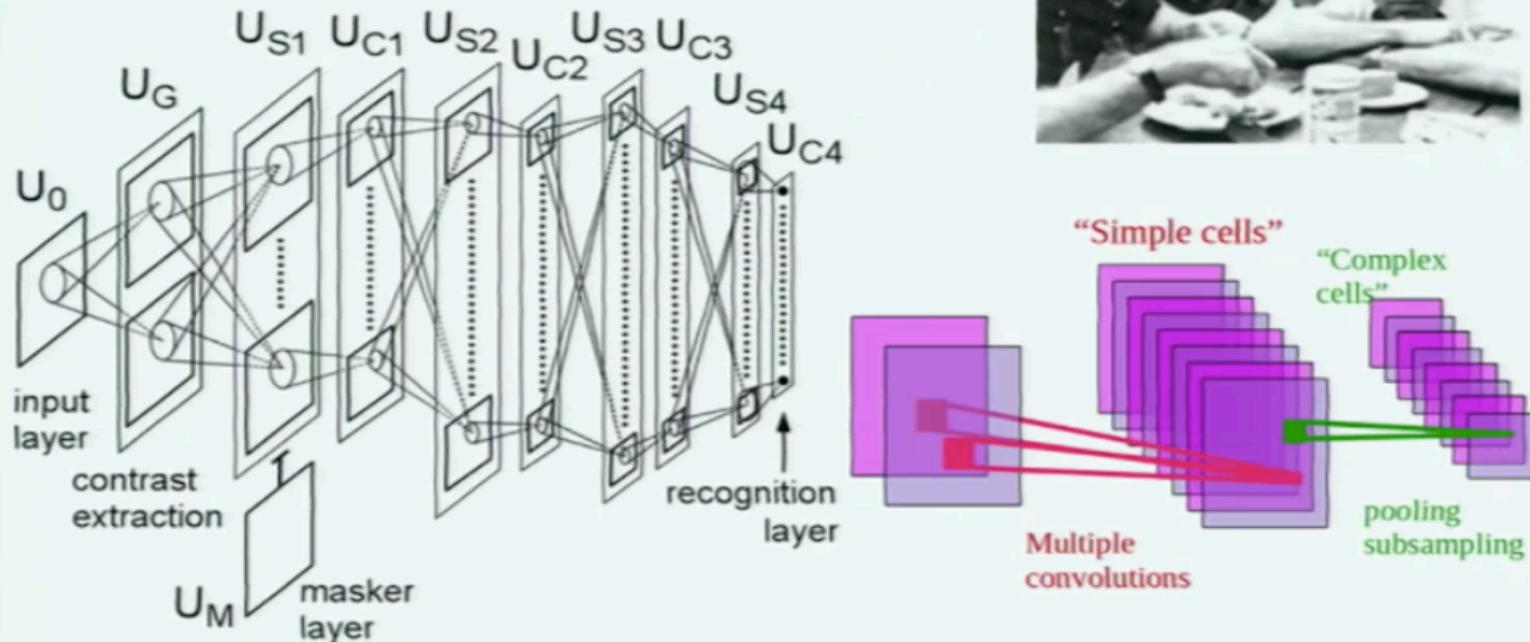
*Not a direct comparison

QU'EST-CE QUE MACHINE LEARNING?

En s'inspirant du fonctionnement du cortex cérébral visuel des animaux et de l'homme, découvert par Hubel et Wiest (prix nobel 1981) on a établi l'architecture **Deep Learning (CNN)**

■ [Hubel & Wiesel 1962]:

- ▶ **simple cells** detect local features
- ▶ **complex cells** “pool” the outputs of simple cells within a retinotopic neighborhood.

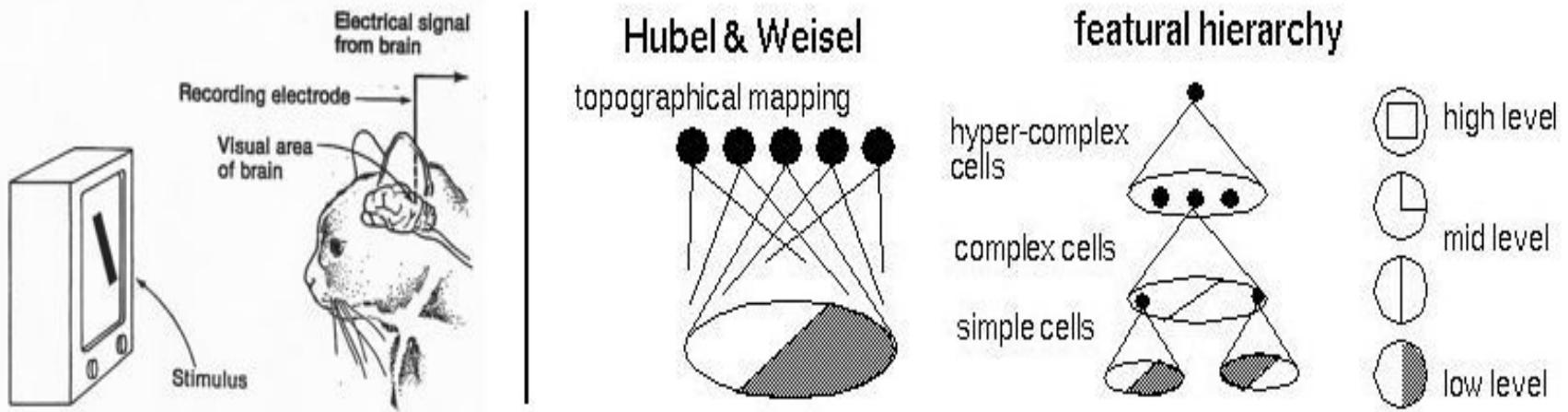


[Fukushima 1982] [LeCun 1989, 1998], [Riesenhuber 1999].....

What is Learning?

Convolutional neural networks

<http://ml4a.github.io/ml4a/convnets/>

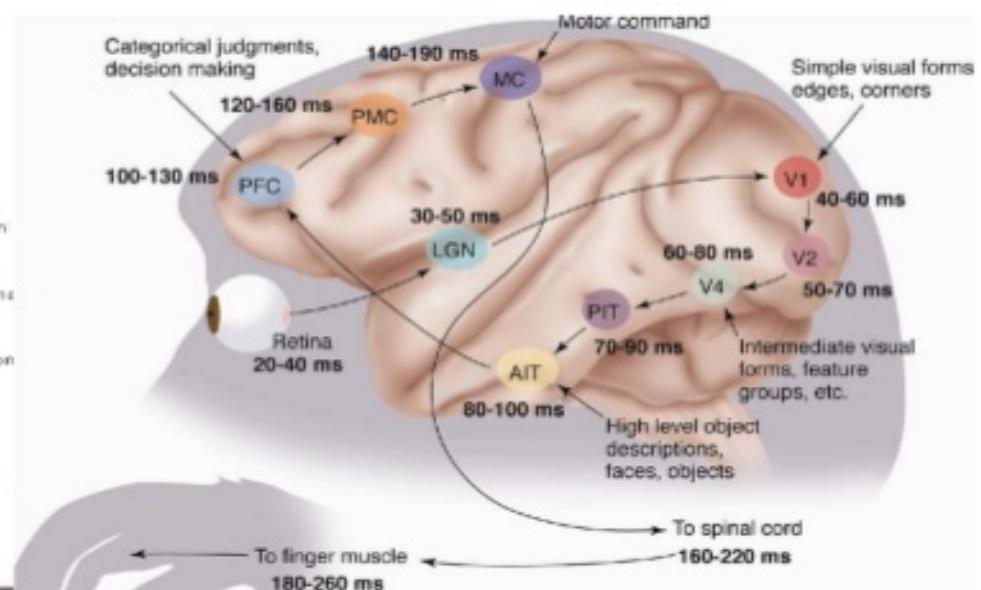
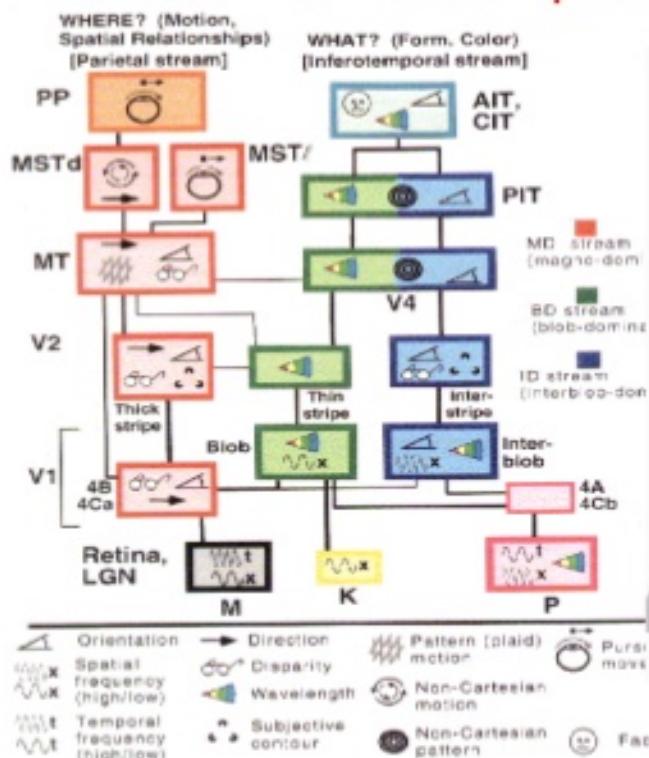


Experiments of Hubel & Wiesel (1960s)

How Deep Learning Works?



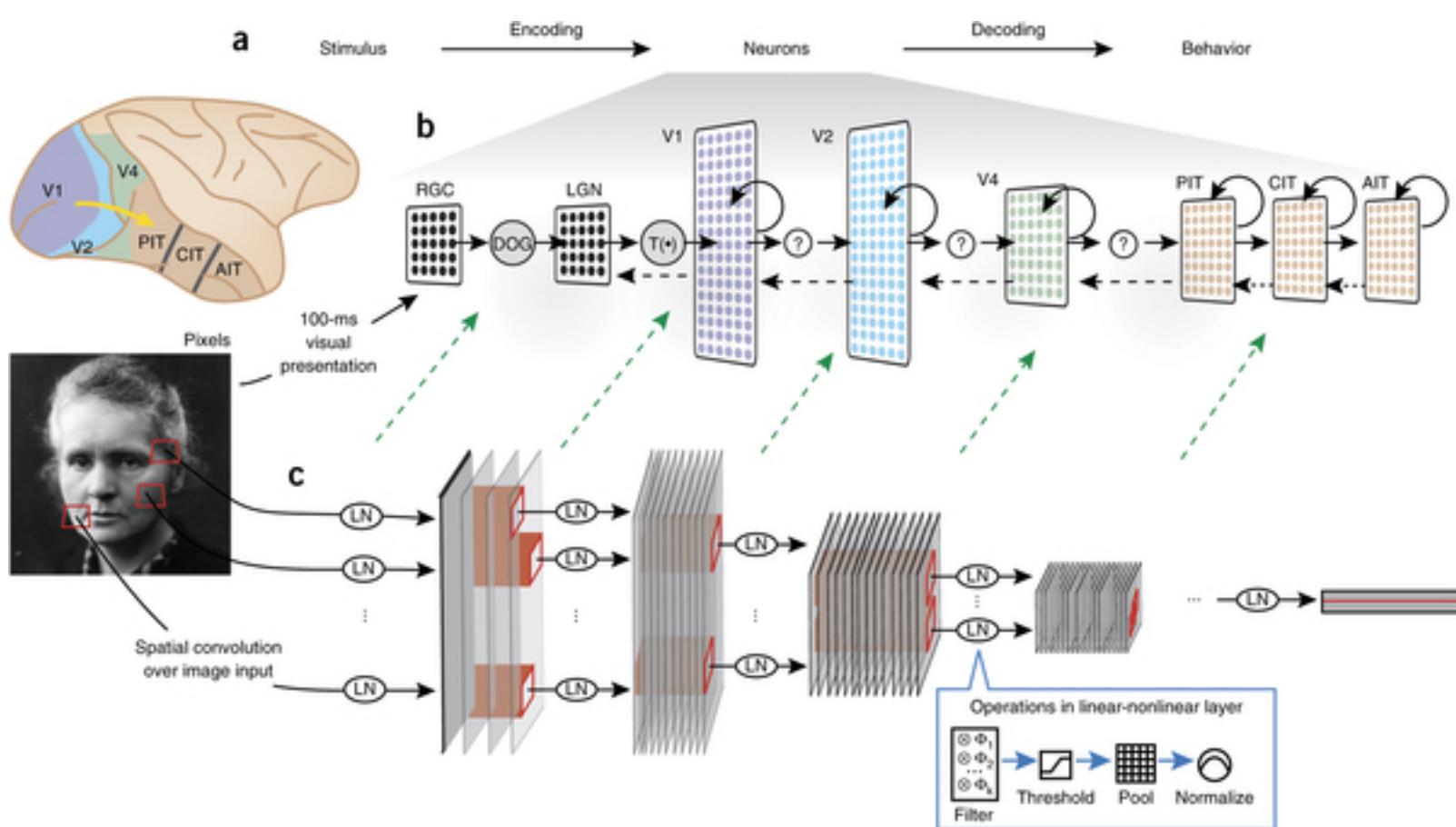
- The ventral (recognition) pathway in the visual cortex has multiple stages
- Retina - LGN - V1 - V2 - V4 - PIT - AIT
- Lots of intermediate representations



[Gallant & Van Essen]

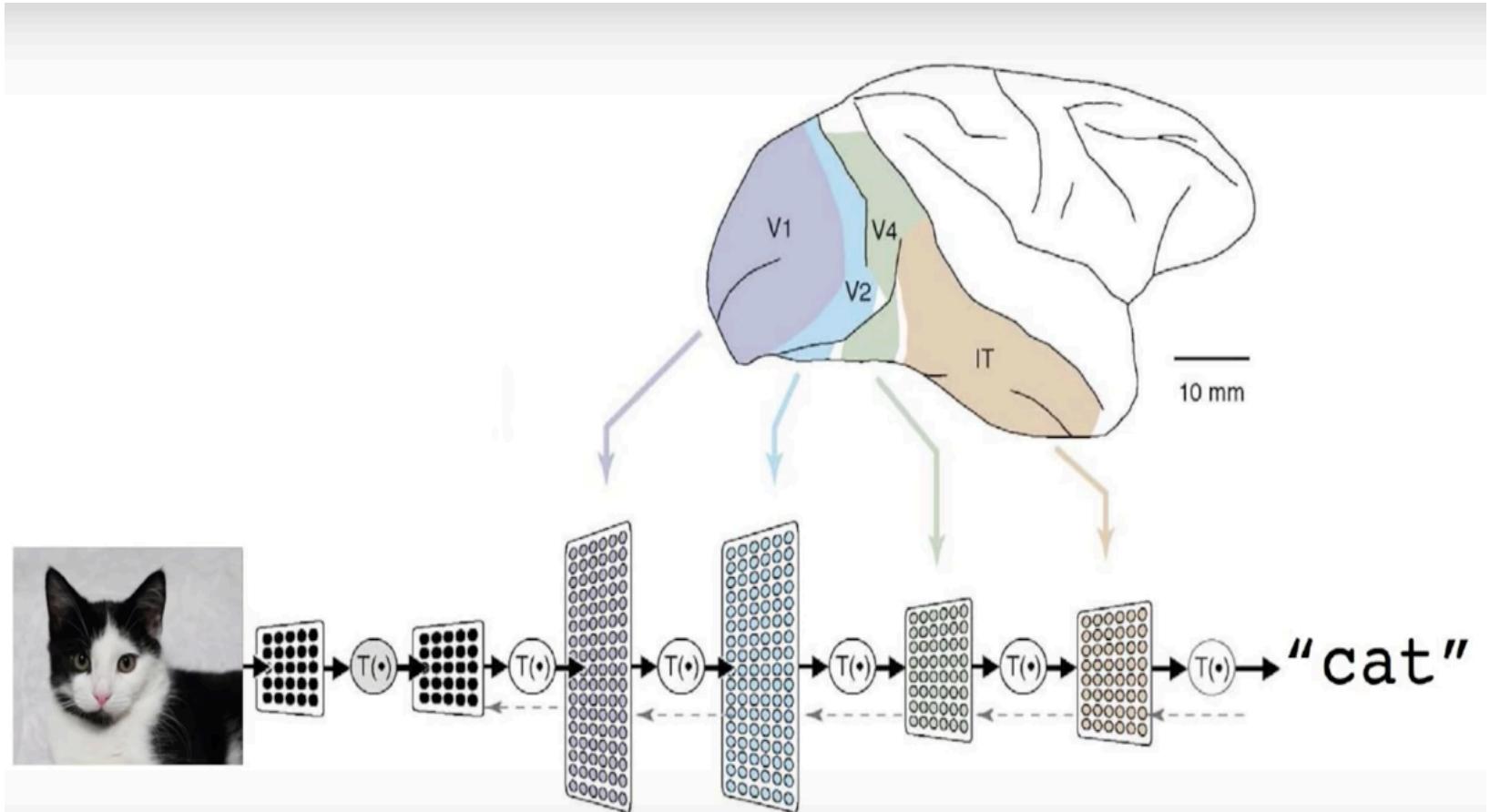
A figure from Van Essen and Gallant 1994 that shows the rough location (in a macaque cortex) and function of regions involved in the visual system

How Deep Learning Works?



Comparing the human visual system to a convolutional net. Both process the world topographically and have a hierarchy of processing layers. From Yamins, Daniel LK, and James J. DiCarlo. "Using goal-driven deep learning models to understand sensory cortex." Nature neuroscience 19.3 (2016): 356-365.

How Deep Learning Works?



What is Deep Learning?



AI vs Brain

Specifically convolutional neural networks for deep learning, have been inspired by the human brain.



Image from the MGH Human Connectome Project: a model of nerve fibers estimated using diffusion MRI (<http://www.humanconnectomeproject.org/gallery/>)

Copyright: bousmah@gmail.com

What is Deep Learning?

