Haute école d'ingénierie et d'architecture Fribourg
Hochschule für Technik und Architektur Freiburg

acf-fgv
association des communes fribourgeoises
freiburger gemeindeverband

iCoSys
Institute of Artificial Intelligence
and Complex Systems

1. Introduction à l'IA

Comment en est-on arrivé là ?

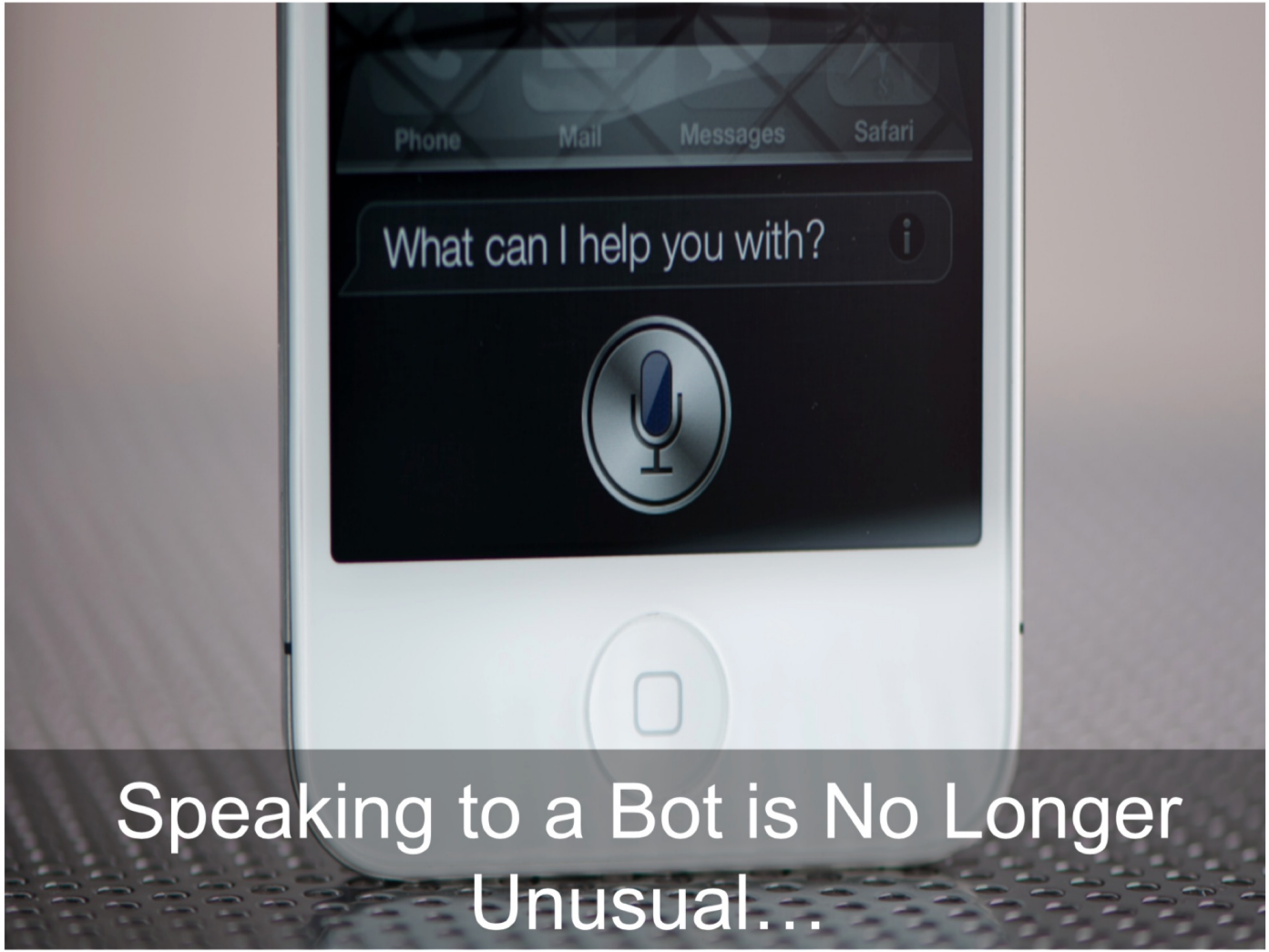
Jean Hennebert

March 2016: World Go Champion Beaten by Machine

A new revolution seems to be in the work after the industrial revolution.

