An introduction to AI

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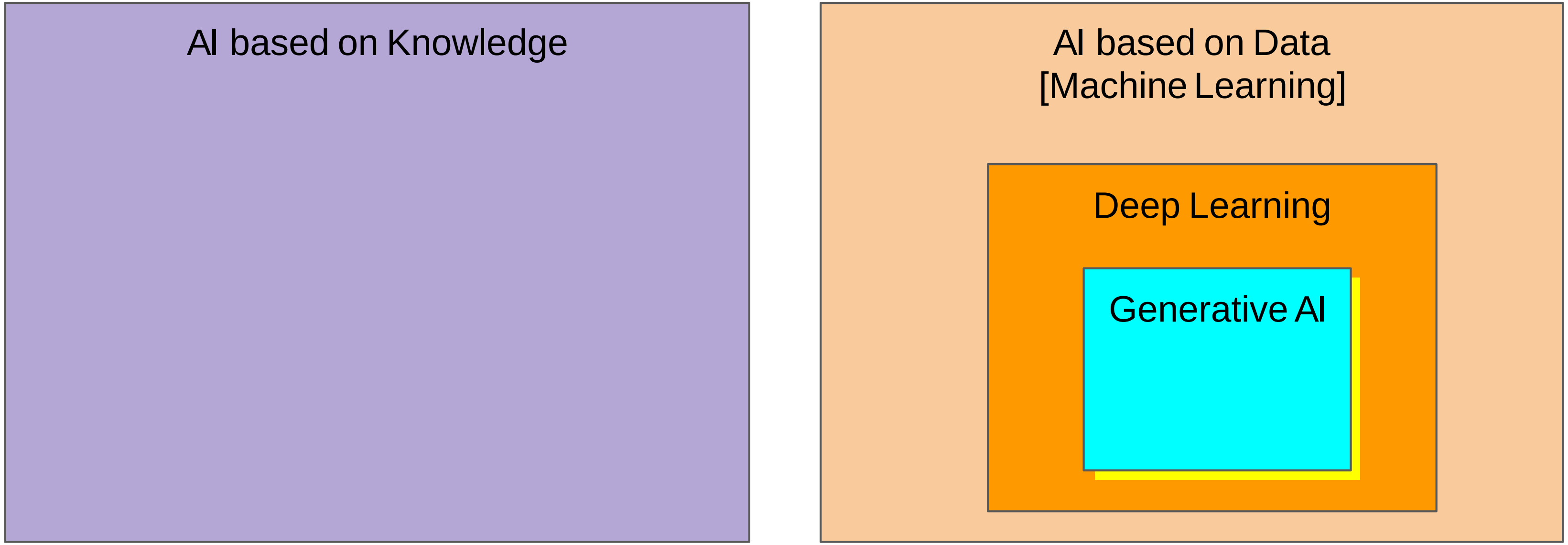
A definition of AI ?

"The construction of computer programs that perform tasks that are, for the moment, accomplished more satisfactorily by human beings"

John McCarthy
AI Pioneers with M.L Minsky



40 minutes to understand how Chat GPT works

STEP 1 : Machine Learning

STEP 2 : Neurones

STEP 3 : Autoencoders

STEP 4 : Sequence to Sequence Models

STEP 5 : Transformers

The different types of learning

Supervised Learning

- Learning with a **labeled** training set.

Learn with exercises
Ex. Driving license

Unsupervised Learning

- Discovering patterns in **unlabeled** data.