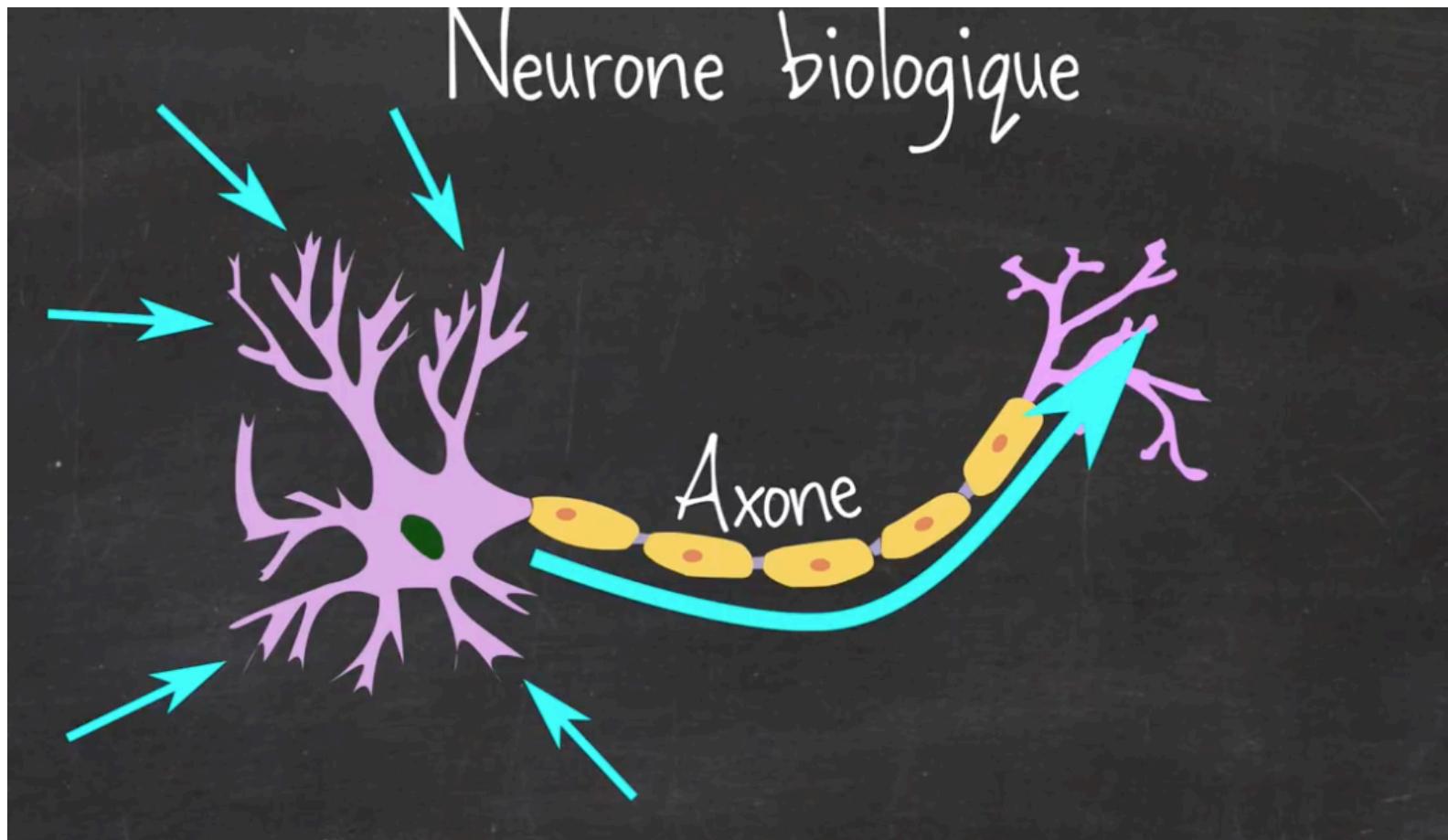
- Artificial Neural Networks (ANN)
- Convolution Neural Networks (CNN)
- Recurrent Neural Networks (RNN)

Different types of Neural Networks in Deep Learning

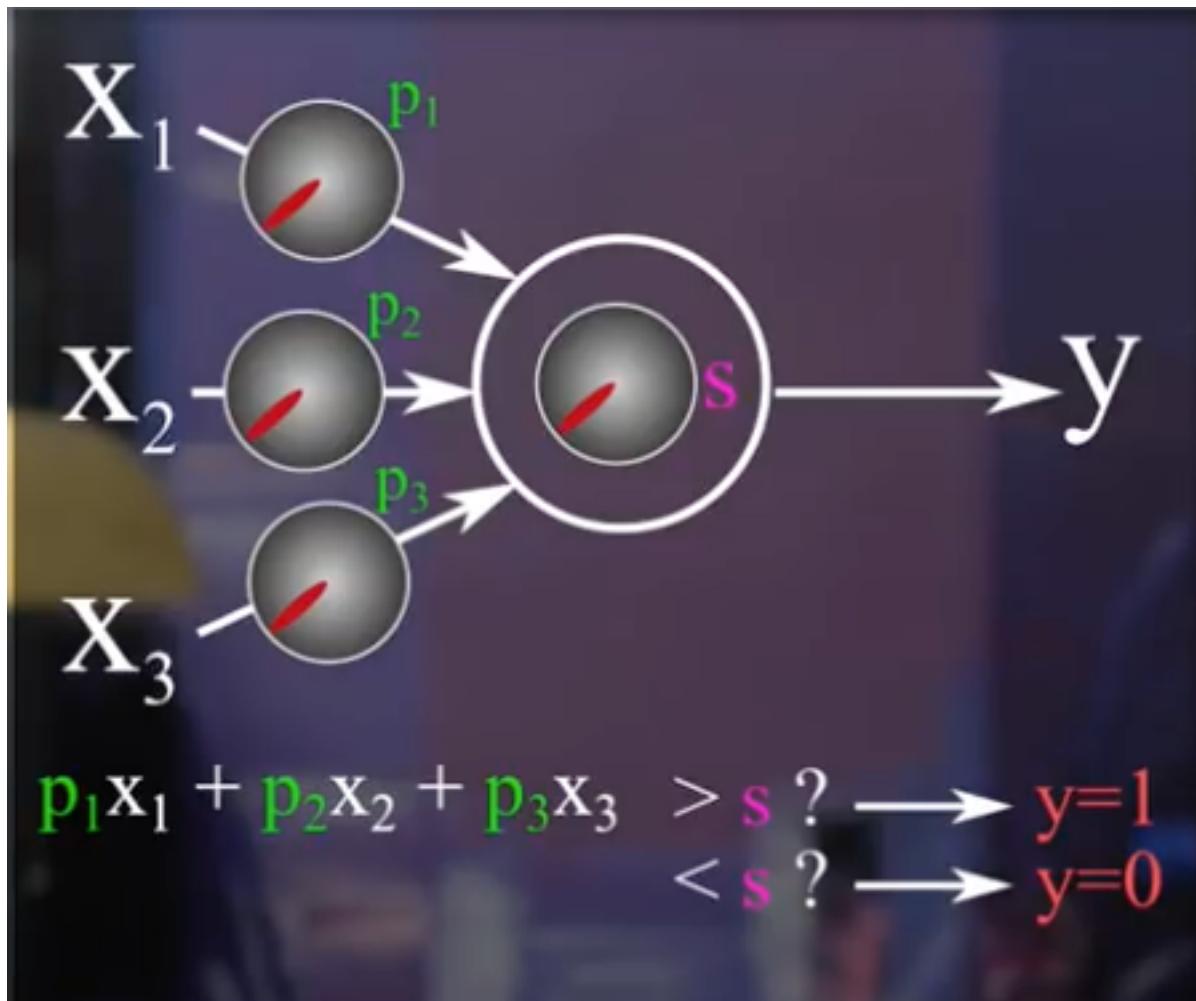
What is Deep Learning?



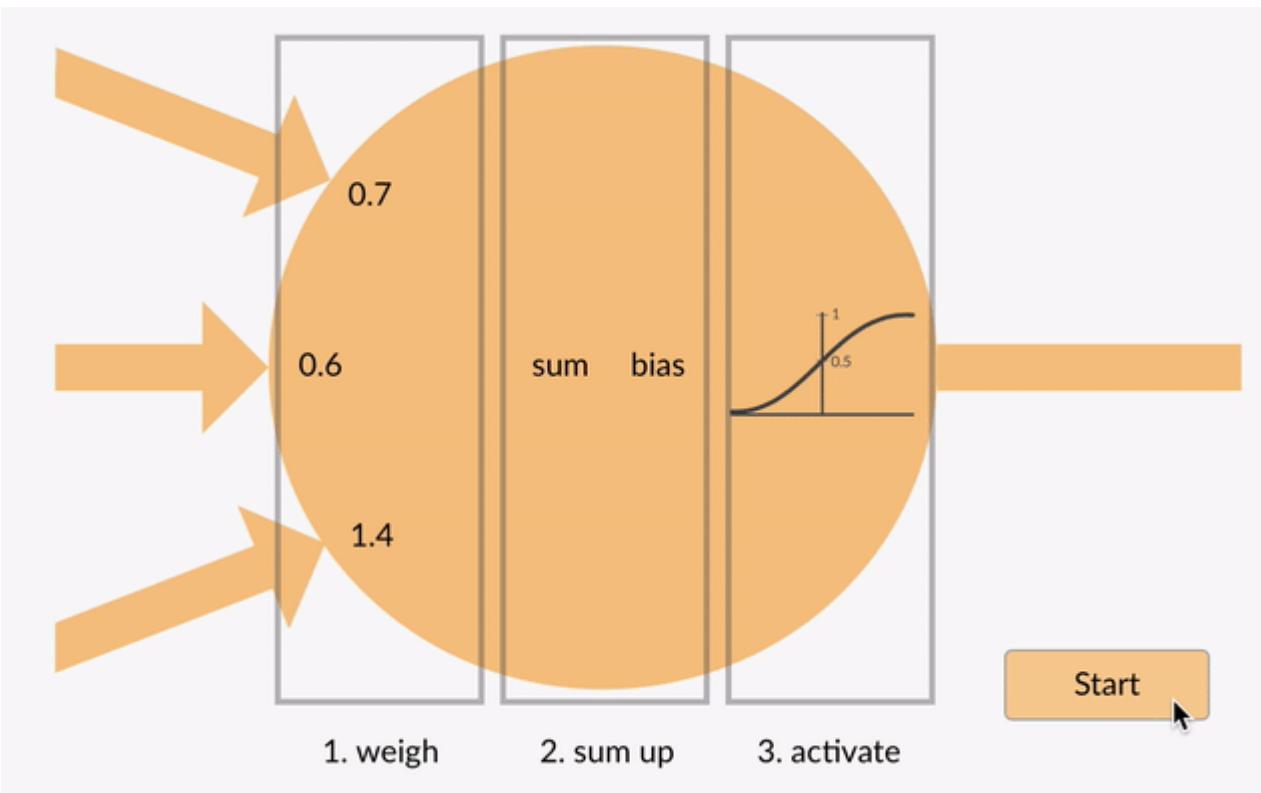
QU'EST-CE QUE MACHINE LEARNING?



QU'EST-CE QUE MACHINE LEARNING?

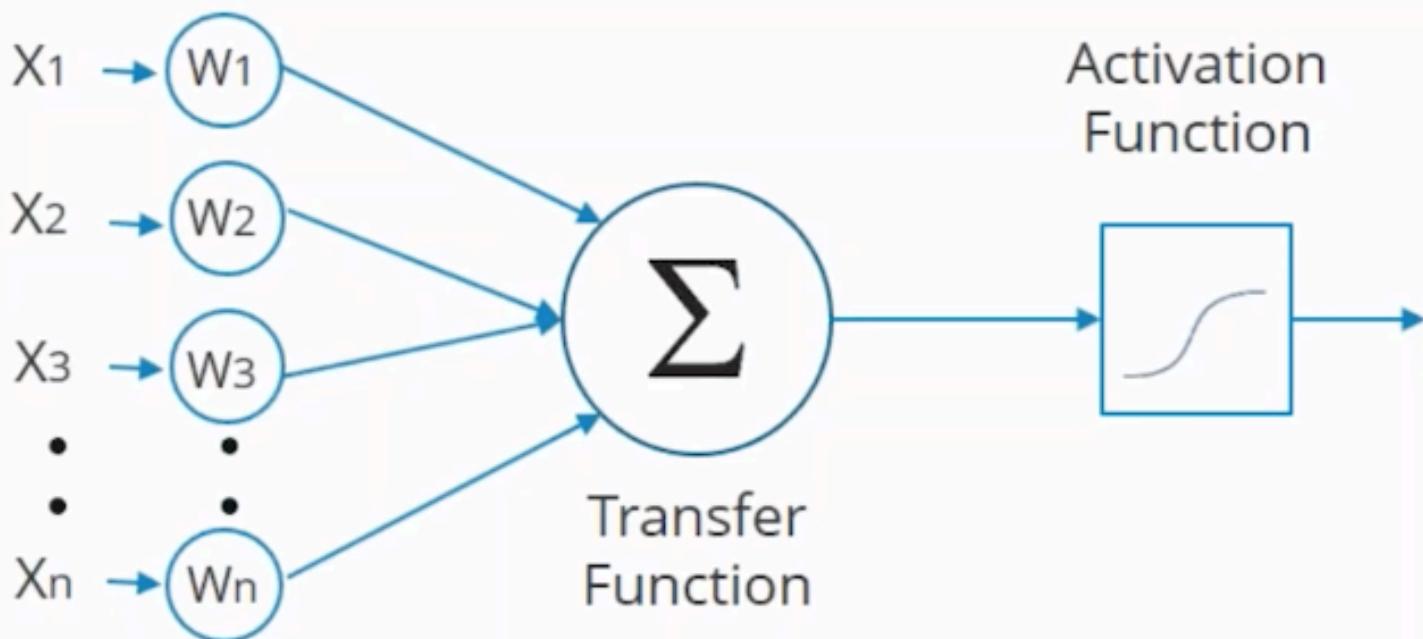


What is Deep Learning?



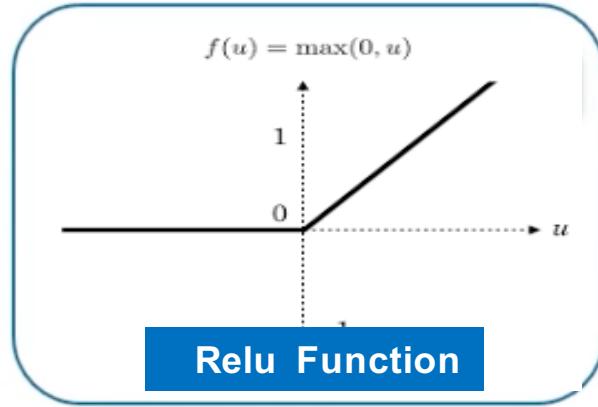
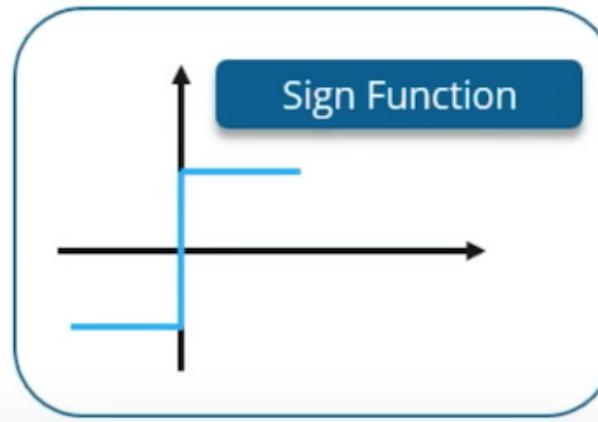
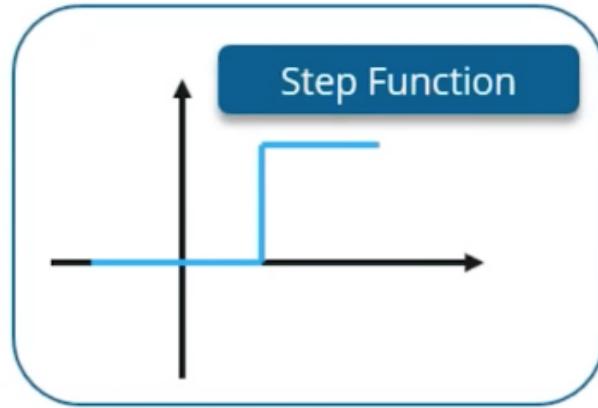
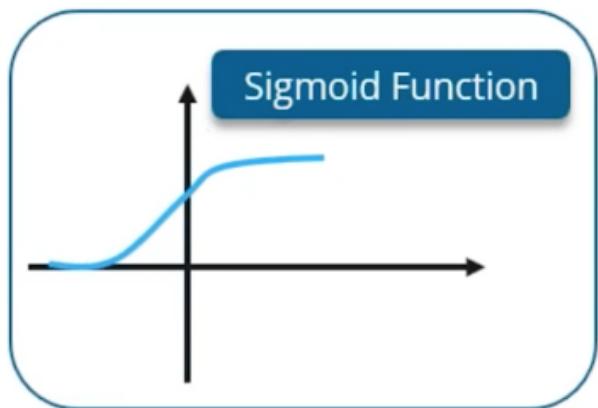
How Deep Learning Works?

Perceptron



How Deep Learning Works?

Activation Function

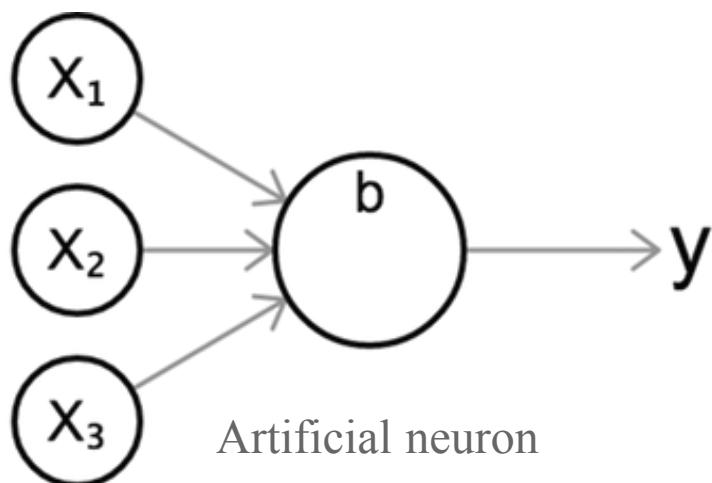
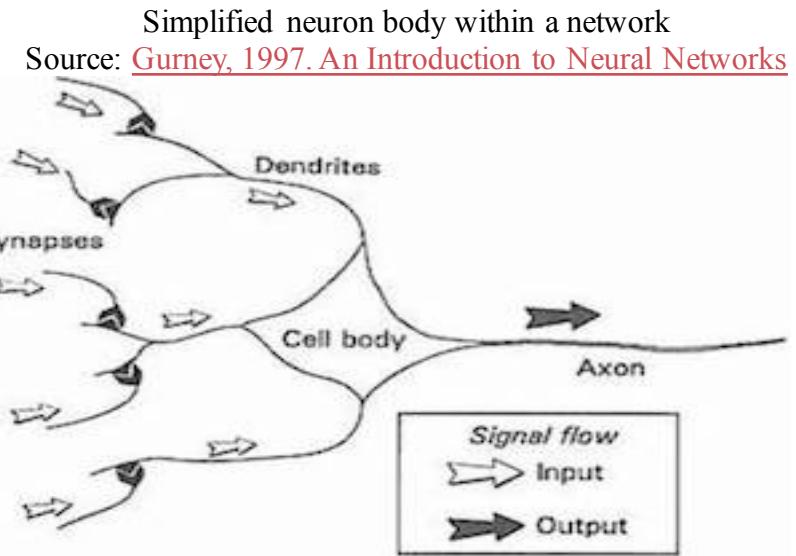
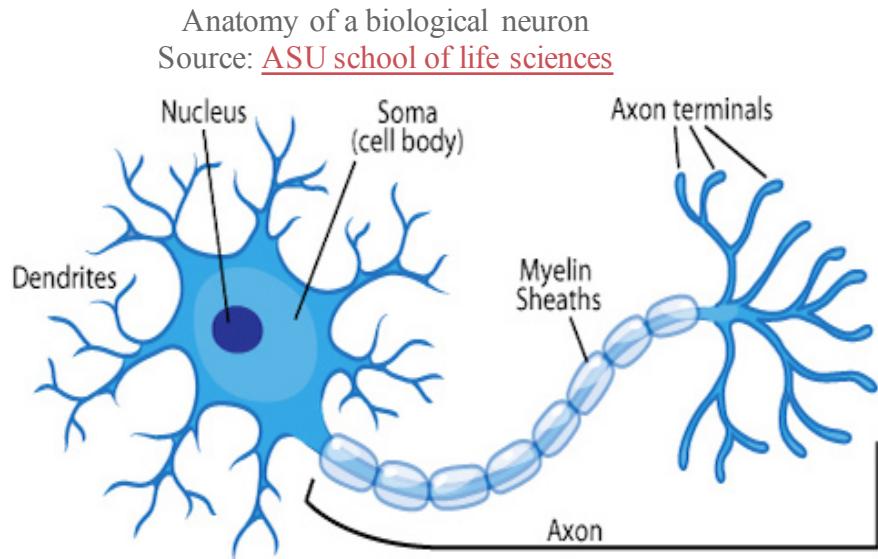


How Deep Learning Works?