Devices are becoming intelligent.

And Deep Learning is at the epicenter of this revolution.



Speaking to a Bot is No Longer Unusual…

DALL·E 2 can create original, realistic images and art from a text description. It can combine concepts, attributes, and styles.

TEXT DESCRIPTION

An astronaut Teddy bears A bowl of soup

riding a horse lounging in a tropical resort in space playing basketball with cats in space

in a photorealistic style in the style of Andy Warhol as a pencil drawing

DALL·E 2

https://openai.com/dall-e-2/

OpenAI

explain why studying deep learning is important in a rap song

Verse 1:
Listen up, let me tell you 'bout a powerful thing
It's called deep learning and it's changing everything
From speech recognition to image classification
It's revolutionizing technology and data computation

Chorus:
Studying deep learning is important, don't you know
It's the key to unlocking the potential of AI, yo
If you wanna be at the forefront of innovation
You gotta get your learnin' on, embrace the education

Verse 2:
Now I know it might sound complex and intimidating
But trust me, with some effort, you'll be exhilarating
With neural networks and backpropagation
You can build algorithms for any application

https://chat.openai.com/chat

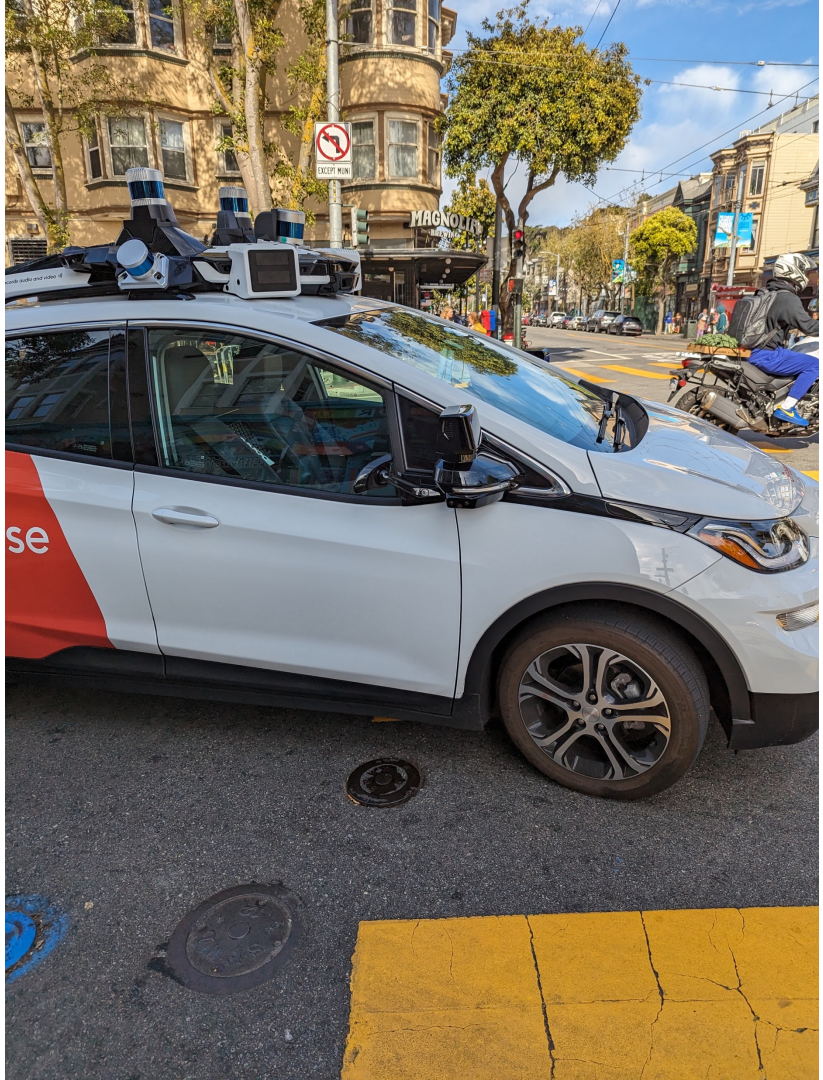
Les voitures conduisent toutes seules

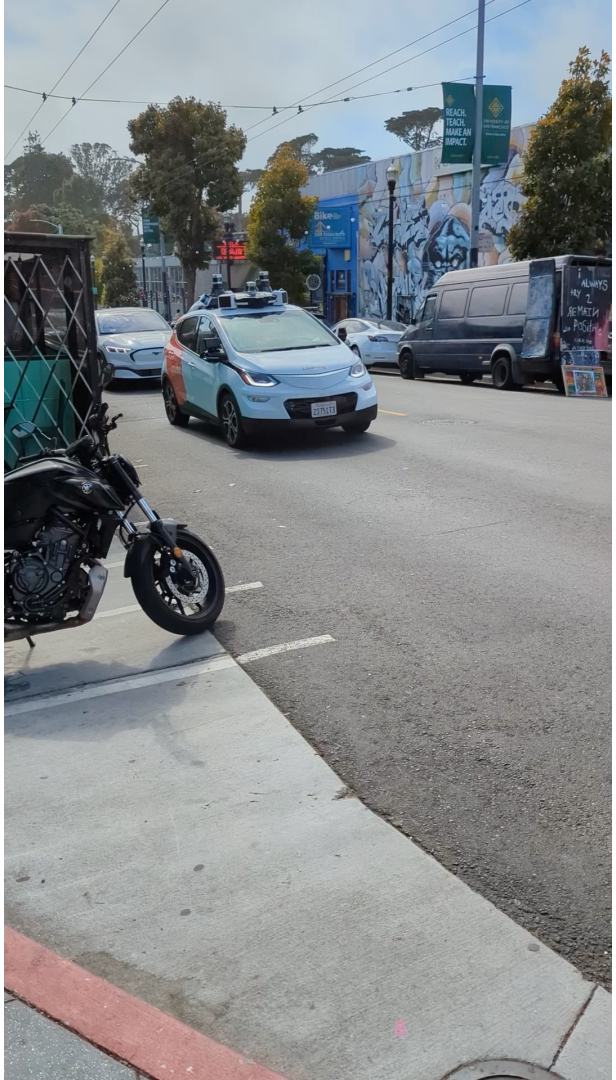
1 minute read · April 26, 2023 9:38 AM GMT+2 · Last Updated 11 days ago

Pony.ai gets permit for driverless robotaxi services in China's Guangzhou

Reuters

A logo of the autonomous driving technology startup Pony.ai is seen on a screen during an event in Beijing, China May 13, 2021. REUTERS/Tingshu Wang





Hes·so

A lean **green way** to deliver the goods

→ View product details and specifications

Reliably cost-effective ×

Cut package-delivery costs by an average of two-thirds and boost the profit margins of your online delivery business. Your customers, too, enjoy lower shipping expenses. **LOXO** also solves the growing problem of a lack of delivery staff. It is easy to load and always ready for deliveries, with a best-in-class package capacity.

Autonomy made safe and compliant +

Emission-free and sustainable +

Convenient on-demand delivery +

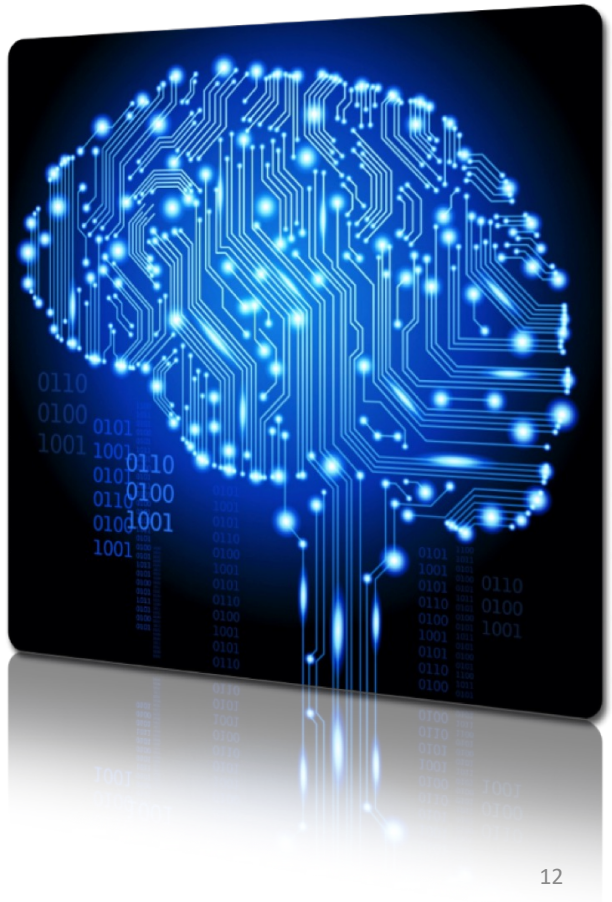
Comment en est-on arrivé là ?