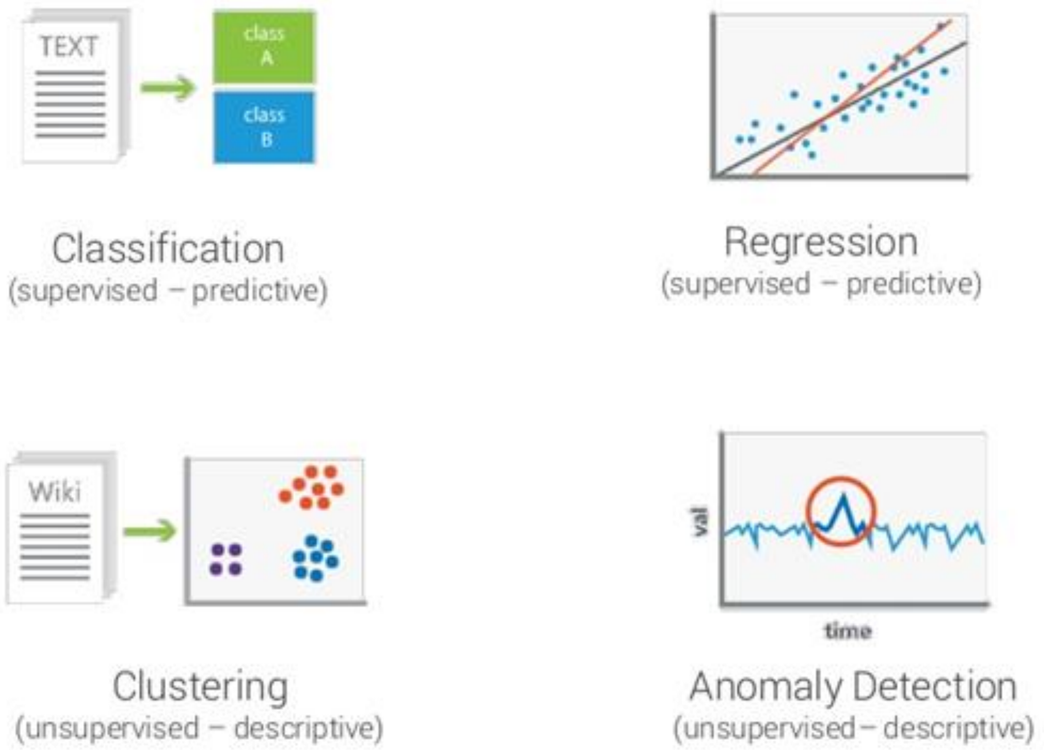
Learn with similitude
Ex. Newton and the apple

Reinforcement Learning

- Learning based on **feedback** or **reward**.

Learn with trial and error
Ex. Ride a bike

ML to solve different types of problems



A brief history of Deep Learning

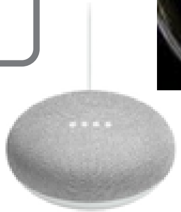
- **1950** — Test de Turing
- **1981** — Fukushima Neocognitron : lecture d'écriture manuscrite en Japonais
- **1988:** — Convolutional Network (**CNN**) de LeCun lecture d'adresse postale. 60k paramètres
- **2012** — Traffic Signs Challenge : Performances meilleures que les humains. AlexNet : 60 M paramètres
- **2016** — Alphago bat le champion du monde de go.
- **2024** — GPT4o : 8*220 Milliards de paramètres

Google Gemini : 1560 Milliards de paramètres


MIT Technology Review

Facebook Launches Advanced AI Effort to Find Meaning in Your Posts

A technique called deep learning could help Facebook understand its users and their data better.



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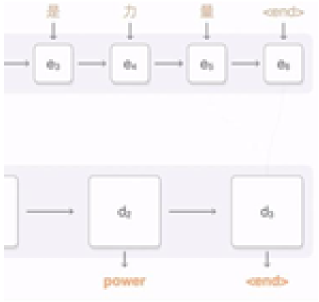
Solved Applications

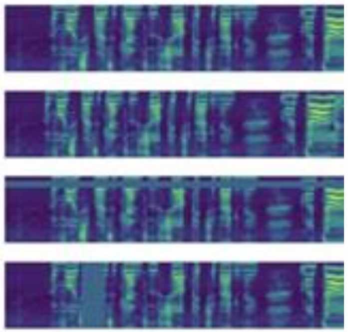
Image Classification:
92% on Image Net

Object Detection

Sentiment analysis
(amazon, twitter, ...)
96% on IMDB



Machine Translation
BLEU score 40
(34 human pro)



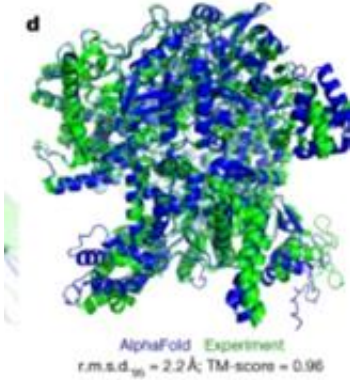
Speech Recognition
97% on Noisy

Atari, Chess, Go

Applications still under research

Image - Video - 3D - World Generation
Diffusion Models

Action models



Protein Prediction
>90% AlphaFold 2

Conversation agents (LLM)
outperforms humans by 30%
on US Medical exam

Multi agents games :
Starcraft, Diplomacy...