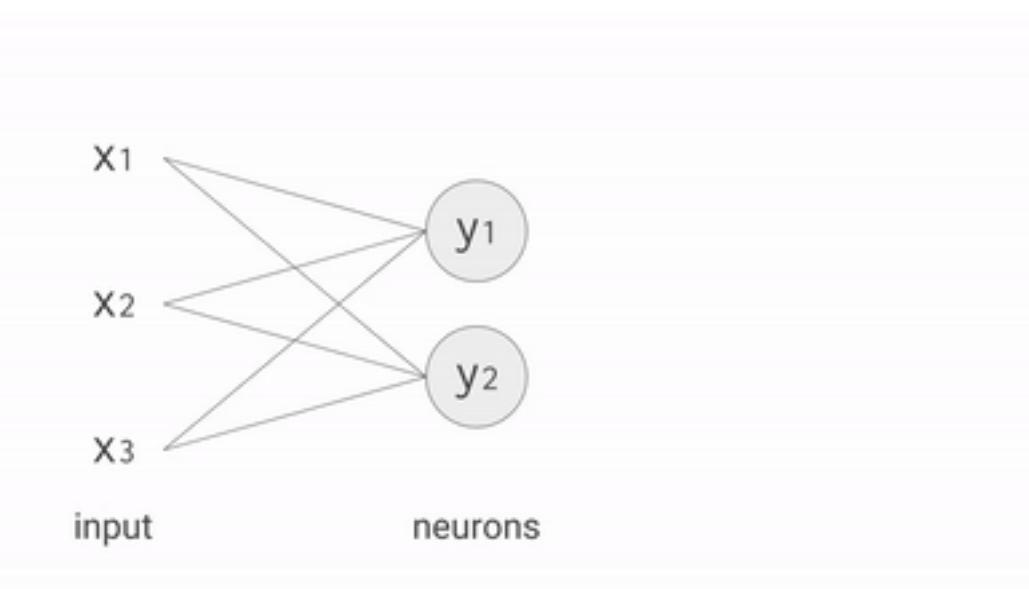
Activation Layers

Name	Plot	Equation	Derivative
Identity		$f(x) = x$	$f'(x) = 1$
Binary step		$f(x) = \begin{cases} 0 & \text{for } x < 0 \\ 1 & \text{for } x \geq 0 \end{cases}$	$f'(x) = \begin{cases} 0 & \text{for } x \neq 0 \\ ? & \text{for } x = 0 \end{cases}$
Logistic (a.k.a Soft step)		$f(x) = \frac{1}{1 + e^{-x}}$	$f'(x) = f(x)(1 - f(x))$
Tanh		$f(x) = \tanh(x) = \frac{2}{1 + e^{-2x}} - 1$	$f'(x) = 1 - f(x)^2$
ArcTan		$f(x) = \tan^{-1}(x)$	$f'(x) = \frac{1}{x^2 + 1}$
Rectified Linear Unit (ReLU)		$f(x) = \begin{cases} 0 & \text{for } x < 0 \\ x & \text{for } x \geq 0 \end{cases}$	$f'(x) = \begin{cases} 0 & \text{for } x < 0 \\ 1 & \text{for } x \geq 0 \end{cases}$
Parameteric Rectified Linear Unit (PReLU) [2]		$f(x) = \begin{cases} \alpha x & \text{for } x < 0 \\ x & \text{for } x \geq 0 \end{cases}$	$f'(x) = \begin{cases} \alpha & \text{for } x < 0 \\ 1 & \text{for } x \geq 0 \end{cases}$
Exponential Linear Unit (ELU) [3]		$f(x) = \begin{cases} \alpha(e^x - 1) & \text{for } x < 0 \\ x & \text{for } x \geq 0 \end{cases}$	$f'(x) = \begin{cases} f(x) + \alpha & \text{for } x < 0 \\ 1 & \text{for } x \geq 0 \end{cases}$
SoftPlus		$f(x) = \log_e(1 + e^x)$	$f'(x) = \frac{1}{1 + e^{-x}}$

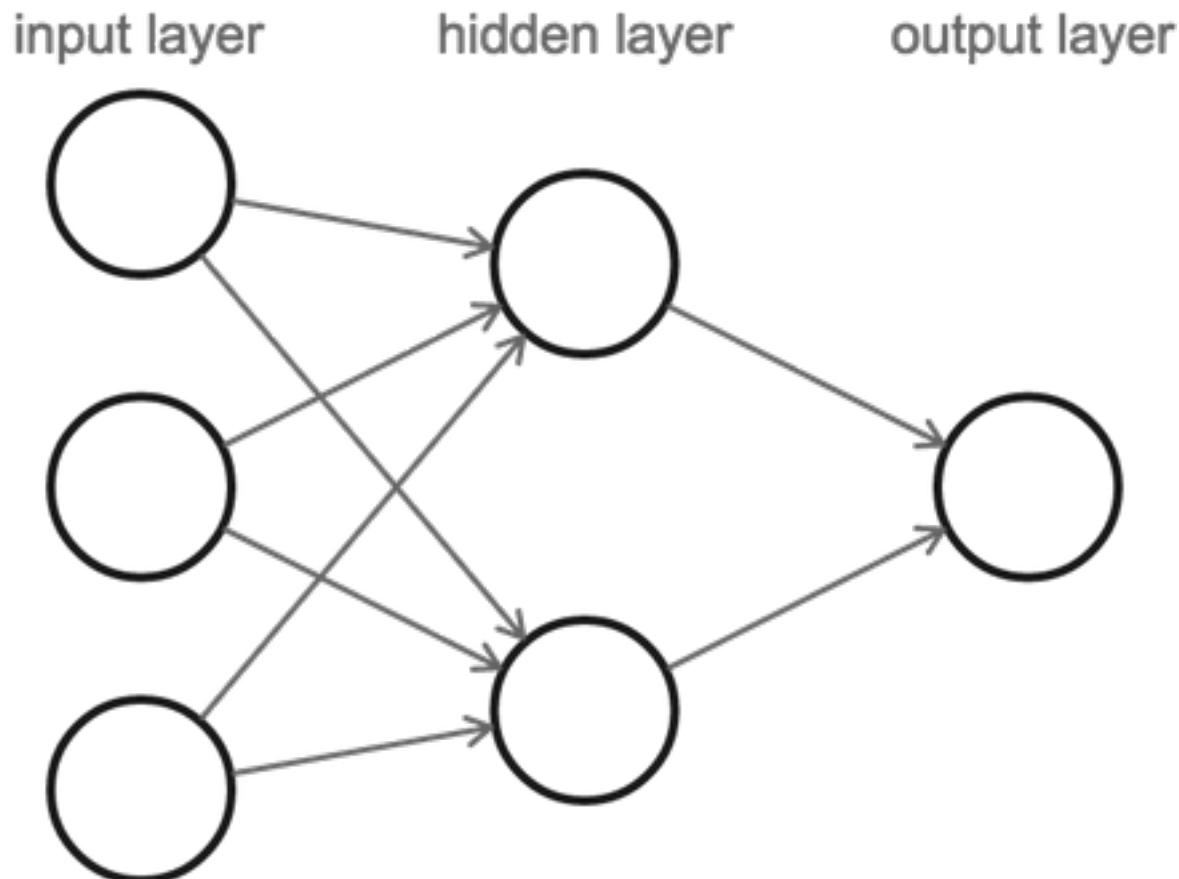
How Deep Learning Works?



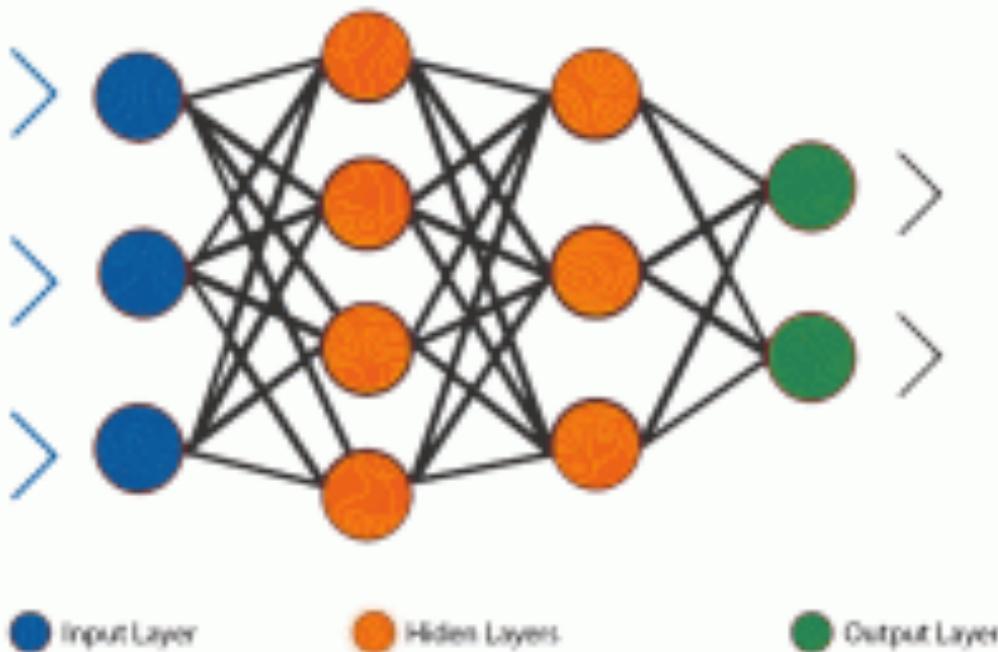
How Deep Learning Works?



What is Learning?

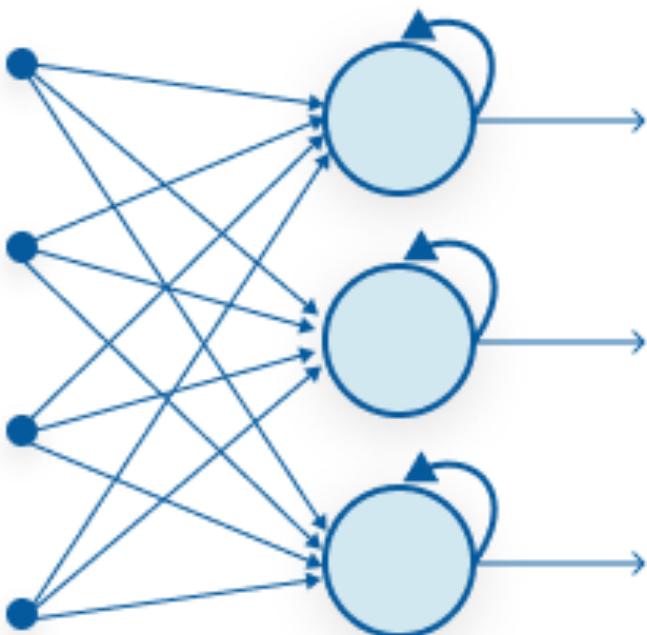


What is Deep Learning?

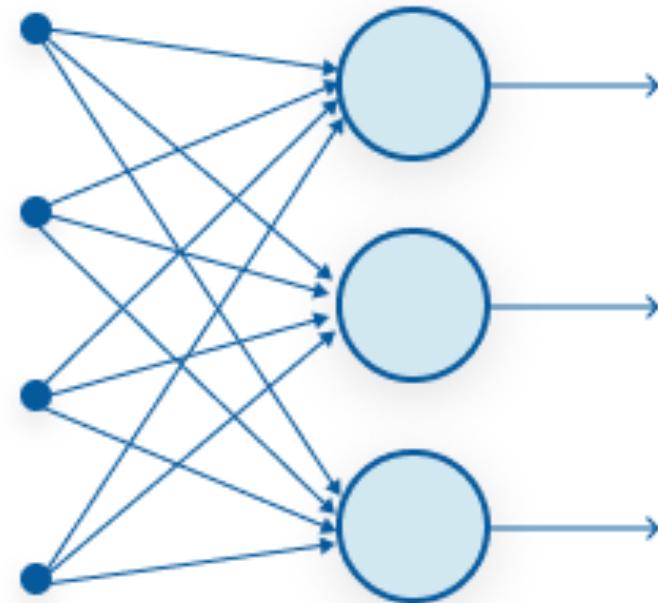


Artificial Neural Network (ANN)

What is Deep Learning?



Recurrent Neural Network



Feed-Forward Neural Network

Deep Learning

RNN: a new approach

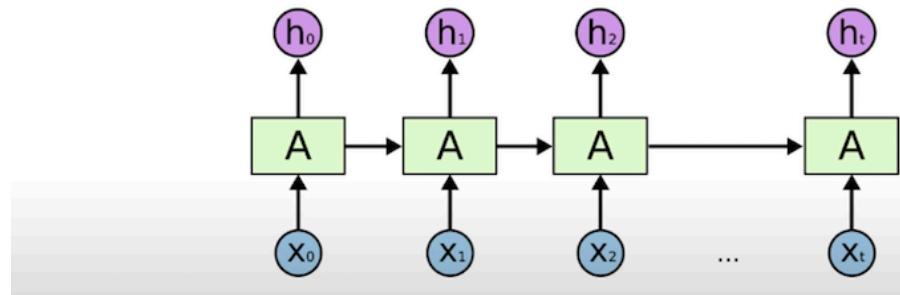
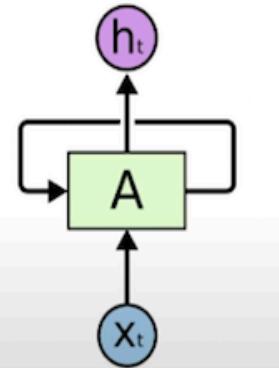
How to calculate $f(x_1, x_2, x_3, \dots, x_N)$

A for-loop in math.

$$H_{i+1} = A(H_i, x_i)$$

$$f(\vec{x}) = H_N$$

“Unrolled” RNN



Deep Learning

Vanishing & Exploding Gradients

$$H_{i+1} = A(H_i, x_i)$$

$$H_3 = A(A(A(H_0, x_0), x_1), x_2)$$

$$A(H, x) := \mathbf{W}x + \mathbf{Z}H$$

$$H_N = \mathbf{W}^N x_0 + \mathbf{W}^{N-1} x_1 + \dots$$

*Leaving out the nonlinear activation in A for clarity. The idea holds.



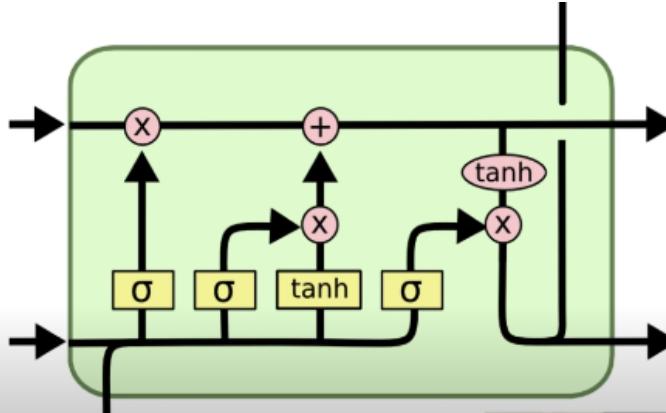
Deep Learning

Vanishing / Exploding Gradients

```
>>> 0.9 ** 100  
2.6561398887587544e-05  
>>> 1.1 ** 100  
13780.61233982238  
>>> 0.9 ** 200  
7.055079108655367e-10  
>>> 1.1 ** 200  
189905276.4604649
```

Deep Learning

Long
Short
Term
Memory



LONG SHORT-TERM MEMORY

NEURAL COMPUTATION 9(8):1735–1780, 1997

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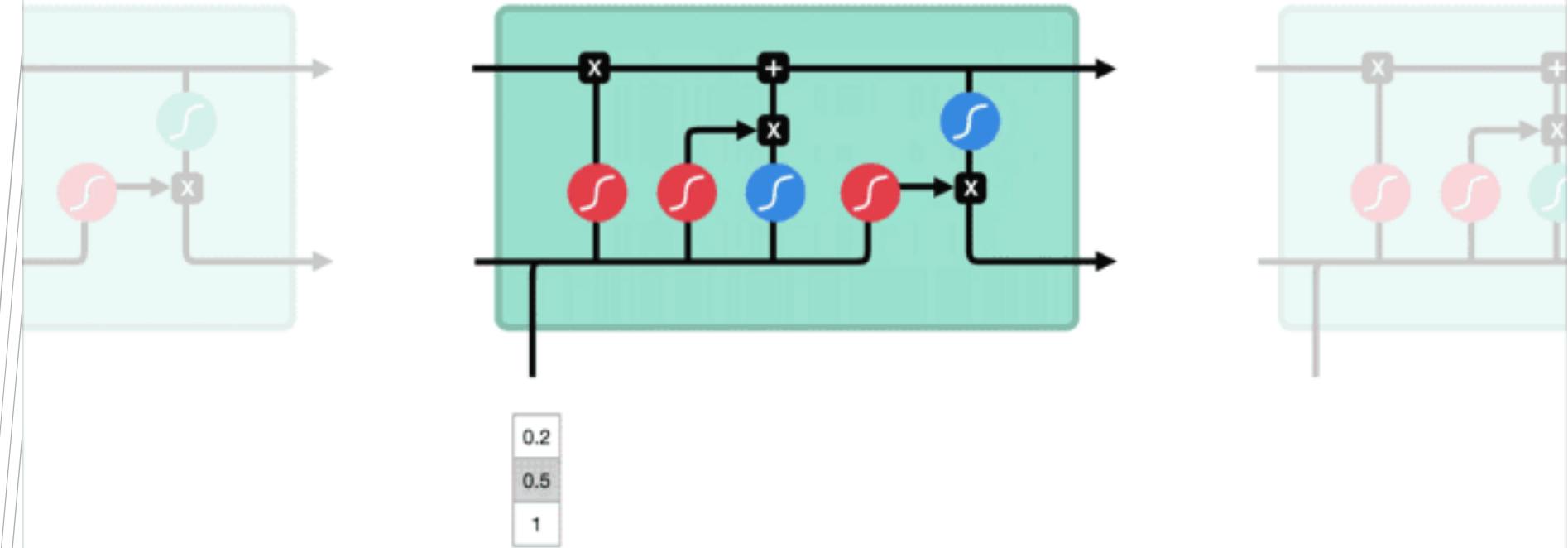
<http://www.idsia.ch/~juergen>

Abstract

Learning to store information over extended time intervals via recurrent backpropagation takes a very long time, mostly due to insufficient, decaying error back flow. We briefly review Hochreiter's 1991 analysis of this problem, then address it by introducing a novel, efficient, gradient-based method called "Long Short-Term Memory" (LSTM). Truncating the gradient where this does not do harm, LSTM can learn to bridge minimal time lags in excess of 1000 discrete time steps by enforcing *constant* error flow through "constant error carousels" within special units. Multiplicative gate units learn to open and close access to the constant error flow. LSTM is local in space and time; its computational complexity per time step and weight is $O(1)$. Our experiments with artificial data involve local, distributed, real-valued, and noisy

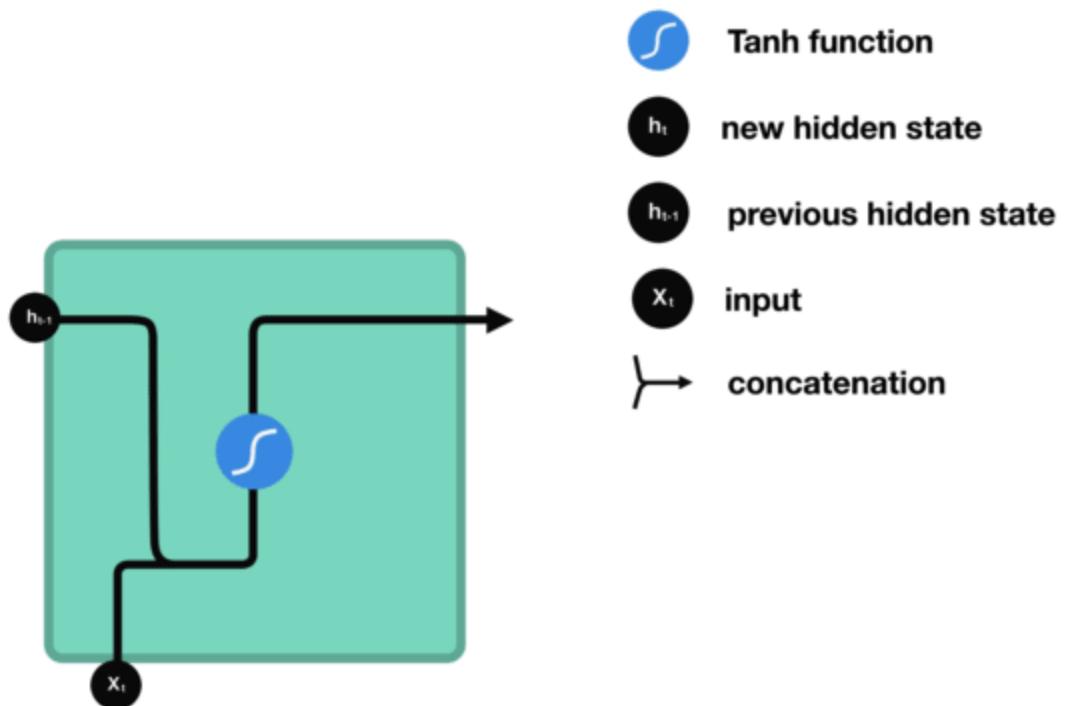
Deep Learning

Long Short-Term Memory (LSTM)