INTRODUCTION AU CONCEPT D'APPRENTISSAGE

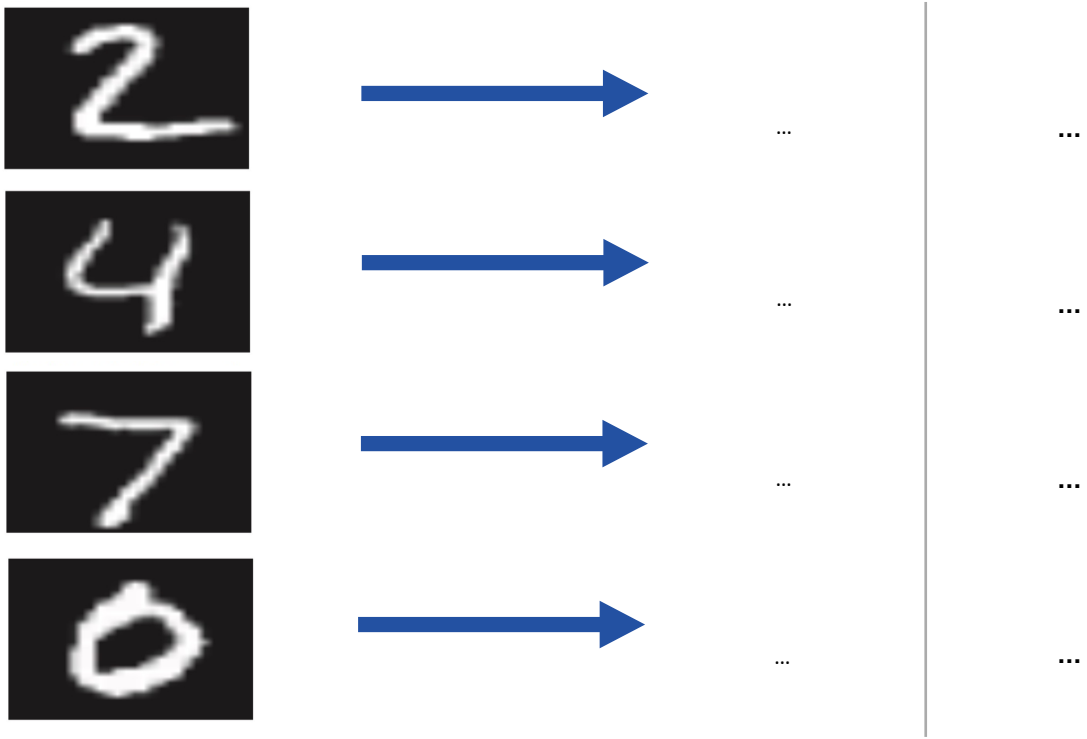
Qu’est ce que le Machine Learning ?

Qu’est ce que le Deep Learning ?