STEP 1 : Machine Learning

STEP 2 : Neurones

STEP 3 : Autoencoders

STEP 4 : Sequence to Sequence Models

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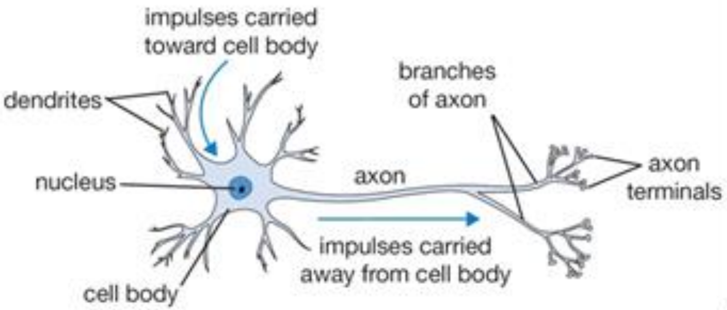
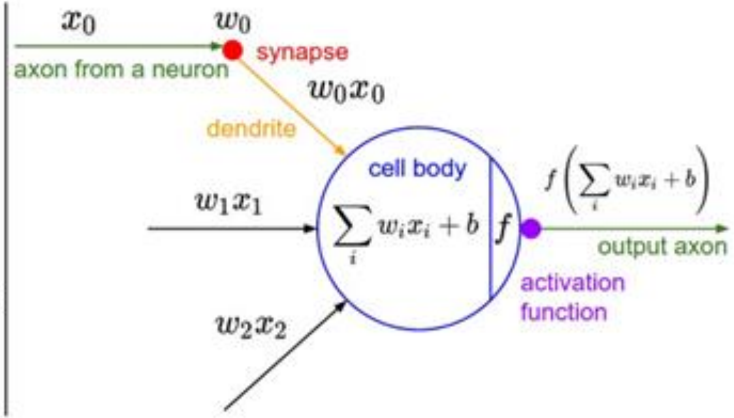
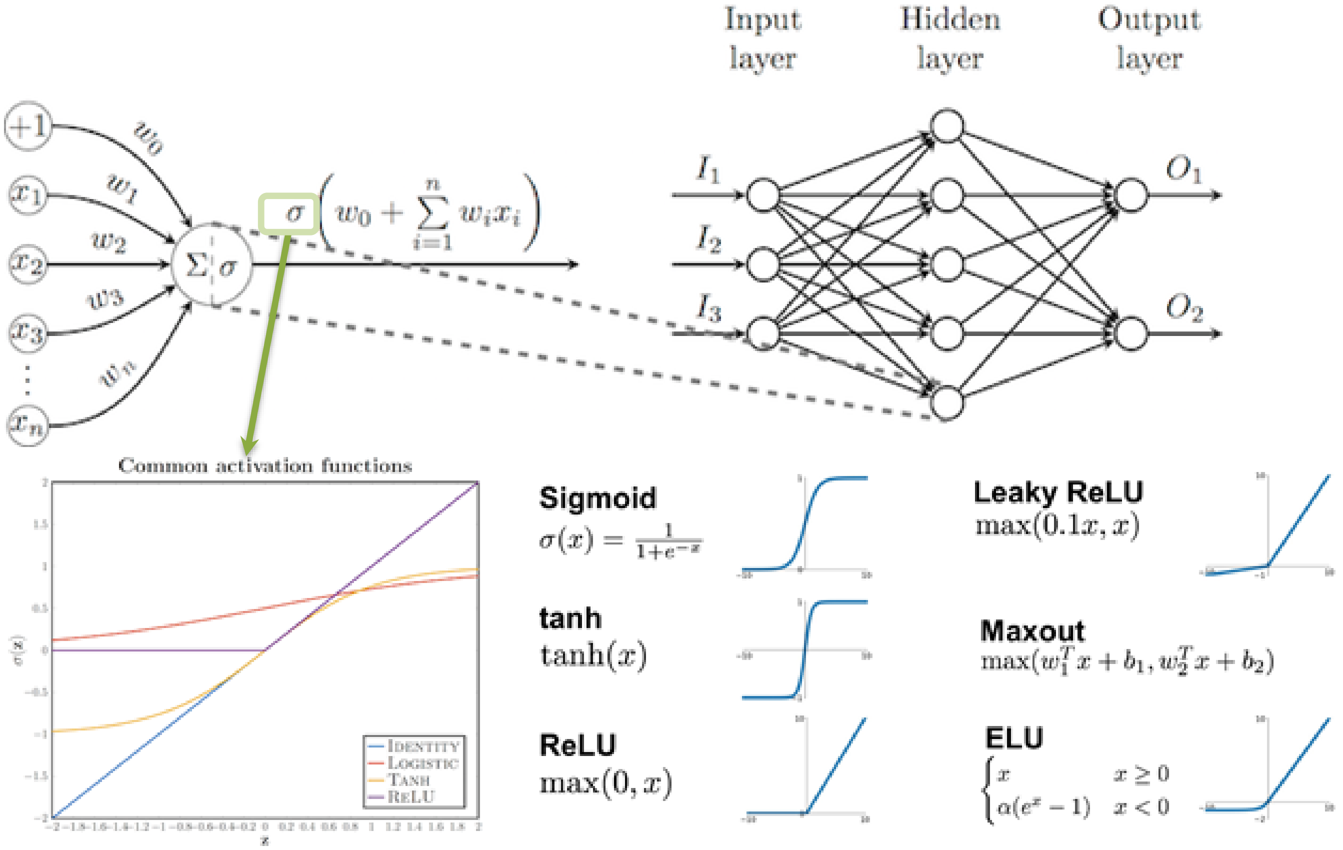
Neurons