Deep Learning

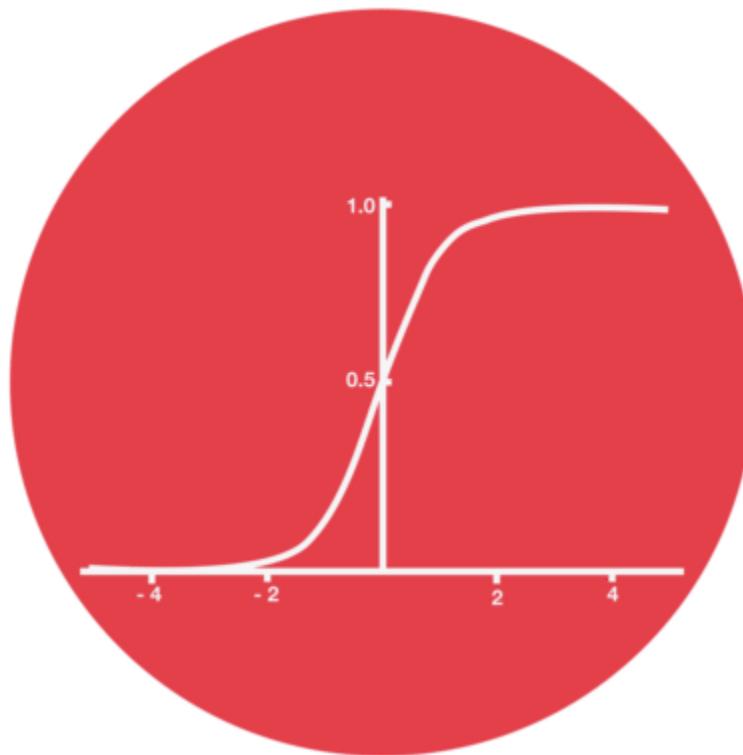
RNN Cell



Deep Learning

Sigmoid squishes values to be between 0 and 1

5
0.1
-0.5

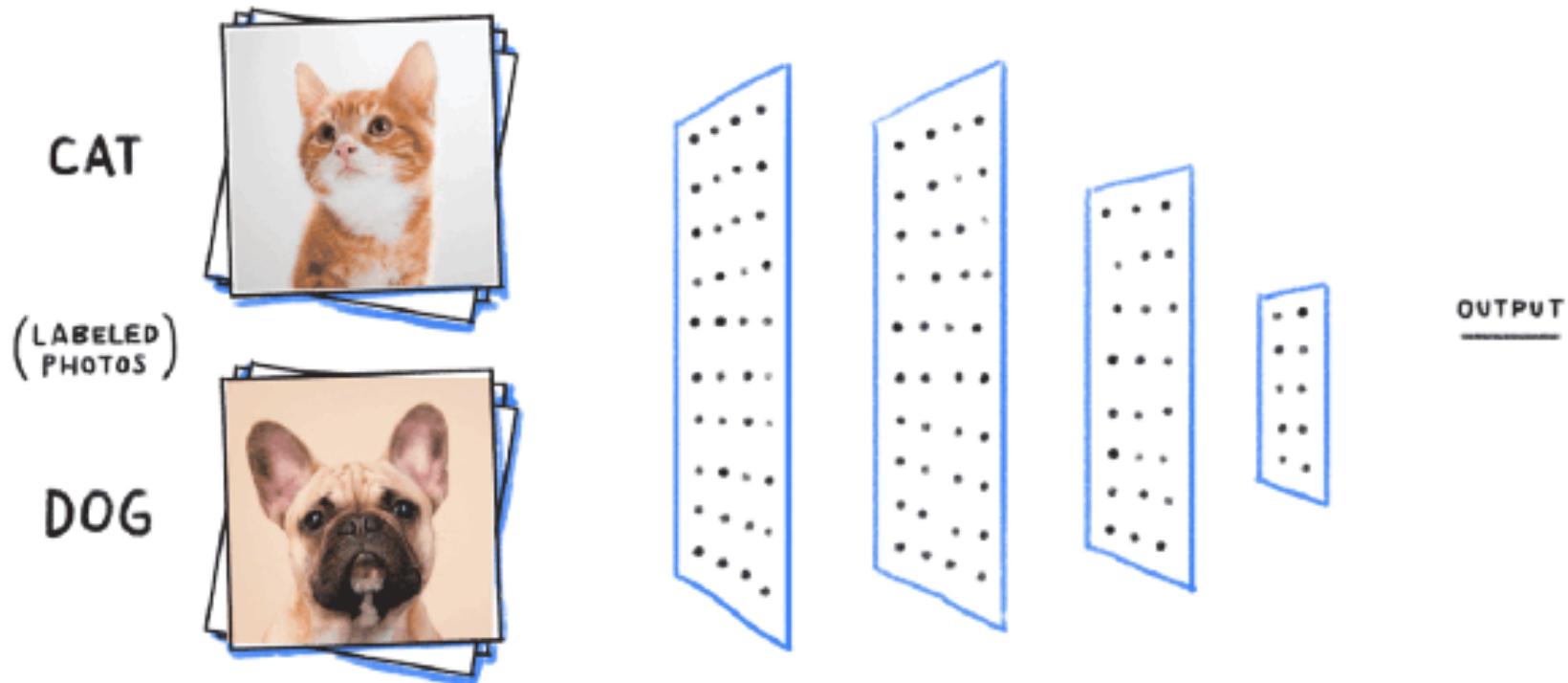


Deep Learning

LSTM's limitations

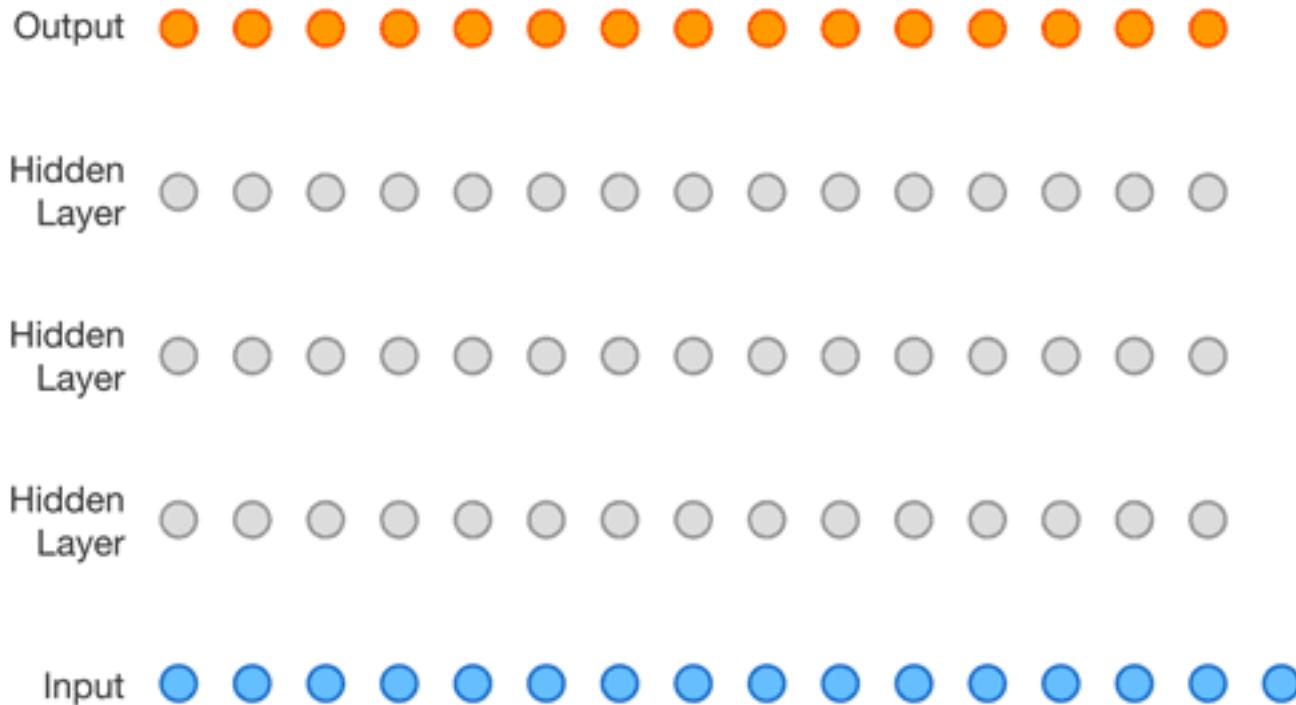
- Difficult to train
- Very long gradient paths
 - LSTM on 100-word doc has gradients like 100-layer network
- Transfer learning never really worked
- Needs specific labelled dataset for every task

What is Deep Learning?



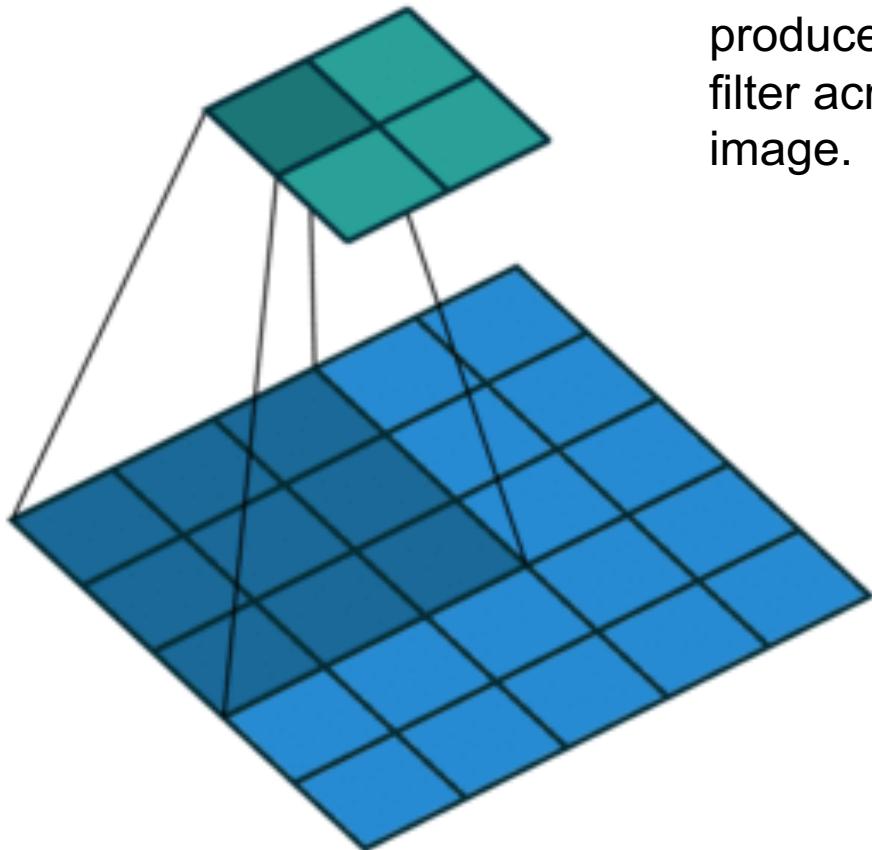
CNN – Image Classification

What is Deep Learning?



What is Deep Learning?

Convolving image with a filter



Notice that the 2×2 feature map is produced by sliding the same 3×3 filter across different parts of an image.

What is a CNN?

Convolutional Neural Networks Visualizing parts of Convolutional Neural Networks using Keras and Cats

<https://hackernoon.com/visualizing-parts-of-convolutional-neural-networks-using-keras-and-cats-5cc01b214e59>

Convolutional Layer

To understand what a CNN is, you need to understand how convolutions work. Imagine you have an image represented as a 5x5 matrix of values, and you take a 3x3 matrix and slide that 3x3 window around the image. At each position the 3x3 visits, you matrix multiply the values of your 3x3 window by the values in the image that are currently being covered by the window. This results in a single number the represents all the values in that window of the image. Here's a pretty gif for clarity:

1 <small>x1</small>	1 <small>x0</small>	1 <small>x1</small>	0	0
0 <small>x0</small>	1 <small>x1</small>	1 <small>x0</small>	1	0
0 <small>x1</small>	0 <small>x0</small>	1 <small>x1</small>	1	1
0	0	1	1	0
0	1	1	0	0

Image

4		

Convolved
Feature

What is a CNN?

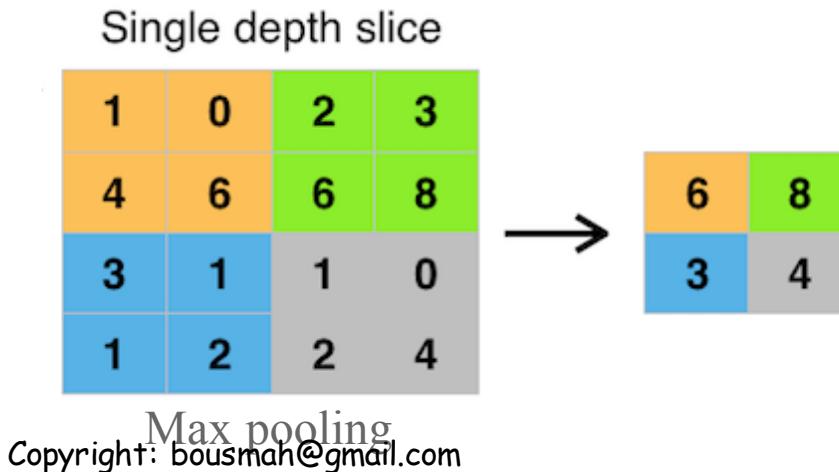
Convolutional neural networks Visualizing parts of Convolutional Neural Networks using Keras and Cats

[+++++https://hackernoon.com/visualizing-parts-of-convolutional-neural-networks-using-keras-and-cats-5cc01b214e59](https://hackernoon.com/visualizing-parts-of-convolutional-neural-networks-using-keras-and-cats-5cc01b214e59)

Pooling Layers

Pooling works very much like convoluting, where we take a **kernel** and move the kernel over the image, the only difference is the function that is applied to the kernel and the image window isn't linear.

Max pooling and **Average pooling** are the most common pooling functions. Max pooling takes the largest value from the window of the image currently covered by the kernel, while average pooling takes the average of all values in the window.

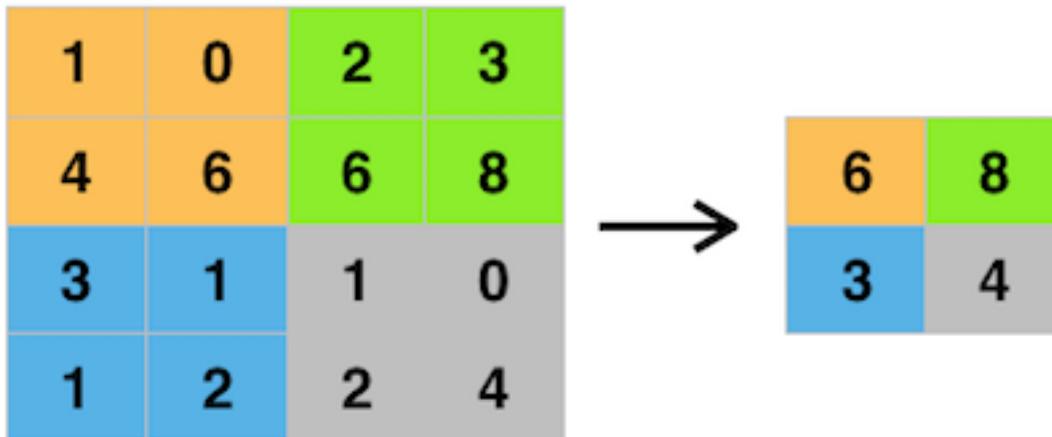


What is a CNN?

Convolutional neural networks Visualizing parts of Convolutional Neural Networks using Keras and Cats

[+++++https://hackernoon.com/visualizing-parts-of-convolutional-neural-networks-using-keras-and-cats-5cc01b214e59](https://hackernoon.com/visualizing-parts-of-convolutional-neural-networks-using-keras-and-cats-5cc01b214e59)

Single depth slice



Max pooling

What is a CNN?

Convolutional neural networks Visualizing parts of Convolutional Neural Networks using Keras and Cats

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Recap

- Three main types of layers in CNNs: **Convolutional, Pooling, Activation**
- **Convolutional layers** multiply kernel value by the image window and optimize the kernel weights over time using gradient descent
- **Pooling layers** describe a window of an image using a single value which is the max or the average of that window
- **Activation layers** squash the values into a range, typically [0,1] or [-1,1]

What is a CNN?

Convolutional neural networks Visualizing parts of Convolutional Neural Networks using Keras and Cats

[+++++https://hackernoon.com/visualizing-parts-of-convolutional-neural-networks-using-keras-and-cats-5cc01b214e59](https://hackernoon.com/visualizing-parts-of-convolutional-neural-networks-using-keras-and-cats-5cc01b214e59)

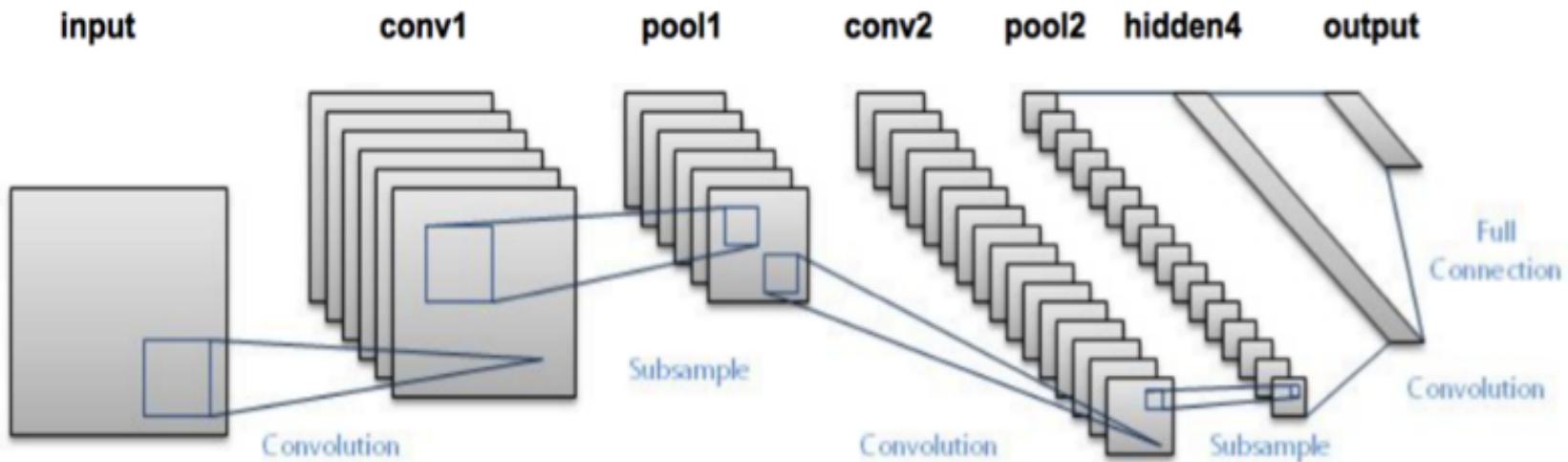
Activation Layers

Activation layers work exactly as in other neural networks, a value is passed through a function that squashes the value into a range. Here's a bunch of common ones:

What is a CNN?

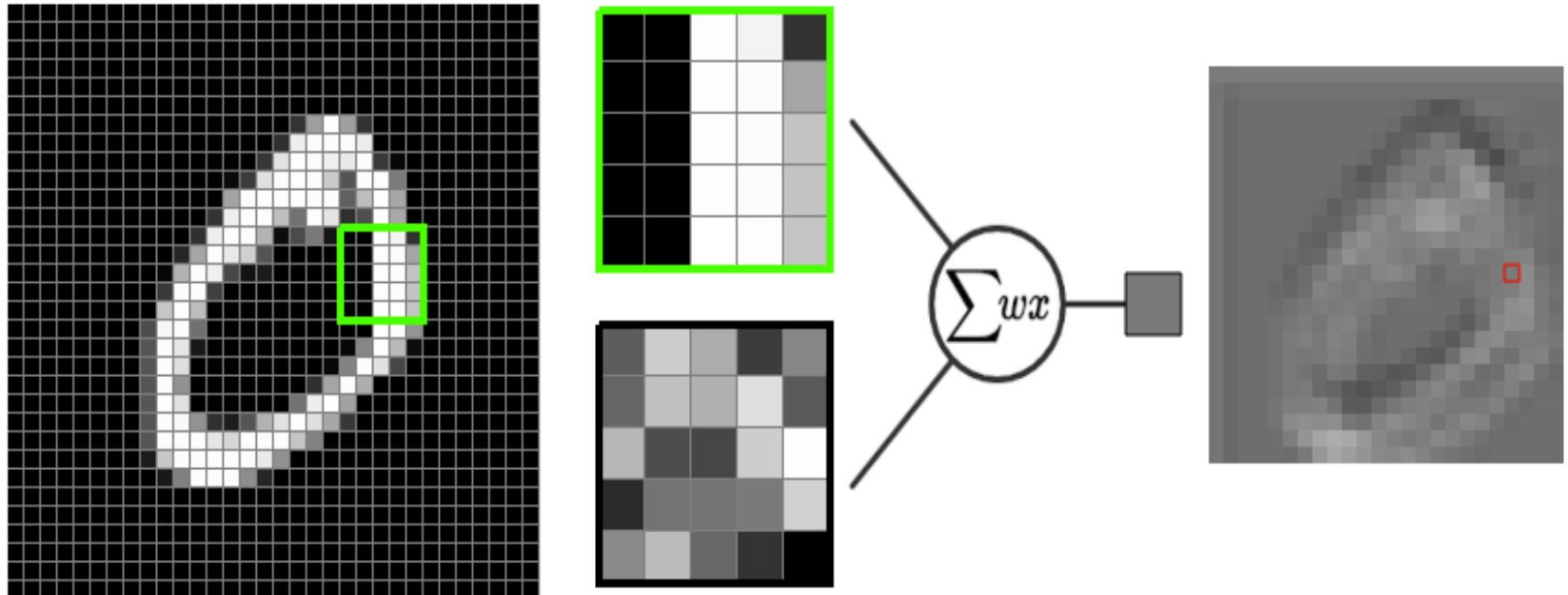
Convolutional neural networks Visualizing parts of Convolutional Neural Networks using Keras and Cats

[+++++https://hackernoon.com/visualizing-parts-of-convolutional-neural-networks-using-keras-and-cats-5cc01b214e59](https://hackernoon.com/visualizing-parts-of-convolutional-neural-networks-using-keras-and-cats-5cc01b214e59)