Prenons un exemple: reconnaisseur de chiffres



Prenons la place de la machine un instant



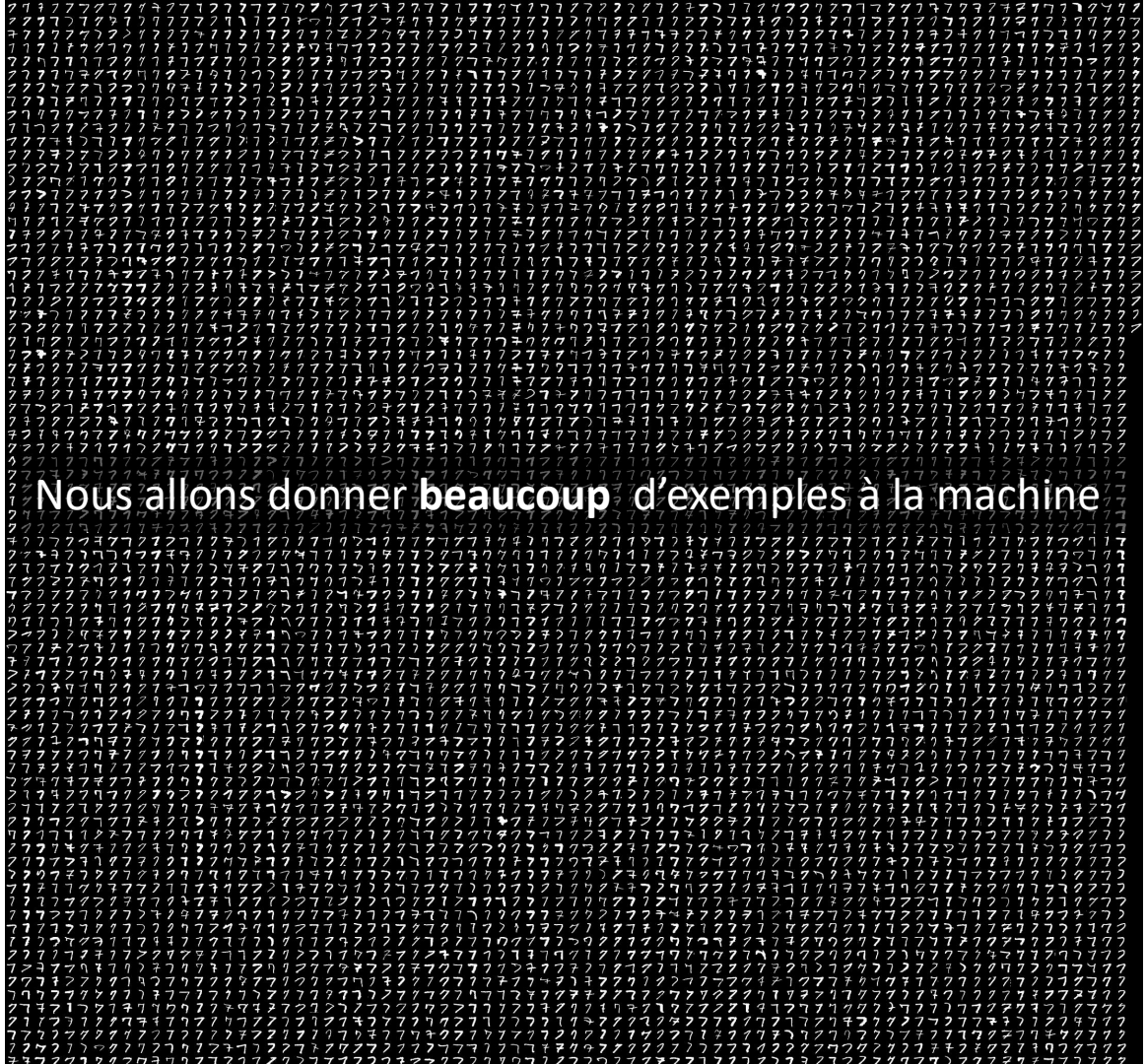
Prenons la place de la machine un instant

x Entrée	***h(x)*** Fonction de transformation	***ŷ*** Sortie estimée	***y*** Sortie désirée
	→	2	**2**
	→	4	**4**
	→	1	**7**
	→	0	**0**

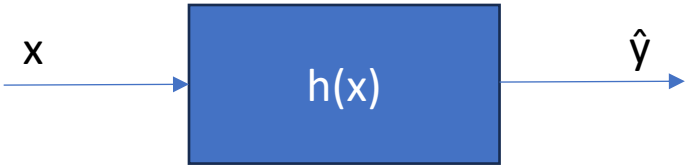
La «vérité»

Nous allons donner des exemples à la machine pour toutes les catégories désirées

La machine doit être exposée à toutes les **variabilités** pour apprendre correctement


Nous allons donner **beaucoup** d'exemples à la machine

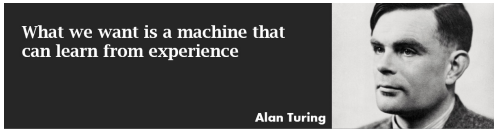
Que se passe-t-il dans le processus d'apprentissage ?



- La machine va tenter de trouver une fonction h(x) qui va réduire la différence entre la valeur estimée ŷ et la valeur désirée y.