- **Neurons** are trained to filter and detect **features** such as edges, shapes, textures, by receiving weighted inputs from the previous neurons, transforming it with an activation function and passing it to the outgoing connections.





Activation Functions



STEP 1 : Machine Learning

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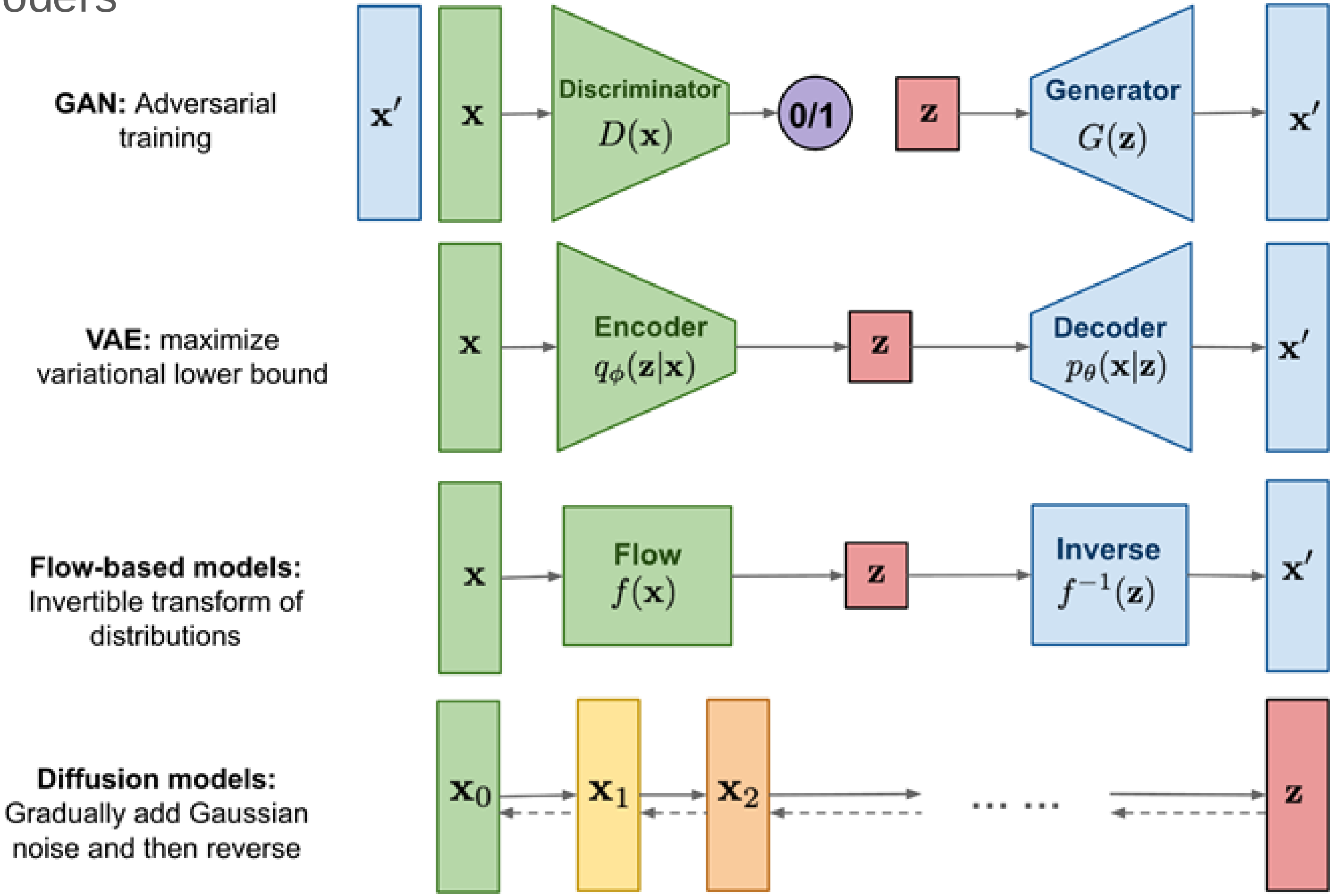
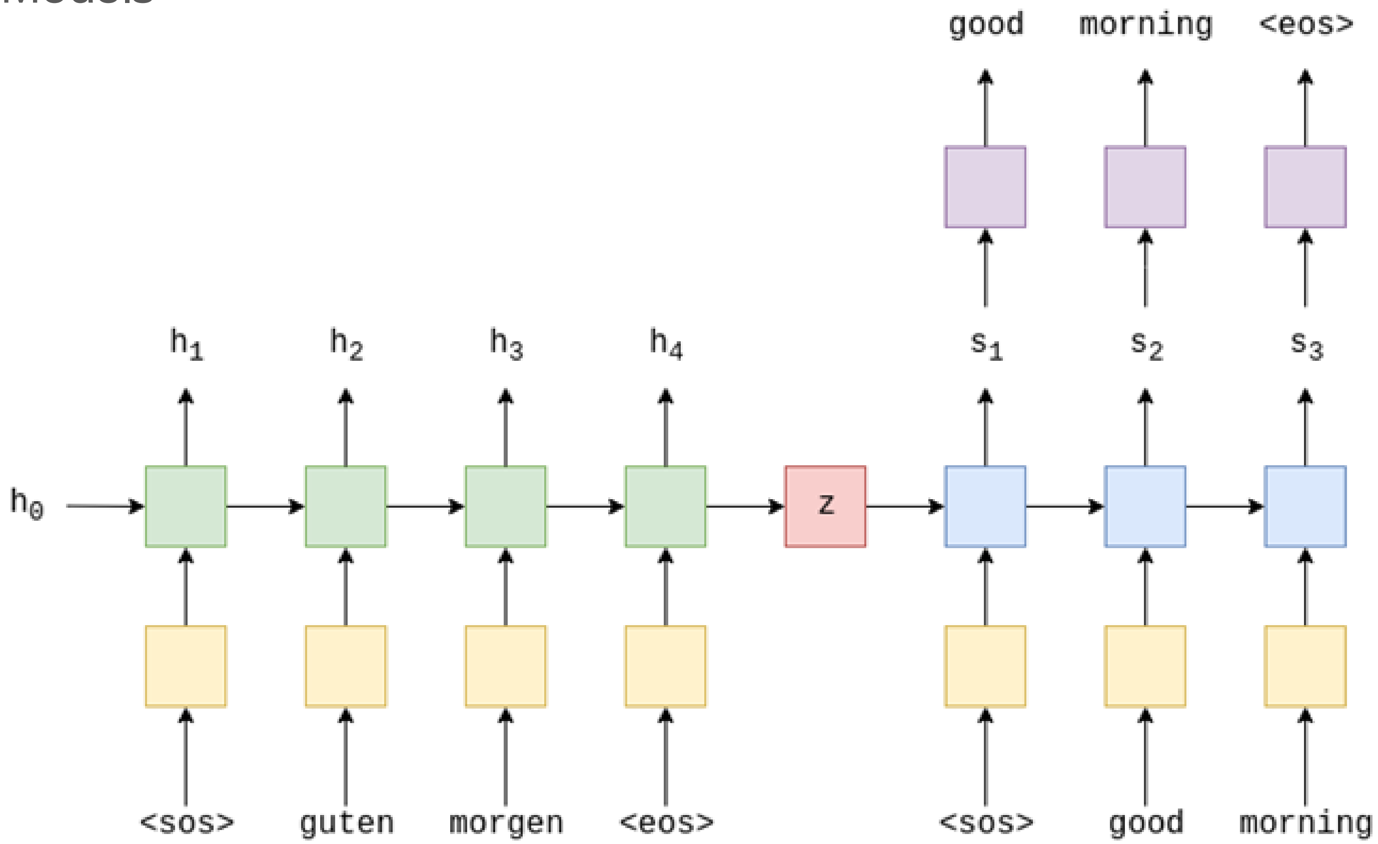
- playground.tensorflow.org/