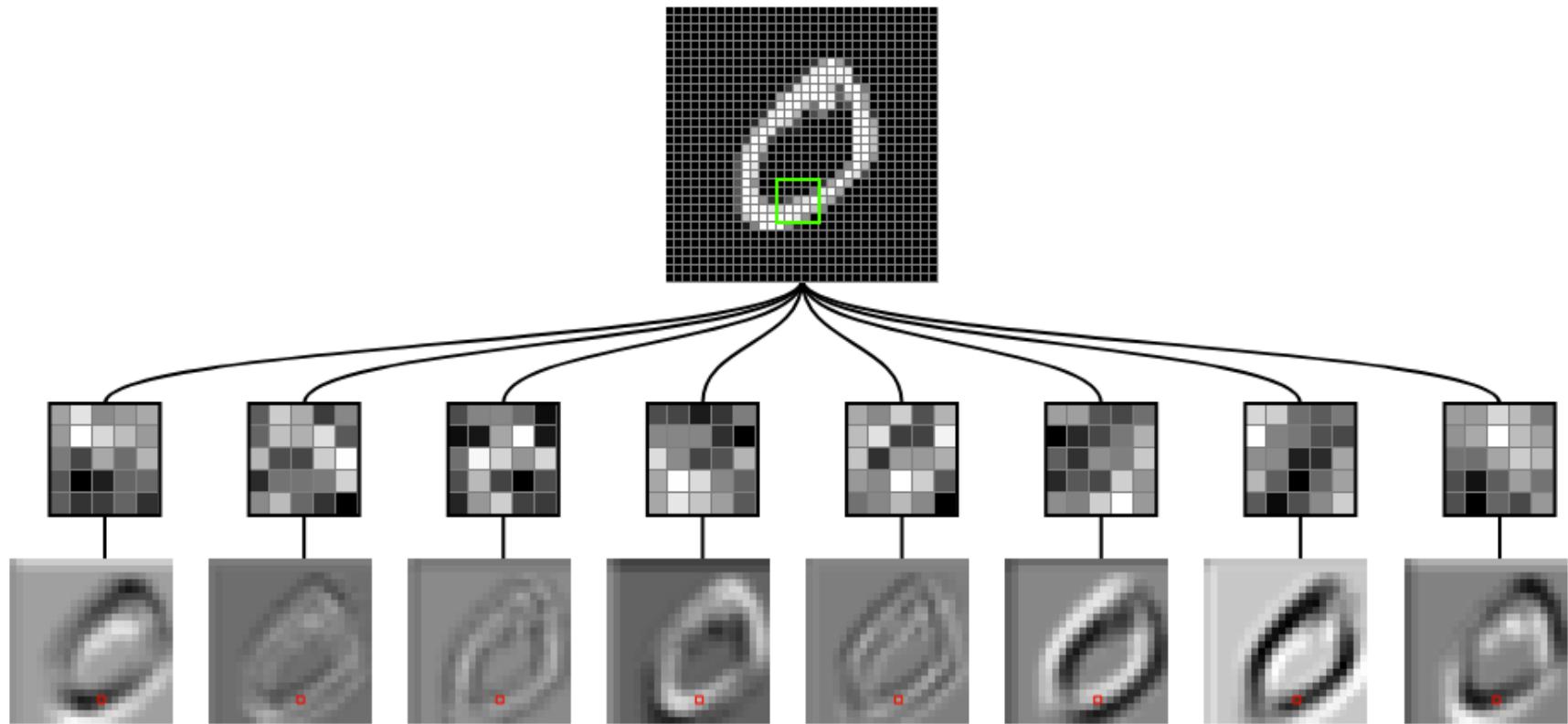
This diagram doesn't show the activation functions, but the architecture is:
Input image → ConvLayer → Relu → MaxPooling → ConvLayer → Relu →
MaxPooling → Hidden Layer → Softmax (activation) → output layer

What is Deep Learning?



Demo: Convolutional neural networks [\[demo page\]](#) [\[view source\]](#)

What is Deep Learning?



Demo: Convolutional neural networks [\[demo page\]](#) [\[view source\]](#)



Travaux Pratiques Python



Anaconda (Python distribution)



(IDE)

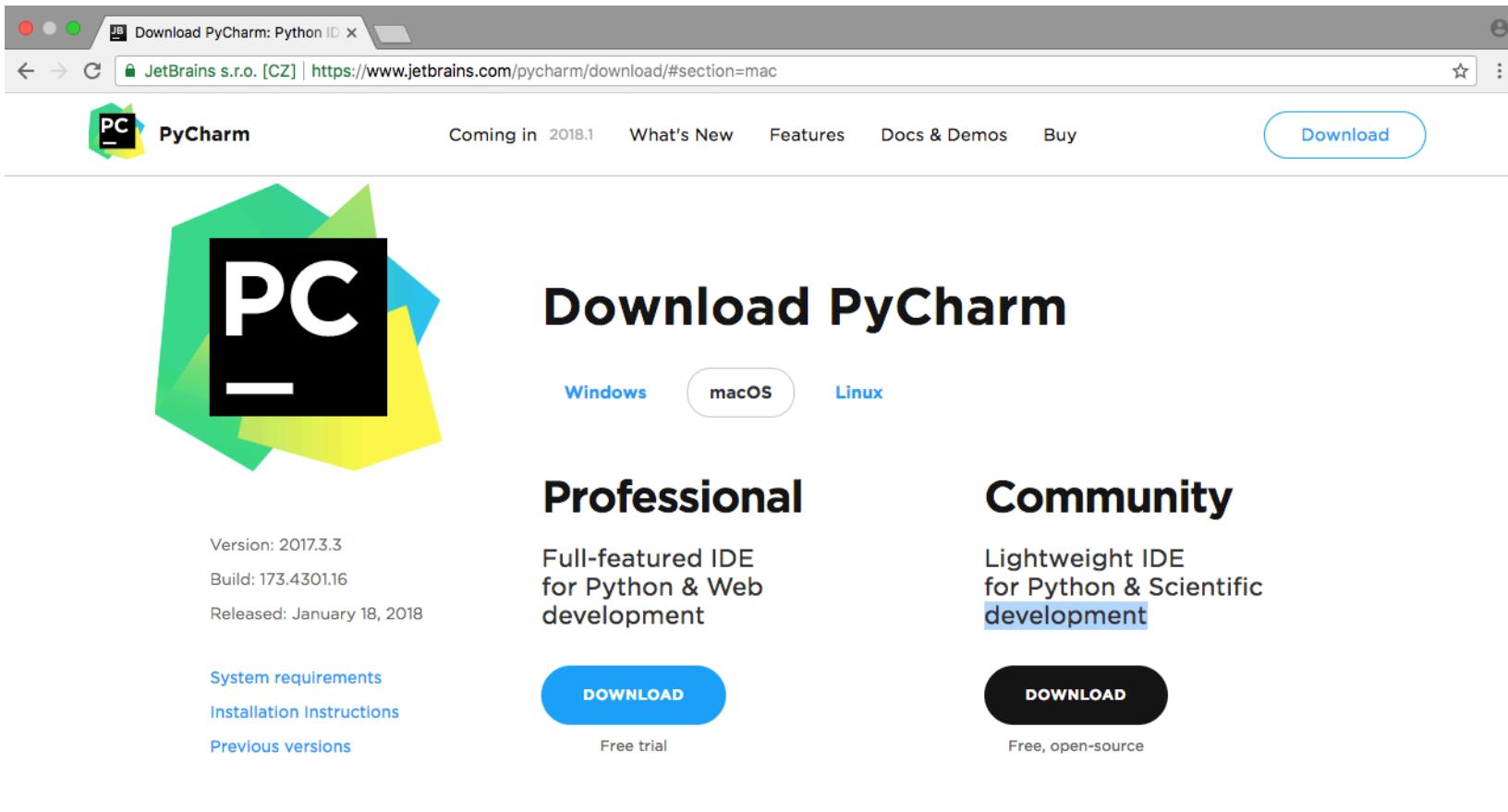
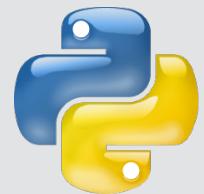


(PyCharm IDE)





Travaux Pratiques Python



The screenshot shows the official PyCharm download page on the JetBrains website. At the top, there's a navigation bar with links for 'Coming in 2018.1', 'What's New', 'Features', 'Docs & Demos', and 'Buy'. A prominent 'Download' button is located on the right. Below the navigation, there's a large image of the PyCharm logo, which consists of a black rectangle with 'PC' in white, surrounded by overlapping green and yellow hexagons. To the right of the logo, the text 'Download PyCharm' is displayed in a large, bold font. Below this, there are three tabs: 'Windows' (in blue), 'macOS' (which is highlighted in a white box), and 'Linux'. Under the 'Professional' section, it says 'Full-featured IDE for Python & Web development' and has a 'DOWNLOAD' button. Under the 'Community' section, it says 'Lightweight IDE for Python & Scientific development' and has a 'DOWNLOAD' button. At the bottom, there's a callout box with the text 'Get the ToolBox App to download PyCharm and its future updates with ease' and a small icon of a toolbox.

Version: 2017.3.3
Build: 173.4301.16
Released: January 18, 2018

[System requirements](#)
[Installation Instructions](#)
[Previous versions](#)

[Windows](#) [macOS](#) [Linux](#)

Professional

Full-featured IDE for Python & Web development

[DOWNLOAD](#)

Free trial

Community

Lightweight IDE for Python & Scientific development

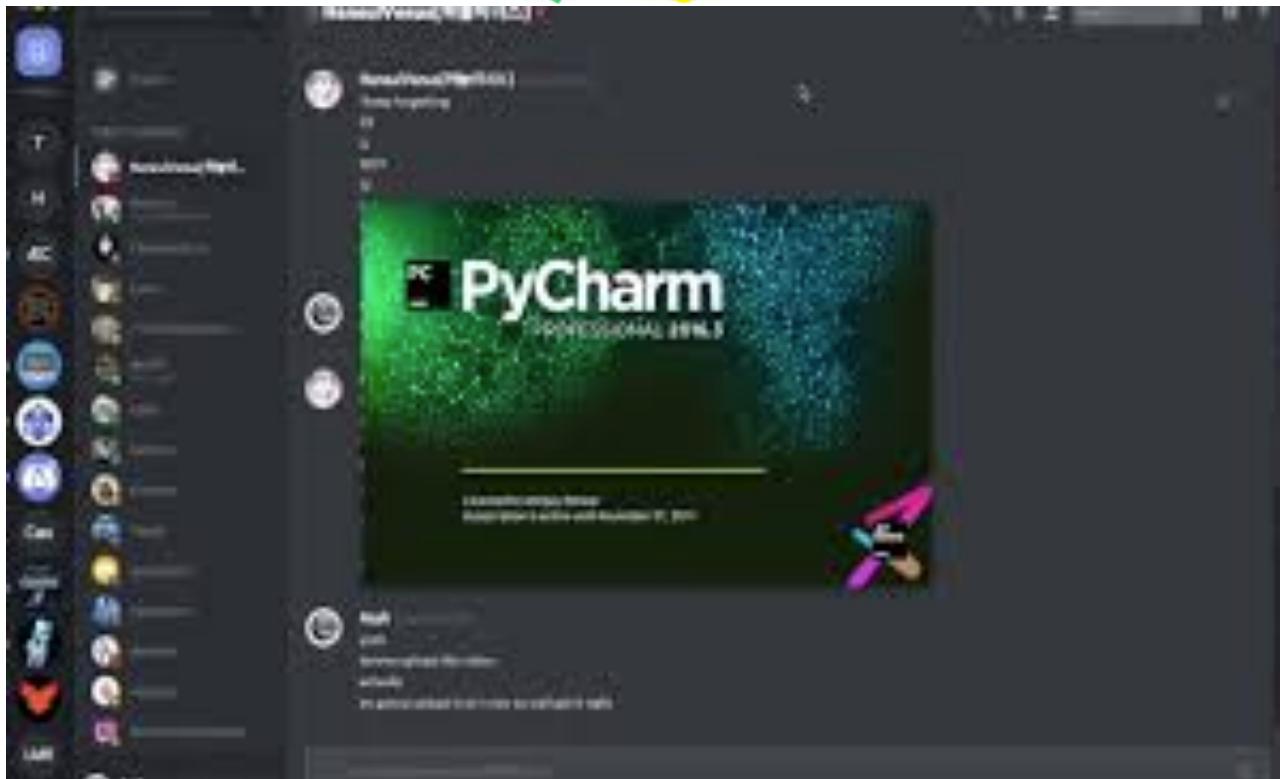
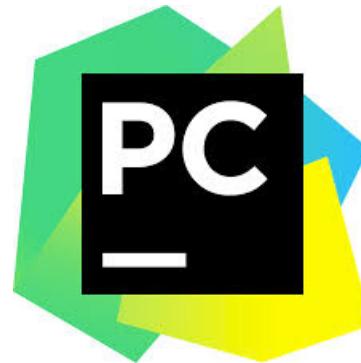
[DOWNLOAD](#)

Free, open-source

Get the [ToolBox App](#) to download PyCharm and its future updates with ease



Travaux Pratiques Python



Why python?

Préambule

- En 1989, le hollandais **Guido van Rossum** commence le développement du langage de programmation Python.
- Python est un langage **multiplateforme**, c'est-à-dire disponible sur plusieurs architectures (compatible PC, tablettes, smartphones, ordinateur low cost Raspberry Pi...) et systèmes d'exploitation (Windows, Linux, Mac, Android...).
- Le langage Python est gratuit, sous **licence libre**.
- C'est un des langages informatiques les plus populaires avec C, C++, C#, Objective-C, Java, PHP, JavaScript, Delphi, Visual Basic, Ruby et Perl ([liste non exhaustive](#)).
- Actuellement, Python en est à sa version 3. Cependant, la version 2 est encore majoritairement utilisée. Attention : Python 2 n'est pas compatible avec Python 3 !

Why python?

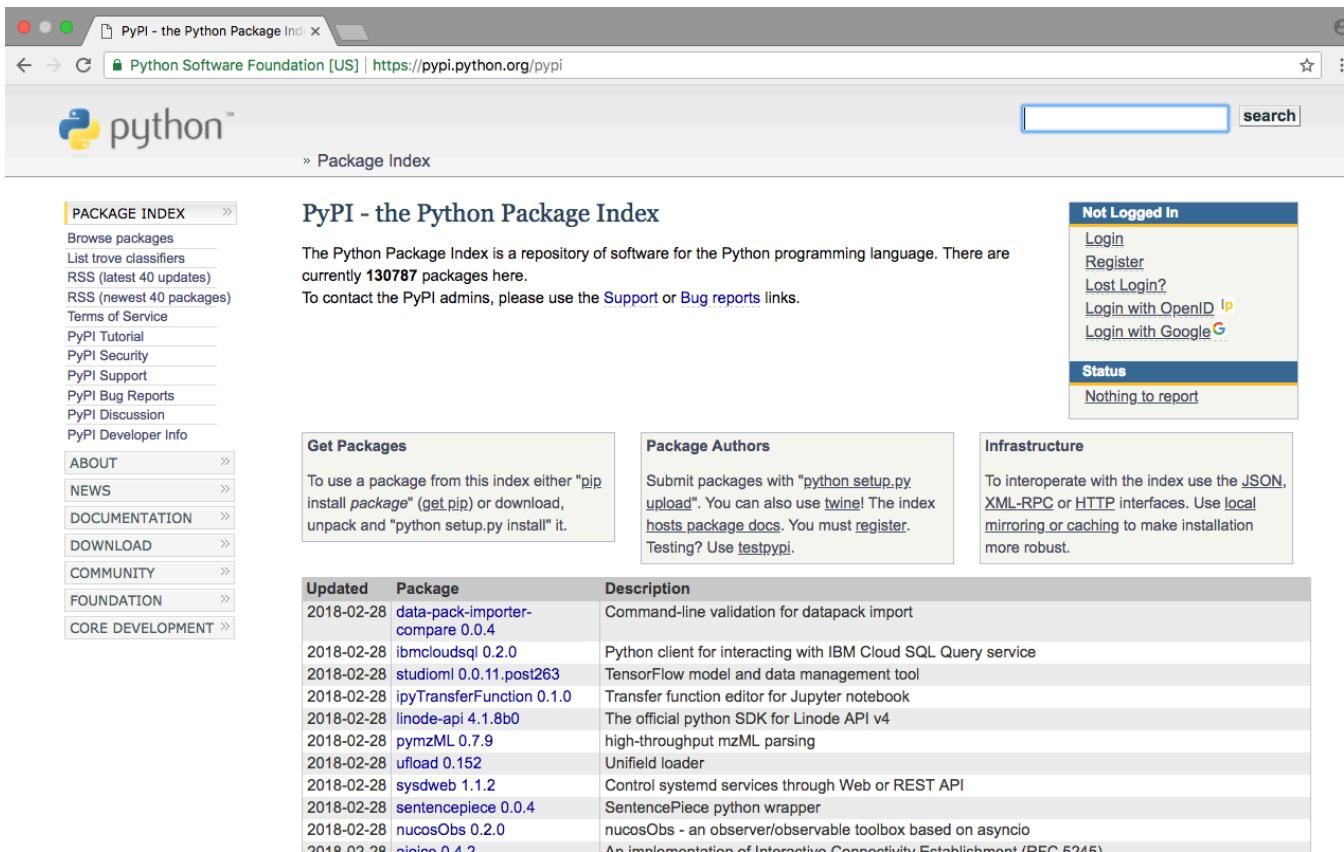
Que peut-on faire avec Python ?

- du calcul scientifique (librairie [NumPy](#))
- des graphiques (librairie [matplotlib](#))
- de l'intelligence artificiel **Machine Learning Deep Learning**
- du traitement du son, de la synthèse vocale (librairie eSpeak)
- du traitement d'image (librairie [PIL](#)), de la vision artificielle par caméra (framework [openCV](#))
- de la bio-informatique (librairie [Biopython](#))
- des applications avec interface graphique GUI (librairies [Tkinter](#), [PyQt](#), [wxPython](#), [PyGTK](#)...)
- des jeux vidéo en 2D (librairie [Pygame](#))
- des applications multi-touch (framework [kivy](#) pour tablette et smartphone à écran tactile)
- des applications Web (serveur Web [Zope](#) ; frameworks Web [Flask](#), [Django](#))
- interfaçer des systèmes de gestion de base de données (librairie [MySQLdb](#)...)
- des applications réseau (framework [Twisted](#))
- communiquer avec des ports série RS232 (librairie [PySerial](#)), en Bluetooth (librairie [pybluez](#)).

Why python?

PyPI - the Python Package Index

The Python Package Index is a repository of software for the Python programming language. There are currently **130742** packages here.
<https://pypi.python.org/pypi>



The screenshot shows the PyPI homepage. At the top, there's a navigation bar with links for "Python Software Foundation [US]" and the URL "https://pypi.python.org/pypi". Below the navigation is a search bar with the word "search". The main header says "PyPI - the Python Package Index". To the left is a sidebar with links for "PACKAGE INDEX", "Browse packages", "List trove classifiers", "RSS (latest 40 updates)", "RSS (newest 40 packages)", "Terms of Service", "PyPI Tutorial", "PyPI Security", "PyPI Support", "PyPI Bug Reports", "PyPI Discussion", and "PyPI Developer Info". Other sections include "ABOUT", "NEWS", "DOCUMENTATION", "DOWNLOAD", "COMMUNITY", "FOUNDATION", and "CORE DEVELOPMENT". The central content area has a "Get Packages" section with instructions for using pip or twine, and a "Package Authors" section with information on submitting packages. On the right, there are sections for "Not Logged In" (with links for Login, Register, Lost Login?, Login with OpenID, and Login with Google), "Status" (with a message "Nothing to report"), and "Infrastructure" (with instructions for interoperation). At the bottom, there's a table of recently updated packages.