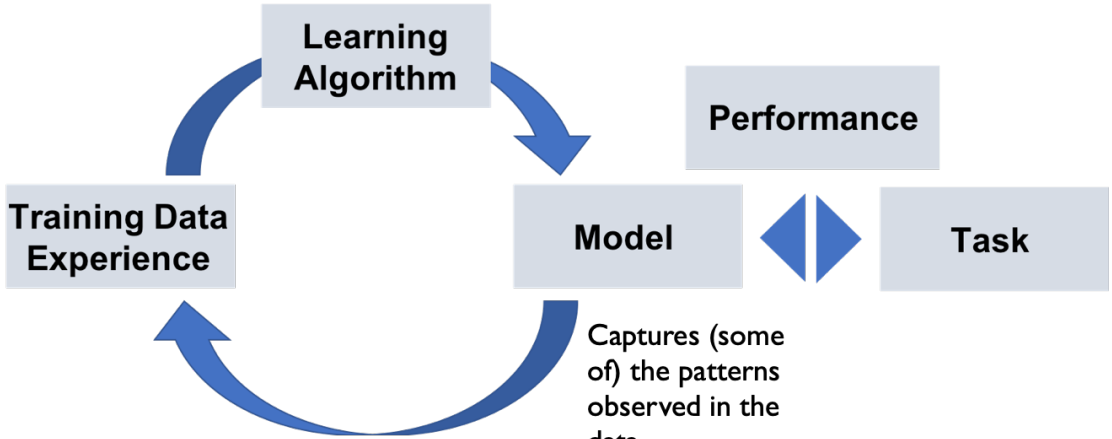
"[Machine Learning is the] field of study that gives computers the ability to learn without being explicitly programmed."

Arthur Samuel, 1959



Learning involves shaping a model (hypothesis function) that can capture the structure seen in the data.

To tune model to data, typically involves optimisation of suitable loss function (or cost, benefit, reward function)



Depending on context raw observed data or preprocessed data with manually engineered features

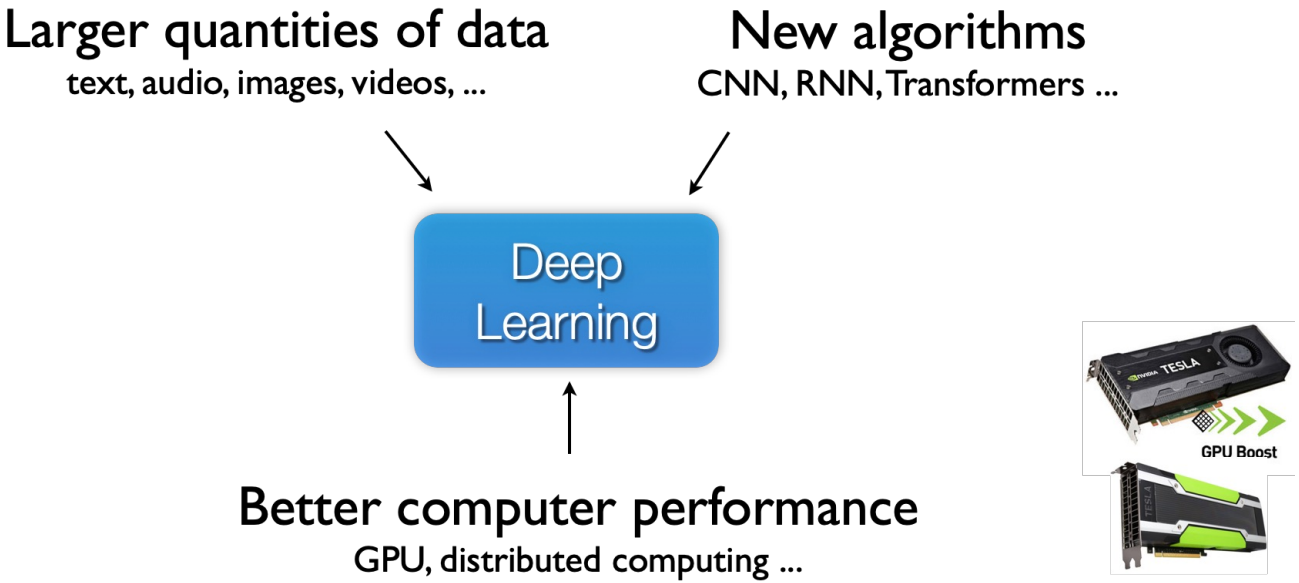
Captures (some of) the patterns observed in the data

Task performs as good as model captures the statistical distribution hidden in the data.

L’ARRIVÉE DU DEEP LEARNING

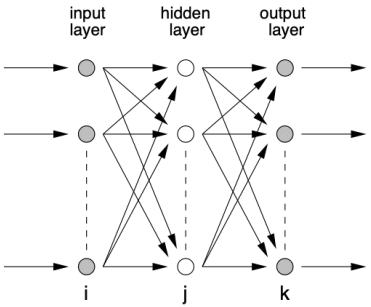
Qu’est-ce que le deep learning ?