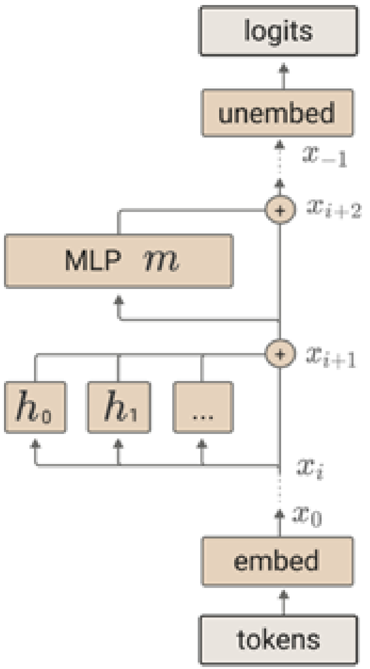
STEP 3 : Autoencoders



STEP 4 : Sequence to Sequence Models



STEP 5 : Transformers



The final logits are produced by applying the unembedding.

$$T(t) = W_U x_{-1}$$

An MLP layer, m, is run and added to the residual stream.

$$x_{i+2} = x_{i+1} + m(x_{i+1})$$

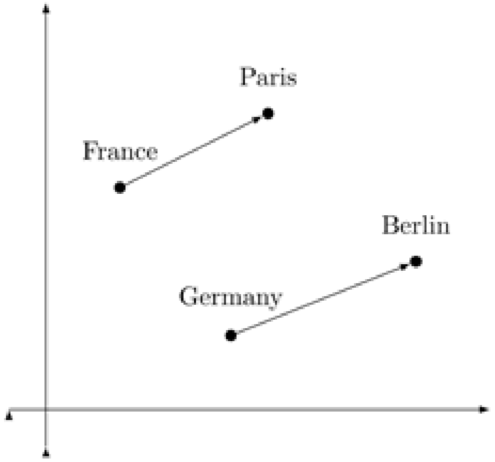
Each attention head, h, is run and added to the residual stream.

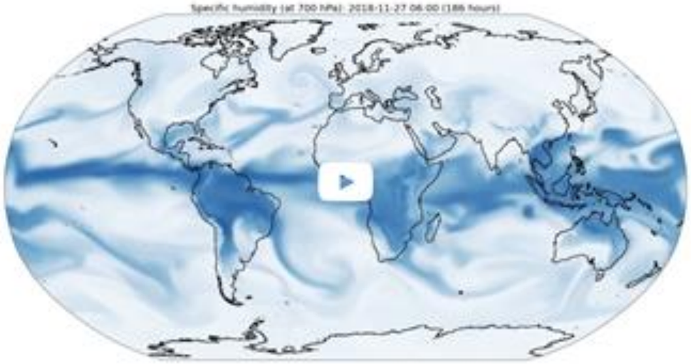
$$x_{i+1} = x_i + \sum_{h \in H_i} h(x_i)$$

One residual block

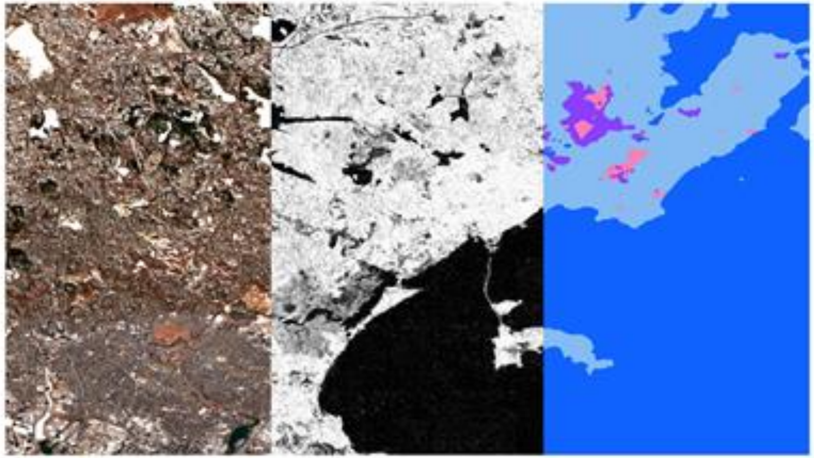
Token embedding.