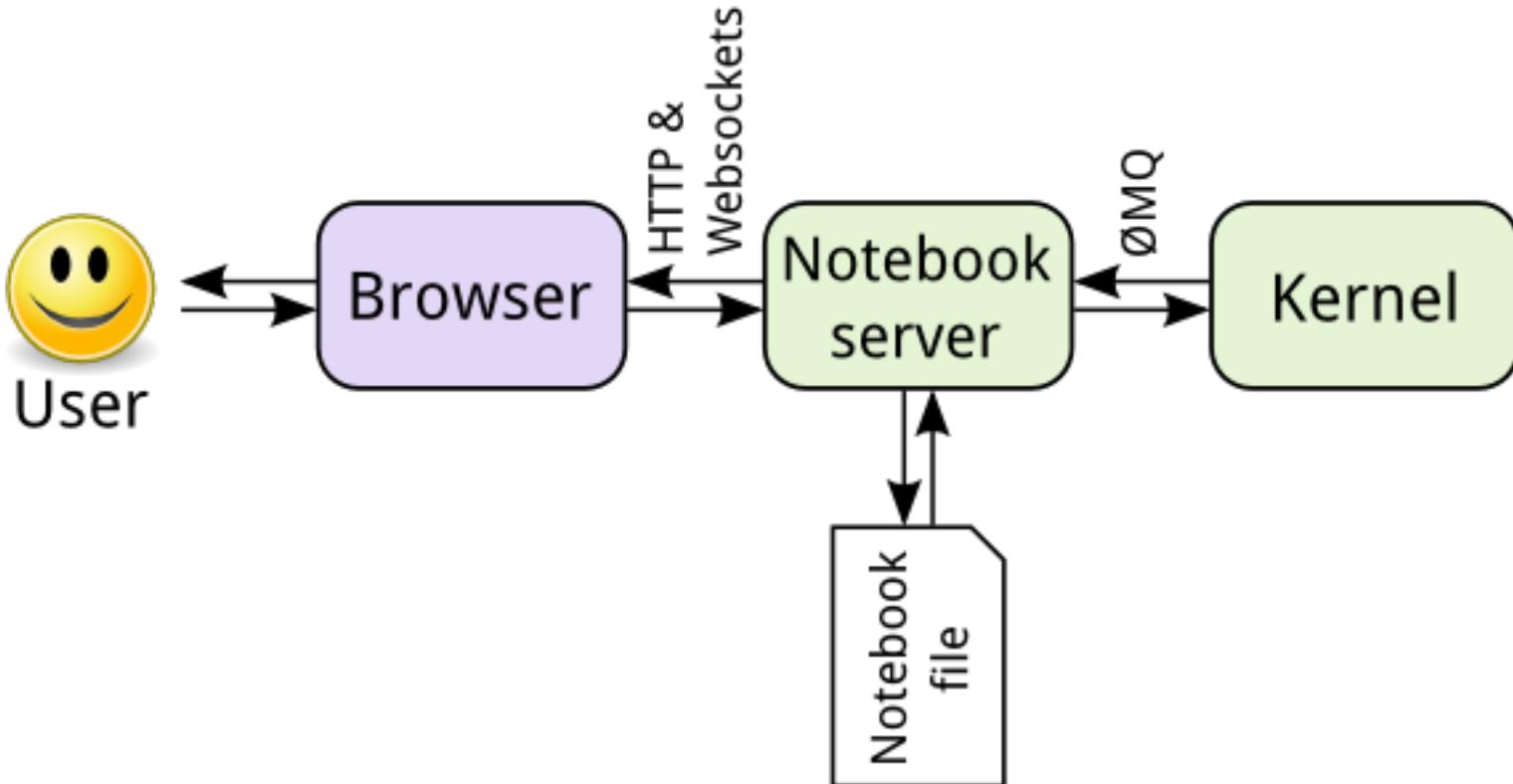
Updated	Package	Description
2018-02-28	data-pack-importer-compare 0.0.4	Command-line validation for datapack import
2018-02-28	ibmcloudsql 0.2.0	Python client for interacting with IBM Cloud SQL Query service
2018-02-28	studioml 0.11.post263	TensorFlow model and data management tool
2018-02-28	ipyTransferFunction 0.1.0	Transfer function editor for Jupyter notebook
2018-02-28	linode-api 4.1.8b0	The official python SDK for Linode API v4
2018-02-28	pymzML 0.7.9	high-throughput mzML parsing
2018-02-28	ufload 0.152	Unifield loader
2018-02-28	sysdweb 1.1.2	Control systemd services through Web or REST API
2018-02-28	sentencepiece 0.0.4	SentencePiece python wrapper
2018-02-28	nucosObs 0.2.0	nucosObs - an observer/observable toolbox based on asyncio
2018-02-28	ainice 0.1.2	An implementation of Interactive Connectivity Establishment (RFC 5245)



Travaux Pratiques Python



The Notebook frontend does something extra. In addition to running your code, it stores code and output, together with markdown notes, in an editable document called a notebook. When you save it, this is sent from your browser to the notebook server, which saves it on disk as a JSON file with a .ipynb extension.



Notebook (bloc-note) Jupyter

Ce Lab contient un notebook (bloc-note) Jupyter pour chaque TP.



Jupyter est une interface web permettant d'exécuter du code Python (ou autres langages) de façon graphique et interactive.

Les notebooks 1 à N correspondent aux TP 1 à N

AI, Machine Learning et le Deep Learning sont des concepts théoriques très avancés qui **s'apprennent surtout par la pratique !**

jupyter notebook →

Cette commande démarre le serveur web de Jupyter,
et ouvre votre navigateur Internet sur l'adresse <http://localhost:8888/tree>

Vous devez y voir le contenu du répertoire courant. Il ne vous reste plus qu'à cliquer sur le notebook 1_.ipynb



Notebook (bloc-note) Jupyter

le principe de jupyter est simple : chaque notebook est constitué d'une liste de cellules. Chacune peut contenir du texte formaté ou du code (Python, dans notre cas). Lorsqu'on exécute une cellule de code, le résultat s'affiche sous la cellule. Cliquez sur le menu Help > User Interface Tour pour un tour rapide de l'interface. Pour vous entraîner, insérez quelques cellules de code au début du notebook, et exécutez quelques commandes Python, telles que `print("Hello world!")` (voir la figure 1.1).

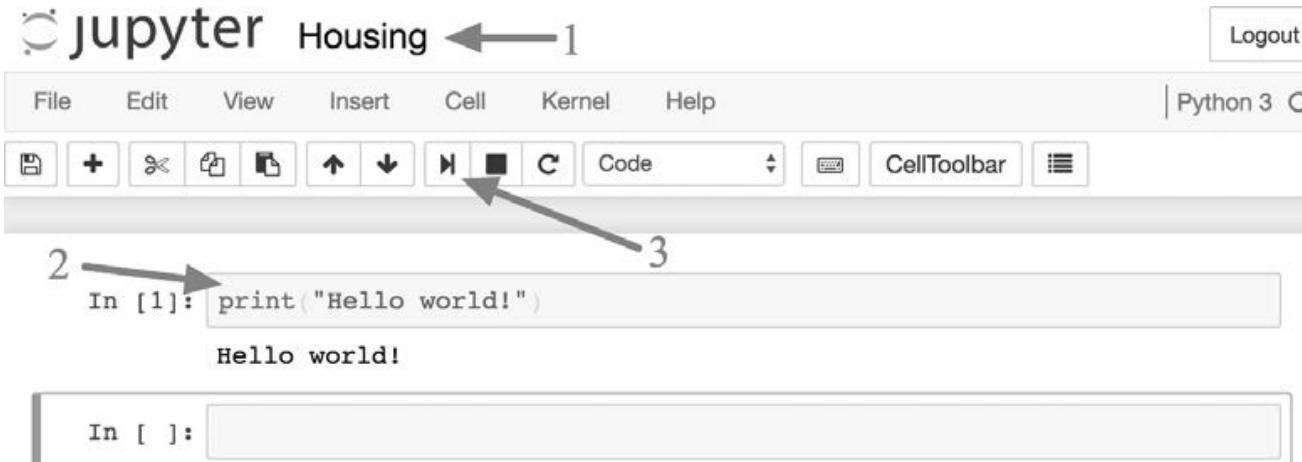


Figure 1.1 – Afficher «Hello world!» dans un notebook Jupyter

Notebook (bloc-note) Jupyter

Vous pouvez renommer le notebook en cliquant sur son nom (voir la figure 1 sur la gure). Cliquez dans une cellule de code et saisissez le code à exécuter (figure 2), puis exécutez le code de la cellule en tapant Shift- Entrée ou en cliquant sur le bouton d'exécution (figure 3). Lorsque vous cliquez à l'intérieur d'une cellule, vous passez en mode édition (la cellule est alors encadrée en vert). Lorsque vous tapez la touche Echap (Esc) ou que vous cliquez juste à gauche de la cellule, vous passez en mode commande (la cellule est alors encadrée en bleu). Lorsque vous êtes en mode commande, tapez la touche H pour afficher les nombreux raccourcis clavier disponibles.

Vous pouvez exécuter toutes les cellules du notebook en cliquant sur le menu Cell > Run All.

Vous remarquerez que tous les notebooks du projet commencent par une cellule qui contient (entre autres) le code suivant :

```
from __future__ import division, print_function, unicode_literals
```

Cette ligne permet aux exemples de code de fonctionner indifféremment sous Python 2 ou Python 3.

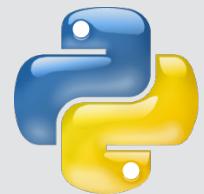


Par ailleurs, certains commentaires dans les exemples de code contiennent des caractères spéciaux (p. ex. des accents). Cela ne devrait pas poser de problèmes dans Jupyter, car il utilise par défaut l'encodage UTF-8, qui supporte ces caractères, mais si vous recopiez ces exemples de code dans des modules Python 2, vous aurez une erreur car Python 2 utilise par défaut l'encodage ASCII, qui ne supporte que les caractères anglo-saxons. Vous devrez soit retirer ces caractères spéciaux, soit rajouter la ligne suivante au tout début du chier pour forcer Python 2 à utiliser l'encodage UTF-8 :

```
# -*- coding: utf-8 -*-
```



Travaux Pratiques Python



jupyter batchdemo Last Checkpoint: a minute ago (autosaved)

File Edit View Insert Cell Kernel Help

| Python 2 |

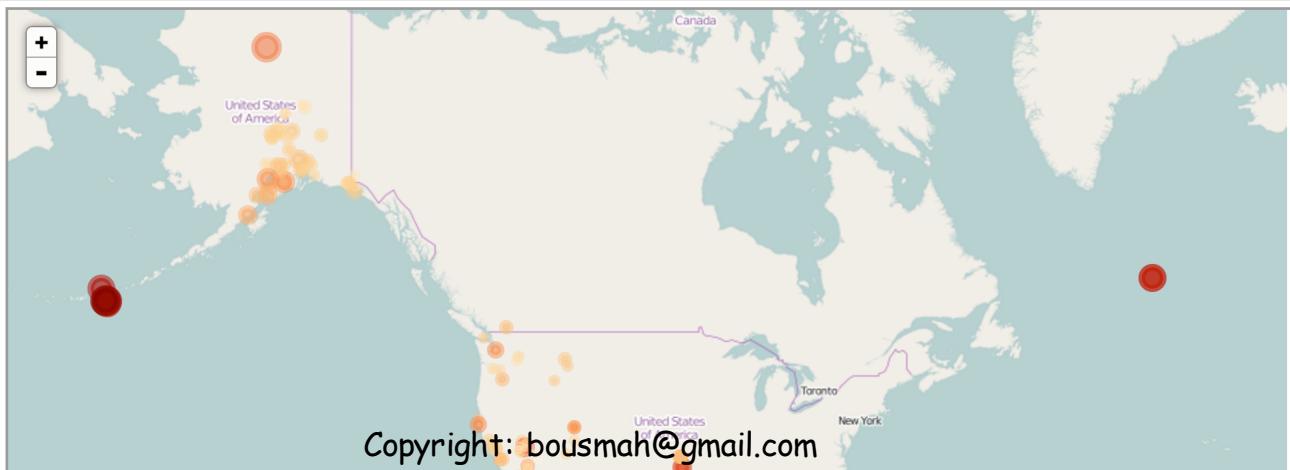
Cell Toolbar: None

```
In [2]: import pandas as pd
import folium
from matplotlib.colors import Normalize, rgb2hex
import matplotlib.cm as cm

In [4]: data = pd.read_csv('http://earthquake.usgs.gov/earthquakes/feed/v1.0/summary/all_day.csv')
norm = Normalize(data['mag'].min(), data['mag'].max())

map = folium.Map(location=[48, -102], zoom_start=3)
for eq in data.iterrows():
    color = rgb2hex(cm.OrRd(norm(float(eq[1]['mag']))))
    map.circle_marker([eq[1]['latitude'], eq[1]['longitude']],
                      popup=eq[1]['place'],
                      radius=20000*float(eq[1]['mag']),
                      line_color=color,
                      fill_color=color)
map.create_map(path='results/earthquake.html')

In [9]: %%HTML
<iframe width="100%" height="350" src="results/earthquake.html"></iframe>
```





Travaux Pratiques Python



mayavi_jupyter

localhost:8891/notebooks/mayavi_jupyter.ipynb

jupyter mayavi_jupyter Last Checkpoint: 2 minutes ago (autosaved)

File Edit View Insert Cell Kernel Help

Python 2

In [1]: `from mayavi import mlab
mlab.init_notebook()`

Notebook initialized with x3d backend.

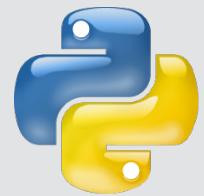
In [2]: `s = mlab.test_plot3d()
s`

Out[2]:

Tn [1]:



Travaux Pratiques Python



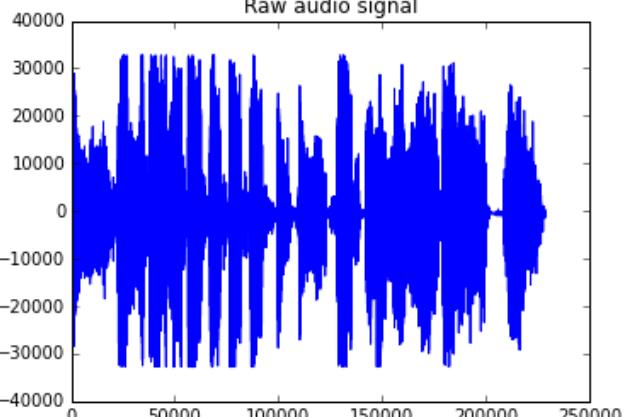
jupyter spectrogram Last Checkpoint: an hour ago (autosaved)

File Edit View Insert Cell Kernel Help

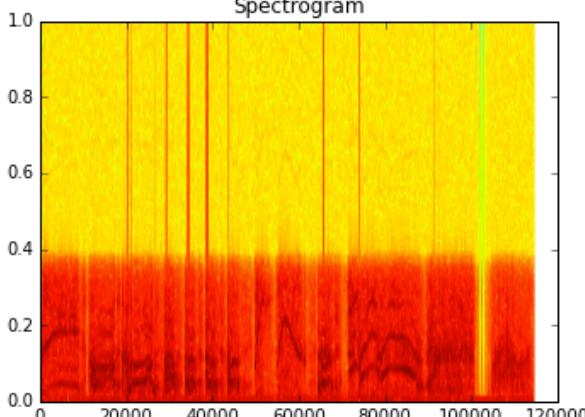
Cell Toolbar: None

```
In [1]: from scipy.io import wavfile  
rate, x = wavfile.read('test_mono.wav')  
  
In [2]: import matplotlib.pyplot as plt  
fig, (ax1, ax2) = plt.subplots(1, 2, figsize=(12, 4))  
ax1.plot(x); ax1.set_title('Raw audio signal')  
ax2.specgram(x); ax2.set_title('Spectrogram')  
plt.show()
```

Raw audio signal

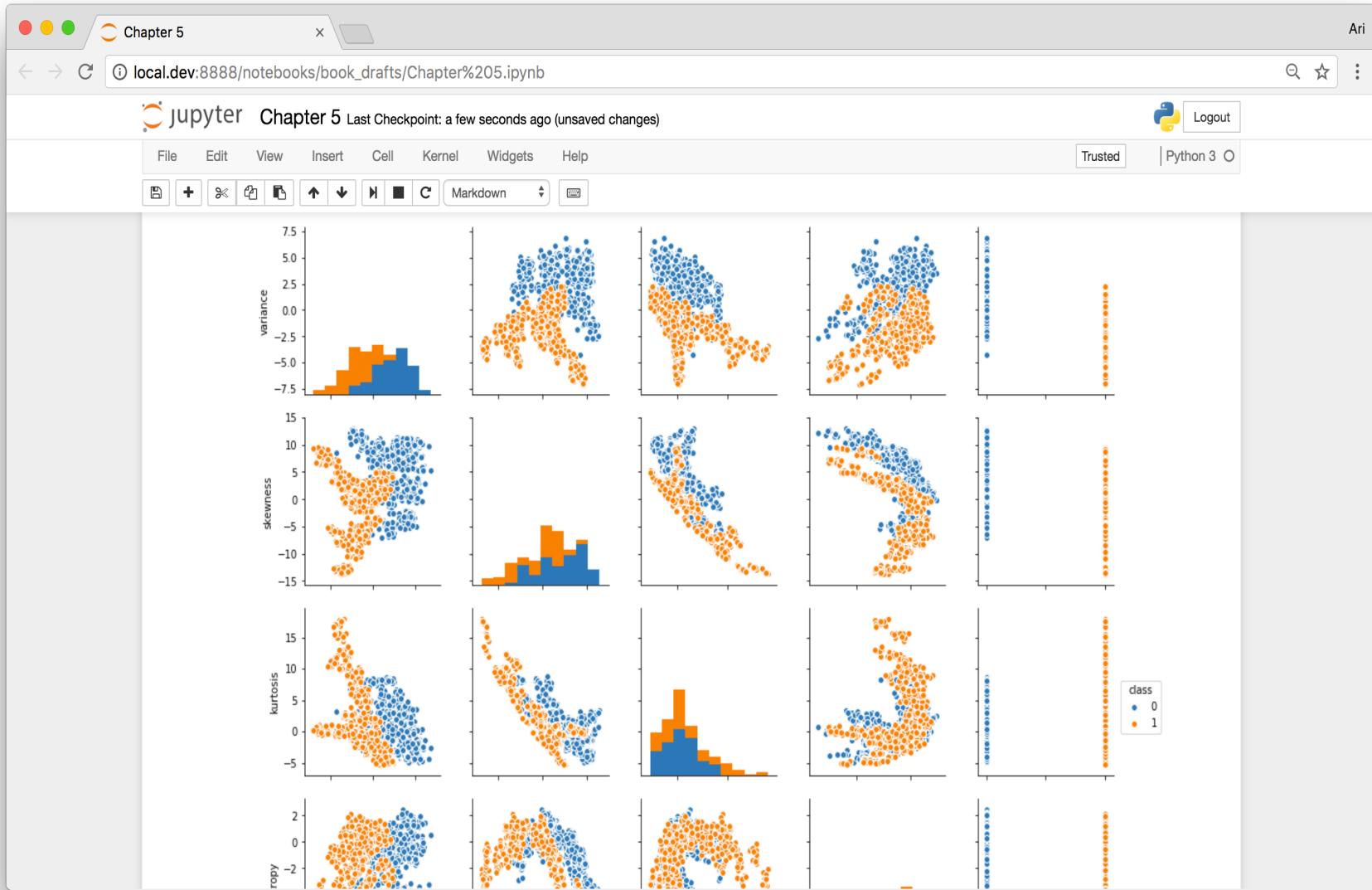
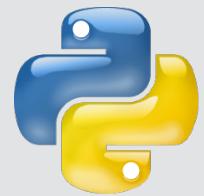


Spectrogram



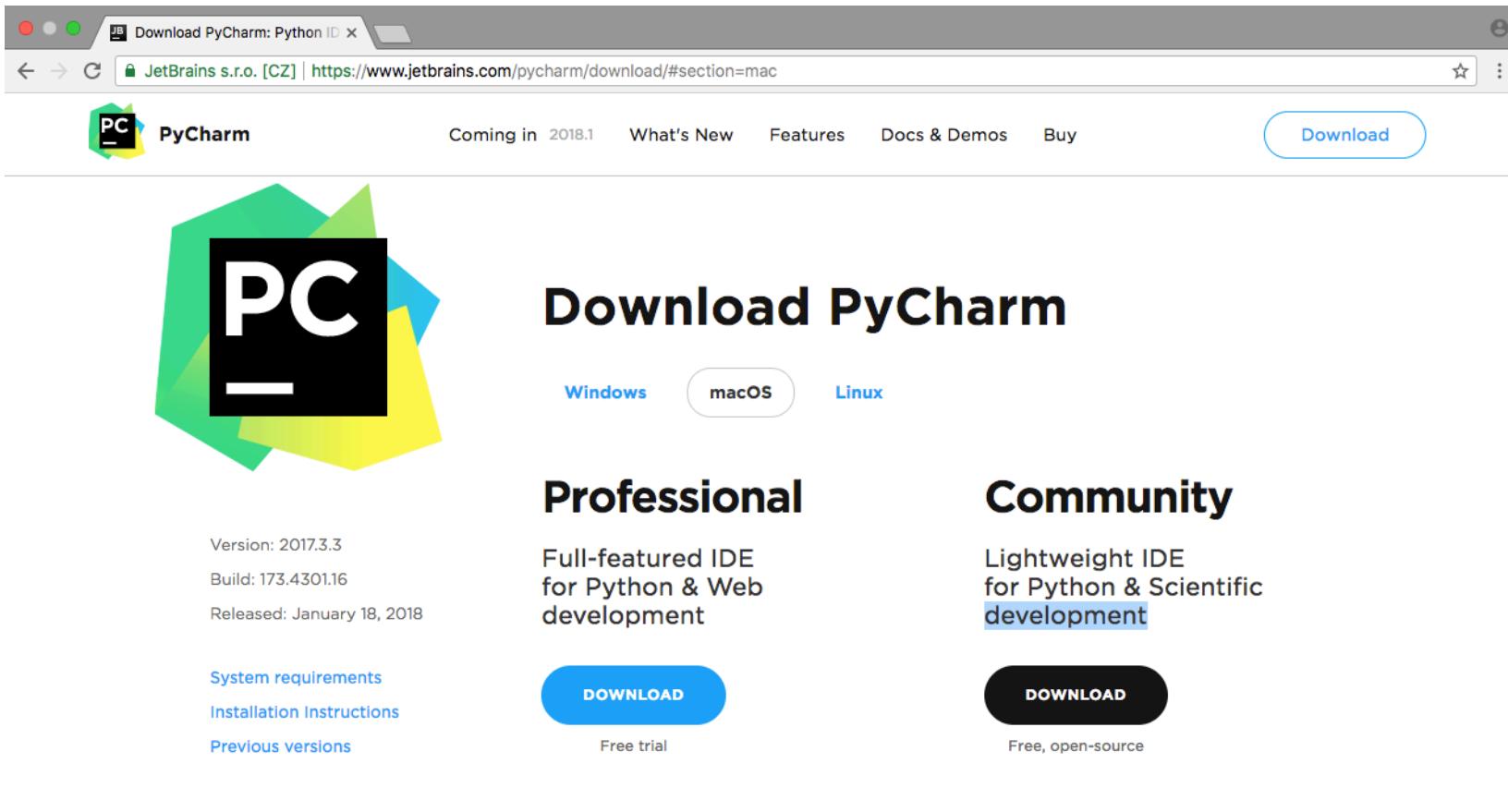
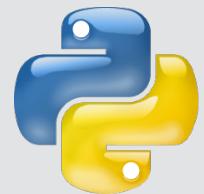


Travaux Pratiques Python





Travaux Pratiques Python



The screenshot shows the official PyCharm download page on the JetBrains website. At the top, there's a navigation bar with links for 'Coming in 2018.1', 'What's New', 'Features', 'Docs & Demos', and 'Buy'. A prominent 'Download' button is located on the right. Below the navigation, there's a large image of the PyCharm logo, which consists of a black rectangle with 'PC' in white, surrounded by overlapping green and yellow hexagons. To the right of the logo, the text 'Download PyCharm' is displayed in a large, bold font. Below this, there are three tabs: 'Windows' (blue), 'macOS' (white, indicating the current selection), and 'Linux' (blue). The page is divided into two main sections: 'Professional' on the left and 'Community' on the right. The 'Professional' section contains the text 'Full-featured IDE for Python & Web development' and a 'DOWNLOAD' button. Below the button, it says 'Free trial'. The 'Community' section contains the text 'Lightweight IDE for Python & Scientific development' and a 'DOWNLOAD' button. Below the button, it says 'Free, open-source'. At the bottom of the page, there's a callout box with the text 'Get the ToolBox App to download PyCharm and its future updates with ease' and an icon of a smartphone.