- Une nouvelle tendance du deep learning
- A la convergence de 3 éléments:

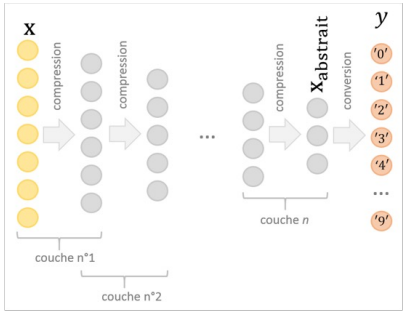


Qu’est-ce que le deep learning ?

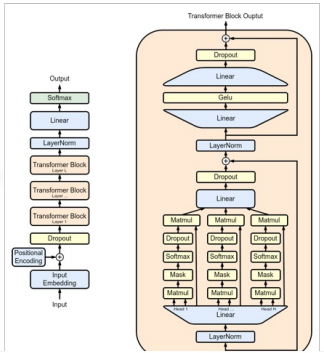
- La mise au point d’architectures neuronales de plus en plus performantes.



1990’s
3 layers
500 neurons
50K params
months of training on cpu



2010’s
10-20 layers
500’000 neurons
60M params
days/weeks of training on gpu

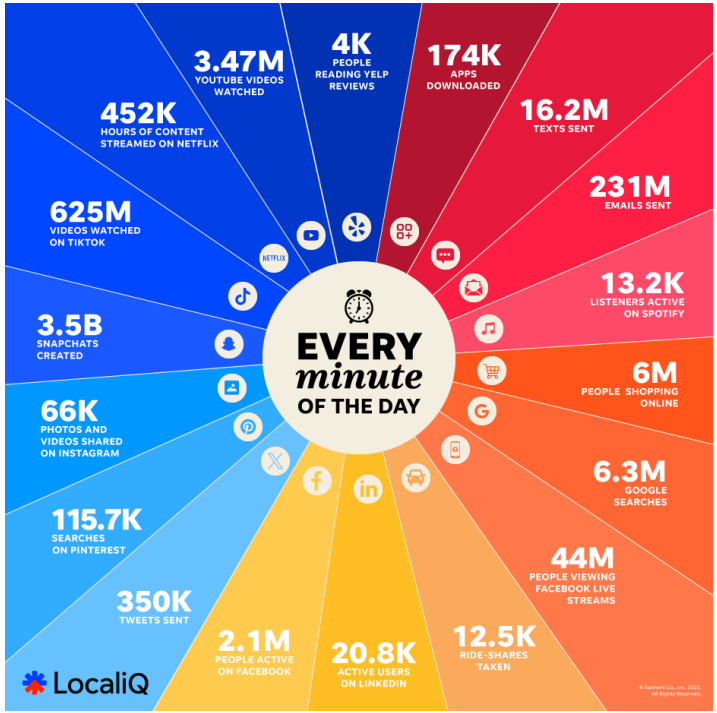


2020’s
up to 100 layers
up to 100 Billion parameters
days/weeks/months of gpu

See e.g. GPT3 with 175 Billion params
https://openai.com/
Switch Transformer 1.6 Trillion params
https://arxiv.org/pdf/2101.03961.pdf

Qu’est-ce que le deep learning ?

- La mise à disposition de gigantesques quantités de données
- Chat – gpt-3: de l’ordre de la 10aine de TB de données d’entraînement
  - 1 TB = 1’000’000’000’000 Bytes = 5’000’000 livres à 200 pages
- Reconnaissance de la parole – Whisper: 1’000’000 d’heures de paroles transcriptes
- Reconnaissance d’image – Segment Anything Model: 1’000’000’000 images annotées



Qu’est ce que le deep learning

- L’usage massif d’accélérateurs de calcul de type GPU

Quelques coeurs (~10), rapide (~4 GHz), beaucoup de cache, quelques processus parallèles.
Très fort pour les tâches séquentielles
Fournisseurs : Intel, AMD

CPU vs GPU

Beaucoup de coeurs (~1’000), lent (~1.5 GHz), peu de cache, beaucoup de processus parallèles.
Très fort pour le calcul parallèle
Fournisseurs : NVIDIA, AMD

QUESTIONS

Travaillons ensemble!

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