$$x_0 = W_E t$$

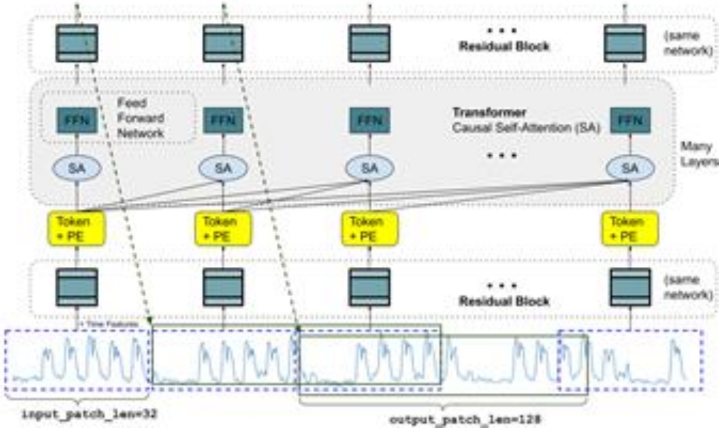


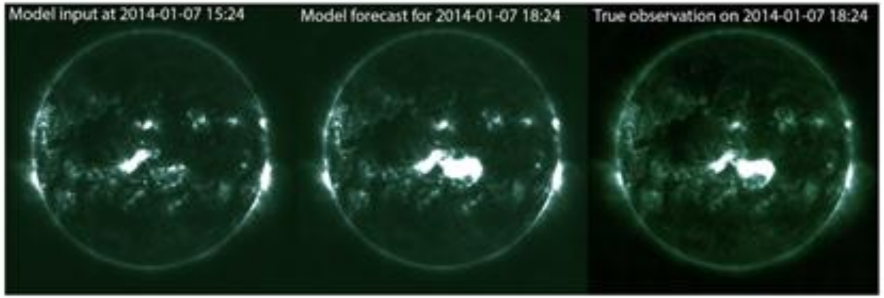


A selection of GraphCast's predictions rolling across 10 days showing specific humidity at 700 hectopascals (about 3 km above surface), surface temperature, and surface wind speed.



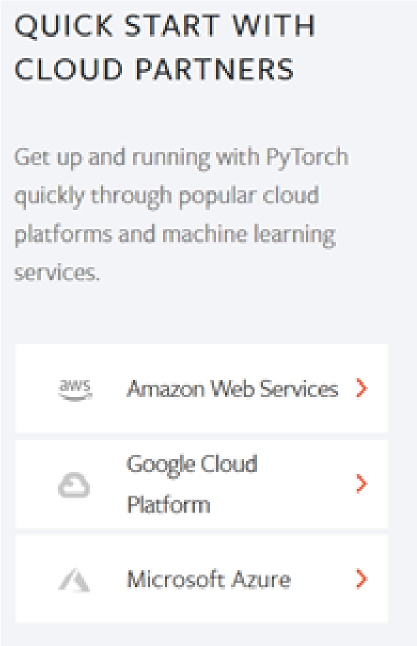
TerraMind's any-to-any generative capabilities demonstrated on a scene over Boston. From left to right: (1) optical input, (2) synthetic radar generated from optical imagery, and (3) generated land use classification.





These images compare the ground-truth data (right) with model output (center) for solar flares, which are the events behind most space weather. Surya's prediction is very close to what happened in reality (right). These preliminary results suggest that Surya has learned enough solar physics to predict the structure and evolution of a solar flare by looking at its beginning phase.
NASA/SDO/ODSI IMPACT AI Team

It may cost some money to train and deploy



https://pytorch.org/

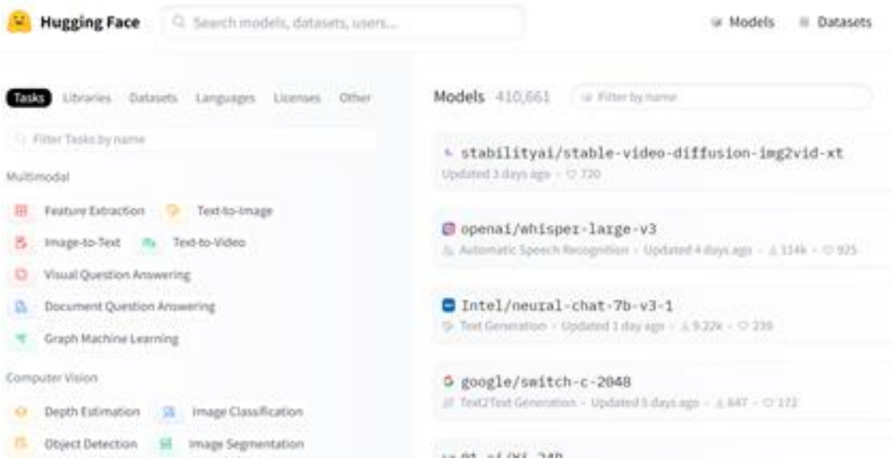
Cloud is the easiest option (by far...)
Optimized stacks for training and inference