JB Download PyCharm: Python ID X

JetBrains s.r.o. [CZ] | https://www.jetbrains.com/pycharm/download/#section=mac

PyCharm

Coming in 2018.1 What's New Features Docs & Demos Buy

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Full-featured IDE for Python & Web development

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Lightweight IDE for Python & Scientific development

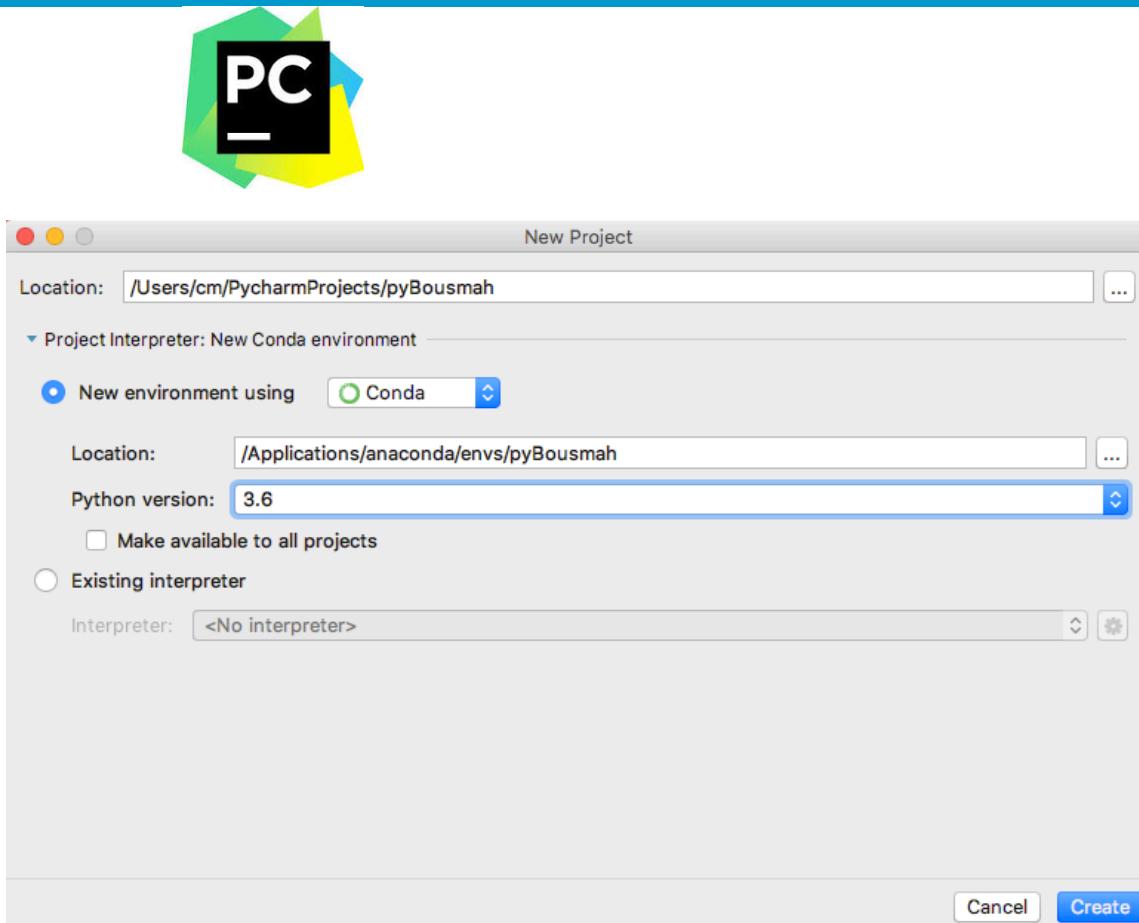
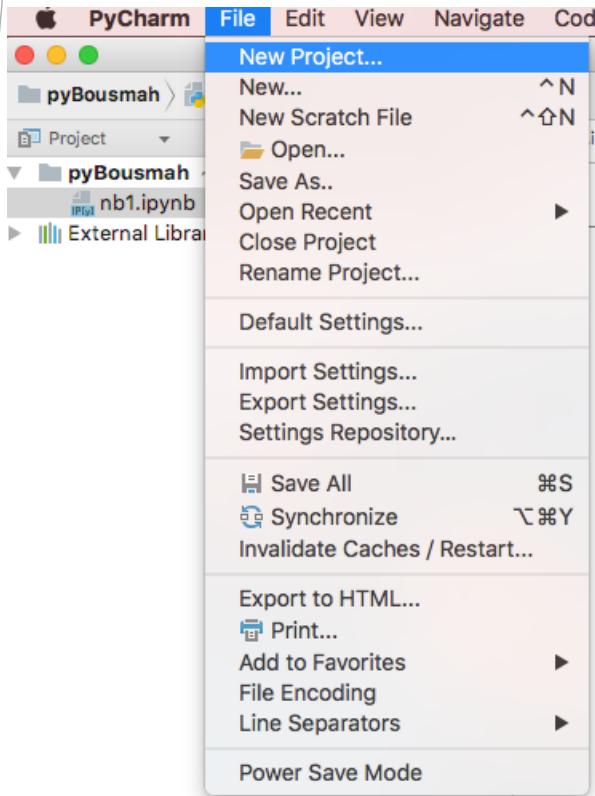
DOWNLOAD

Free, open-source

Get the [ToolBox App](#) to download PyCharm and its future updates with ease



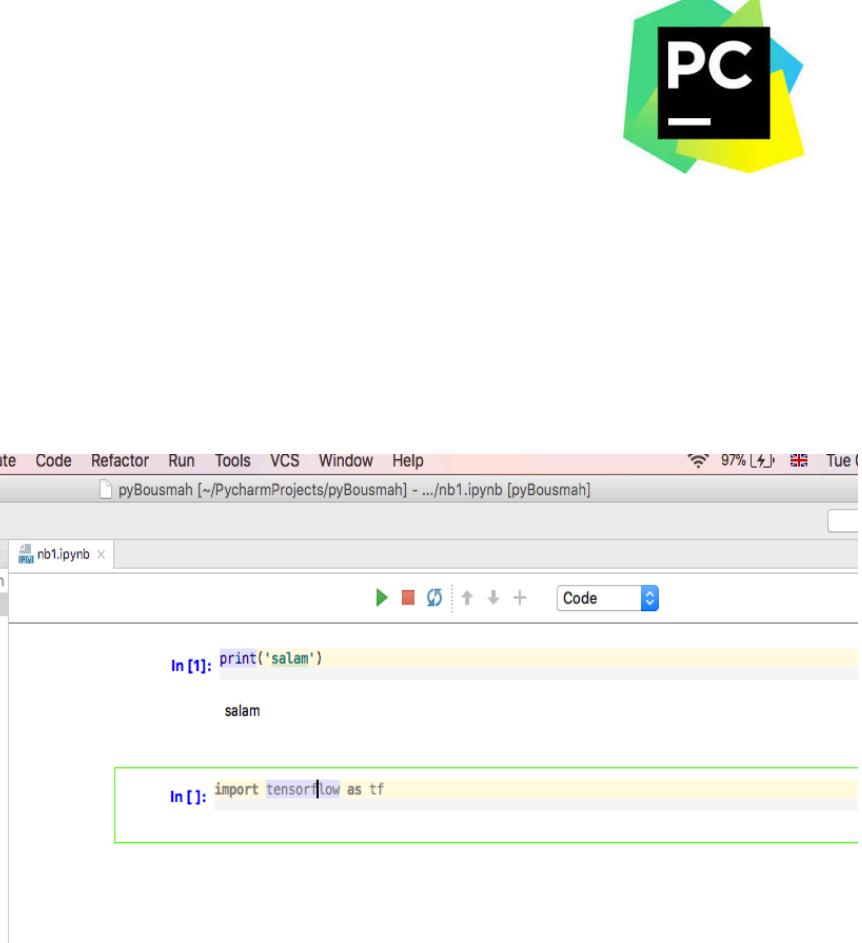
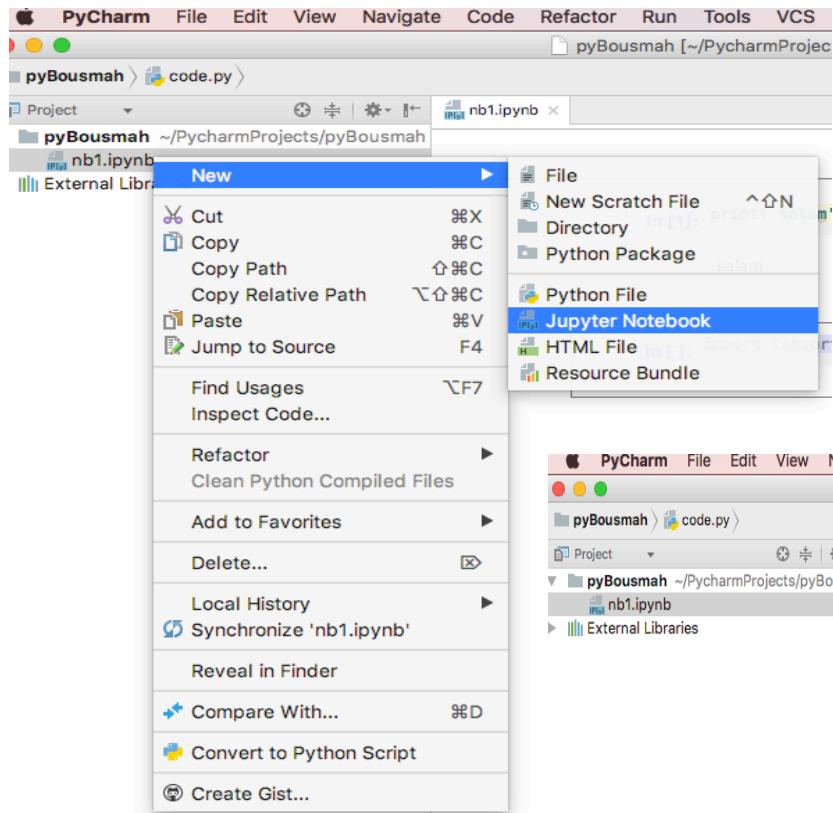
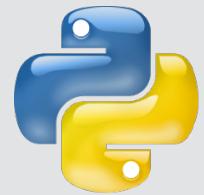
Travaux Pratiques Python



The screenshot shows the PyCharm interface. On the left, the 'File' menu is open, with 'New Project...' highlighted. The main window displays a 'New Project' dialog box. The 'Location:' field is set to '/Users/cm/PycharmProjects/pyBousmah'. Under 'Project Interpreter: New Conda environment', the 'New environment using' radio button is selected, and 'Conda' is chosen from the dropdown. The 'Location:' field for the interpreter is set to '/Applications/anaconda/envs/pyBousmah'. The 'Python version:' dropdown is set to '3.6'. There is also a checkbox for 'Make available to all projects' which is unchecked. Below this, there is an 'Existing interpreter' section with a dropdown labeled '<No interpreter>'. At the bottom right of the dialog are 'Cancel' and 'Create' buttons.

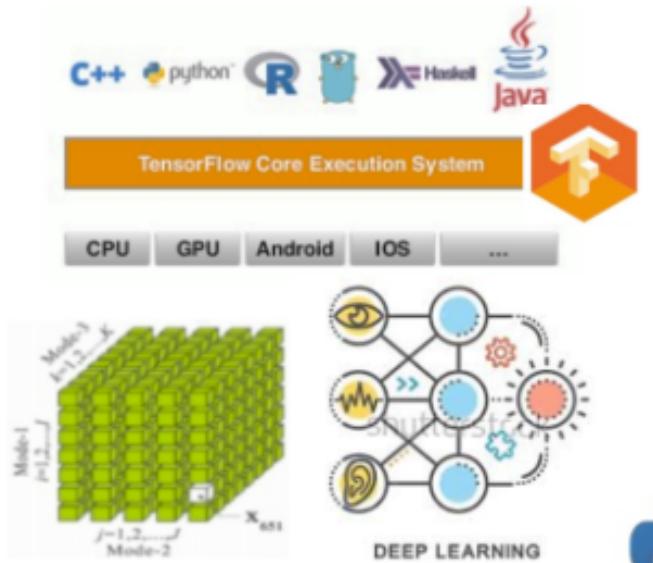
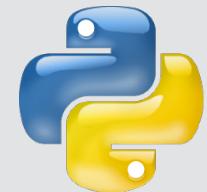


Travaux Pratiques Python





Travaux Pratiques Python



jupyter
notebook



ANACONDA®





Travaux Pratiques Python

Niveau: 1



A screenshot of a web browser window. The title bar says "Cours de programmation en ligne". The address bar shows the URL "fsincere.free.fr/isn/python/cours_python.php". Below the address bar, there's a message: "This page is in French Would you like to translate it? Nope Translate Never translate French Options".

Introduction au langage de programmation Python 3

Ce cours a été testé sous Windows et GNU/Linux.

[Python 2](#) . [Python 3](#)

[Préambule sur le langage Python](#)

[Chapitre 1 - Variables, types et opérateurs](#)

[Chapitre 2 - Les conditions \(instructions if, elif, else\)](#)

[Chapitre 3 - Les boucles \(instructions for, while\)](#)

[Chapitre 4 - Les fonctions](#)

[Chapitre 5 - Gestion des exceptions](#)

[Chapitre 6 - Classes et modules](#)

[Chapitre 7 - Création](#)

Préambule

En 1989, le hollandais **Guido van Rossum** commence le développement du langage de programmation Python.

Python est un langage **multiplateforme**, c'est-à-dire disponible sur plusieurs architectures (compatible PC, tablettes, smartphones, ordinateur low cost Raspberry Pi...) et systèmes d'exploitation (Windows, Linux, Mac, Android...).

Le langage Python est gratuit, sous **licence libre**.

C'est un des langages informatiques les plus populaires avec C, C++, C#, Objective-C, Java, PHP, JavaScript, Delphi, Visual Basic, Ruby et Perl ([liste non exhaustive](#)).

Actuellement, Python en est à sa version 3.

Cependant, la version 2 est encore majoritairement utilisée.

Attention : Python 2 n'est pas compatible avec Python 3 !

Que peut-on faire avec Python ?

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Travaux Pratiques Python

Niveau: 1



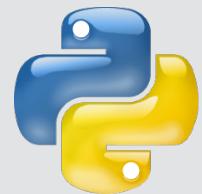
Ecrire un programme python permettant de demander à l'utilisateur de deviner un nombre aléatoire entre 1 et 100 et d'afficher le nombre de tentatives

```
Entrez un nombre 50
Trop petit
Entrez un nombre 75
Trop petit
Entrez un nombre 90
Trop petit
Entrez un nombre 95
Trop grand
Entrez un nombre 93
Bravo vous l'avez trouvé apres : 5 essais
```



Travaux Pratiques Python

Niveau: 1

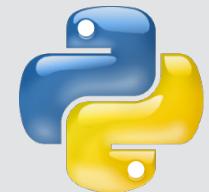


```
import random
nb = random.randint(1, 100)
ch = -1
n=0
while nb != ch :
    ch = int(input("Entrez un nombre "))
    if ch < nb : print("Trop petit")
    if ch > nb : print("Trop grand")
    n=n+1
print("Bravo vous l'avez trouvé après : ",n,"essais")
```



Travaux Pratiques Python

Niveau: 1



Ecrire un programme python permettant de simuler un jeu de DE

```
Touche q pour quitter  
Touche Enter pour continuer
```

```
Tirage : 2
```

```
Tirage : 4
```

```
Tirage : 3
```

```
Tirage : 3
```

```
Tirage : 3
```

```
Tirage : 4
```

```
q
```

Améliorer ce programme





Travaux Pratiques Python

Niveau: 1



```
: # définition des fonctions
def info():
    """ Informations """
    print("Touche q pour quitter")
    print("Touche Enter pour continuer")

def tirage_de():
    """ Retourne un nombre entier aléatoire entre 1 et 6 """
    import random
    valeur = random.randint(1, 6)
    return valeur

# début du programme
info()
while True:
    choix = input()
    if choix == 'q':
        break
    print("Tirage :", tirage_de())
```



Travaux Pratiques Python

Niveau: 1



```
import matplotlib.pyplot as plt
import matplotlib.image as mpimg

# définition des fonctions
def info():
    """ Informations """
    print("Touche q pour quitter")
    print("Touche Enter pour continuer")

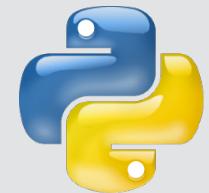
def tirage_de():
    """ Retourne un nombre entier aléatoire entre 1 et 6 """
    import random
    valeur = random.randint(1, 6)
    return valeur

# début du programme
info()
while True:
    choix = input()
    if choix == 'q':
        break
    dados= 'd'+str(tirage_de())+'.png'
    print(dados)
    img=mpimg.imread(dados)
    imgplot=plt.imshow(img)
    plt.show()
```



Travaux Pratiques Python

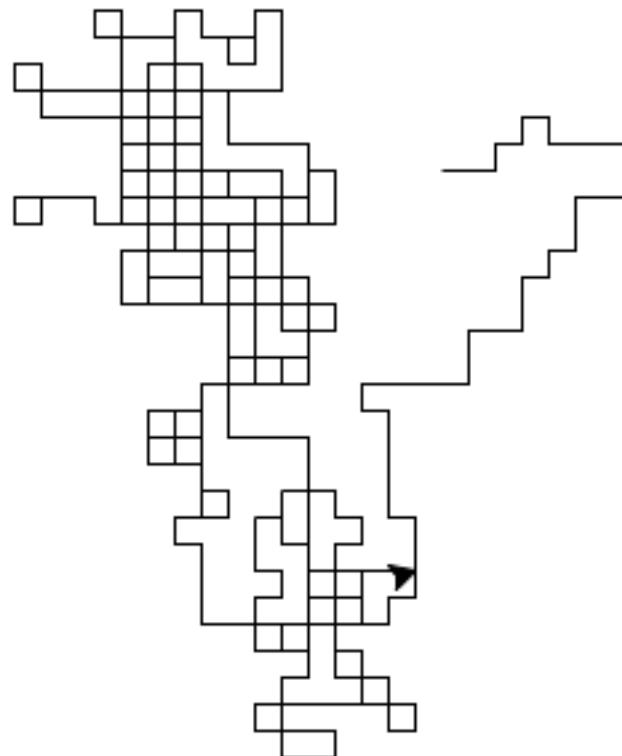
Niveau: 1



Analyser le programme suivant et dire ce qu'il affiche comme résultats

```
import random
from turtle import *

while True :
    fd(10)
    nb = random.randint(0, 2)
    if nb==0:
        lt(90)
    if nb==1:
        rt(90)
```





Travaux Pratiques Python

Niveau: 1



Analyser le programme suivant et dire ce qu'il affiche comme résultats

```
import pickle

# création d'un dictionnaire
departement = {1:'Rabat',6:'Casablanca-Anfa', 55:'El jadida'}

# enregistrement du dictionnaire dans un fichier
Fichier = open('data.bin','wb')
pickle.dump(departement,Fichier)      # sérialisation
Fichier.close()
```

```
import pickle

# récupération du dictionnaire
Fichier = open('data.bin','rb')
Dept = pickle.load(Fichier)      # désérialisation
Fichier.close()

print(Dept)
print(Dept[1])
```

```
{1: 'Rabat', 6: 'Casablanca-Anfa', 55: 'El jadida'}
Rabat
```

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Travaux Pratiques Python

Niveau: 1



Streamlit Demo: Uber Pickups in New York City

A Streamlit demo [written in pure Python](#) to interactively visualize Uber pickups in New York City.





Atelier n° 1



TensorFlow

Classification of clothing images



TensorFlow

But:

Etre capable de concevoir et réaliser une AI permettant la classification des images de vêtements.

T.A.F:

- Démarrer le programme
<https://www.tensorflow.org/tutorials/keras/classification>
- Expliquer ce programme
- Améliorer ce programme



Atelier n° 1



Comment va-t-on faire ?



Machine Learning Paradigm ou Paradigme Apprentissage Automatique:

Programmer les ordinateurs de sorte qu'ils puissent apprendre à partir de données.



Atelier n° 1



Steps

1. Download Dataset
2. Create a Model
3. Train the Model
4. Test the Model



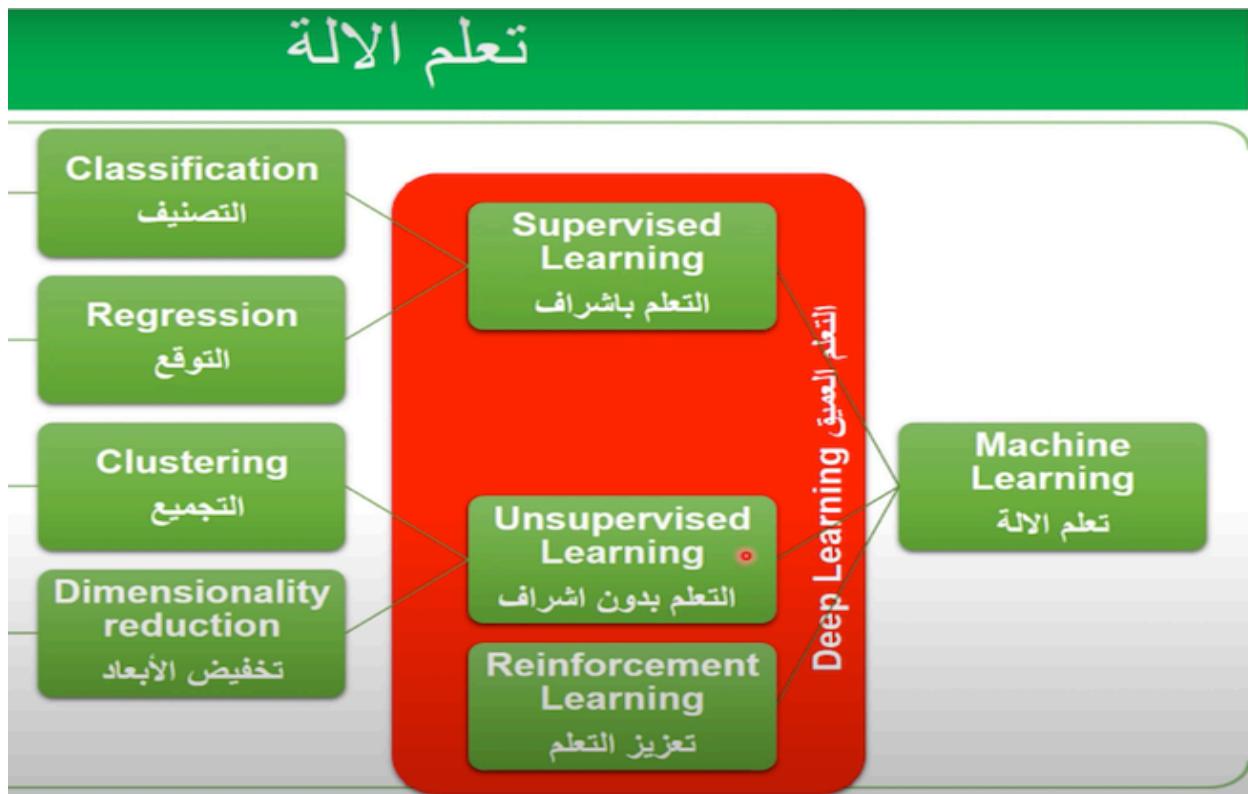
Atelier n° 1



TensorFlow



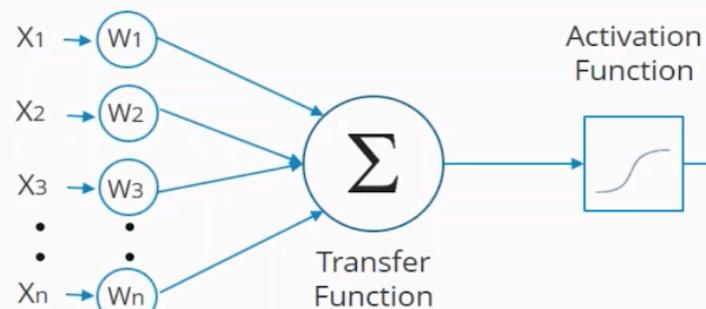
TensorFlow



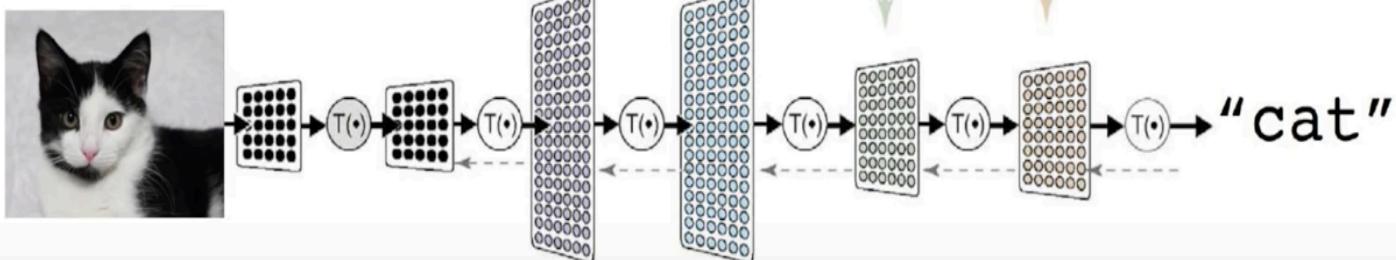
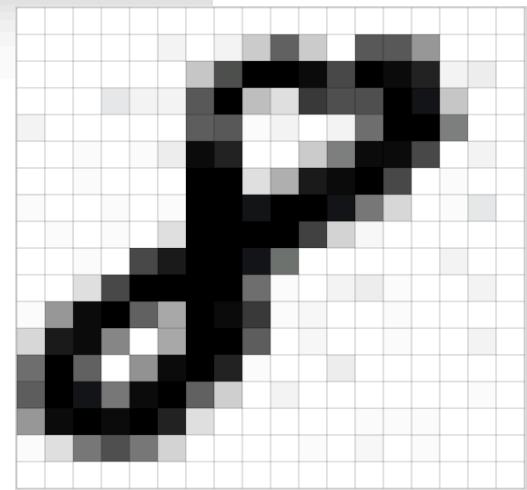
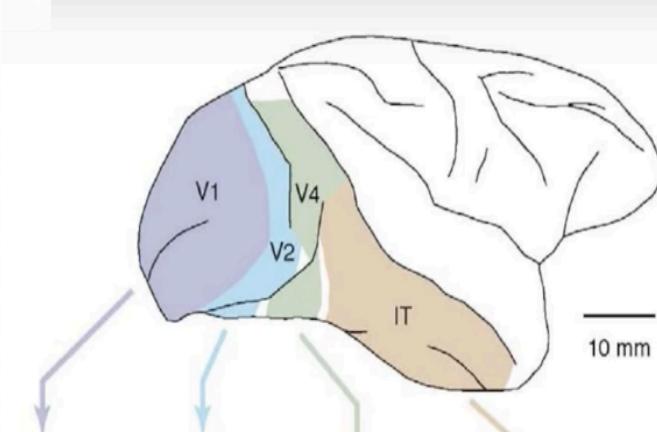
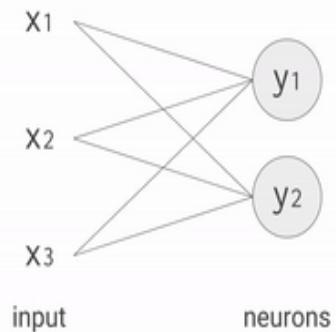


Atelier n° 1

Deep Learning



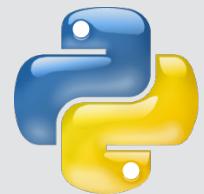
Schematic for a neuron in a neural net



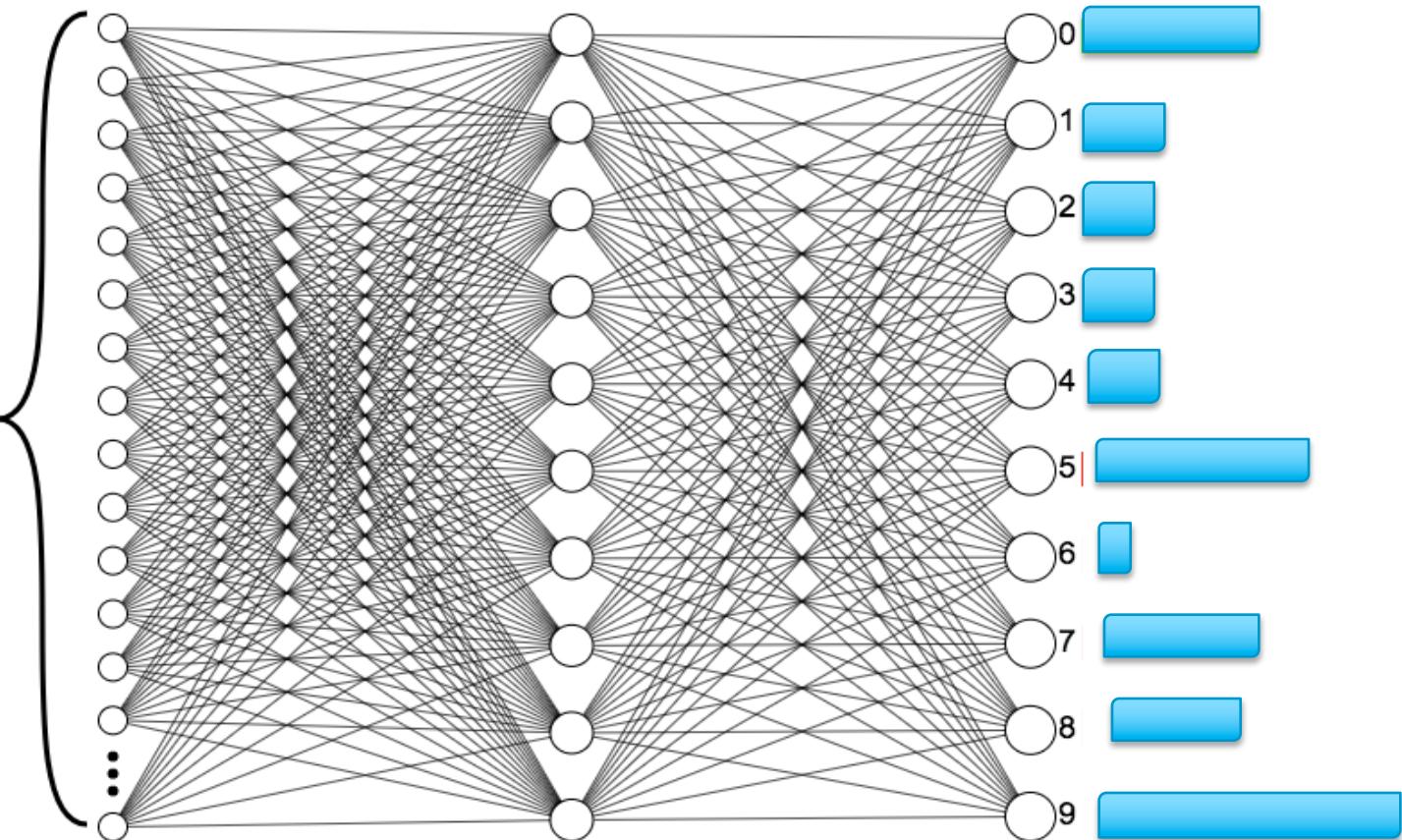


Atelier n° 1

Deep Learning



```
class_names = ['T-shirt/top', 'Pantalon', 'Pullover', 'Robe', 'Manteau',  
    'Sandale', 'Chemise', 'Sneaker', 'Sac', 'Bottine']
```





Atelier n° 2

Machine Learning to Predict Stock Prices



Can the AI trader
beat the Human
trader ?



But:

Etre capable de concevoir et réaliser une AI permettant la **prédiction du cours de l'action**.
(Le prix auquel s'échangent les **actions** sur les bourses)

T.A.F:

- Démarrer le programme:
- <https://towardsdatascience.com/predicting-stock-prices-using-a-keras-lstm-model-4225457f0233>
- Expliquer ce programme
- Améliorer ce programme



Atelier n° 2

Machine Learning to Predict Stock Prices



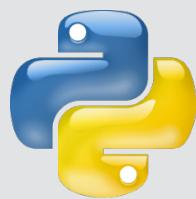
Une action est un titre de propriété d'une fraction du capital d'une société cotée en Bourse. Elle donne droit à son détenteur, l'actionnaire, de participer à l'assemblée générale en exerçant son droit de vote et de percevoir éventuellement une part des bénéfices de l'entreprise concernée sous forme de dividendes. Le cours de l'action varie à la hausse ou à la baisse au sein de chaque séance de cotation dans l'année.

Une action est une part du capital d'une entreprise cotée en Bourse.



Atelier n° 2

Machine Learning to Predict Stock Prices



Comment va-t-on faire ?





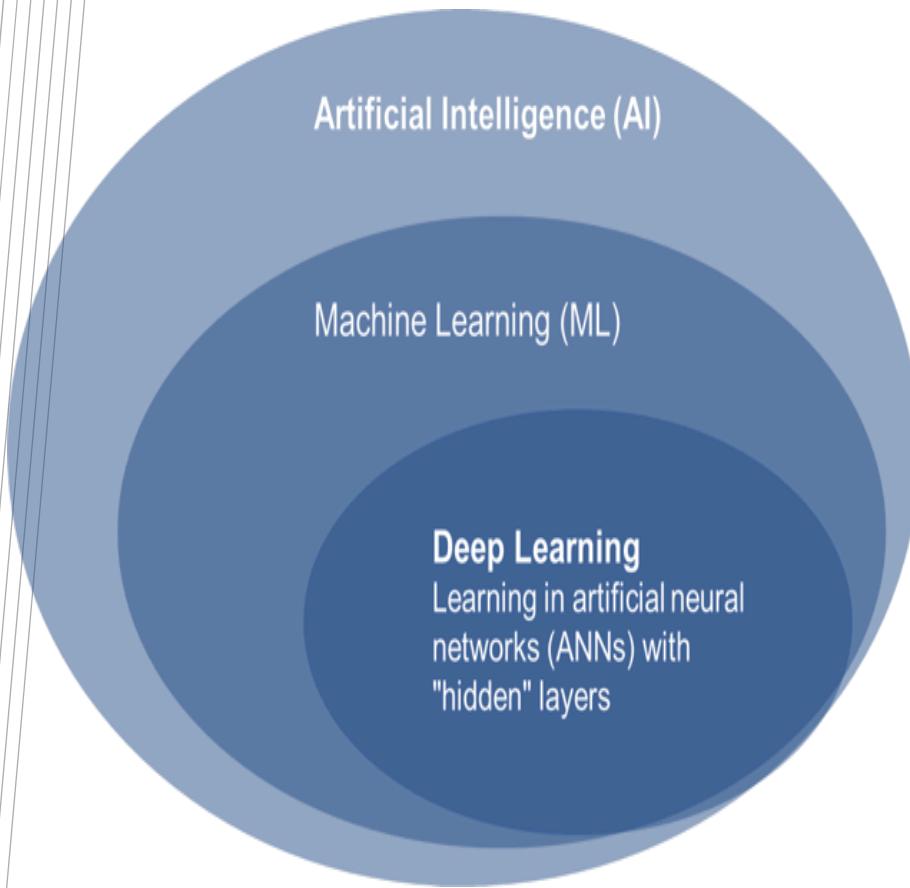
Atelier n° 2



Steps

1. Download Dataset
2. Create a Model
3. Train the Model
4. Test the Model

Quel Modèle ?



Atelier n° 2

Machine Learning to Predict Stock Prices



Keras LSTM model to forecast
stock trends

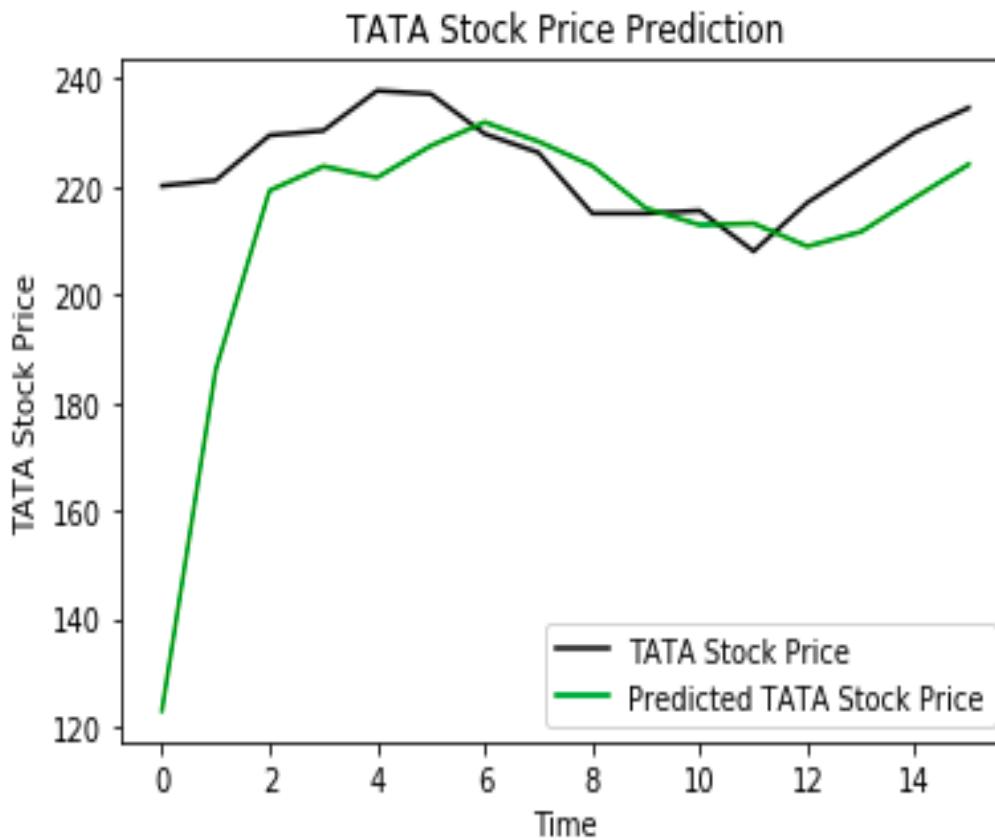
solution



Candlestick Model

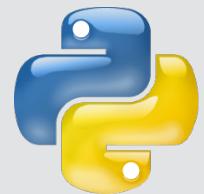
Atelier n° 2

Machine Learning to Predict Stock Prices





Merci de votre attention



Questions ???