But ...
Exploding costs depending on the number of parameters

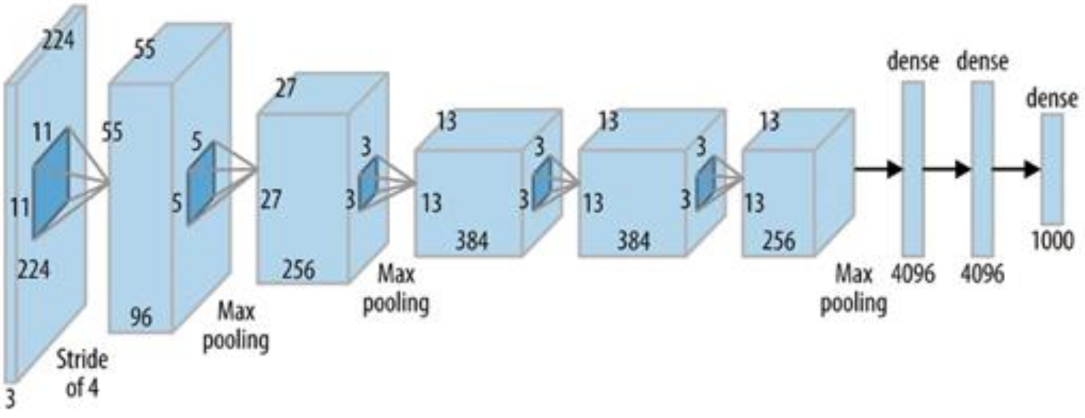
	Training cost
DeepMind AlphaGO	35 Million $
GPT3	12 Million $
CoAtNet (top 1 ImageNet)	250 000 $
BERT	7000 $
Yolo V5	100 $
ResNet 50	10 $

Start from a model already trained

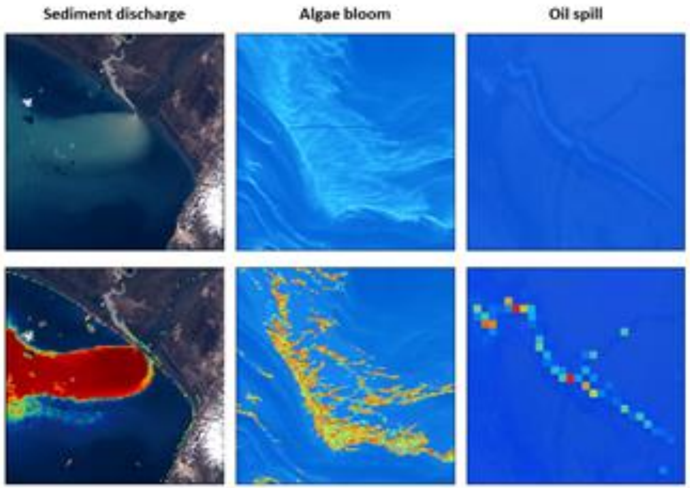
Hugging Face / Pytorch hub : state of the art models with weight already tuned
=> we add images, continue training and voilà !

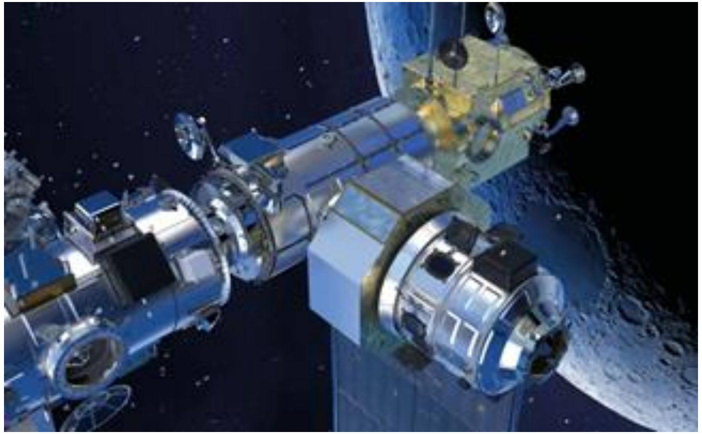


Articles and blogs describe architectures (how many layers, which types), which are known to work well on a given problem



Alexnet Block Diagram (source:oreilly.com)





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