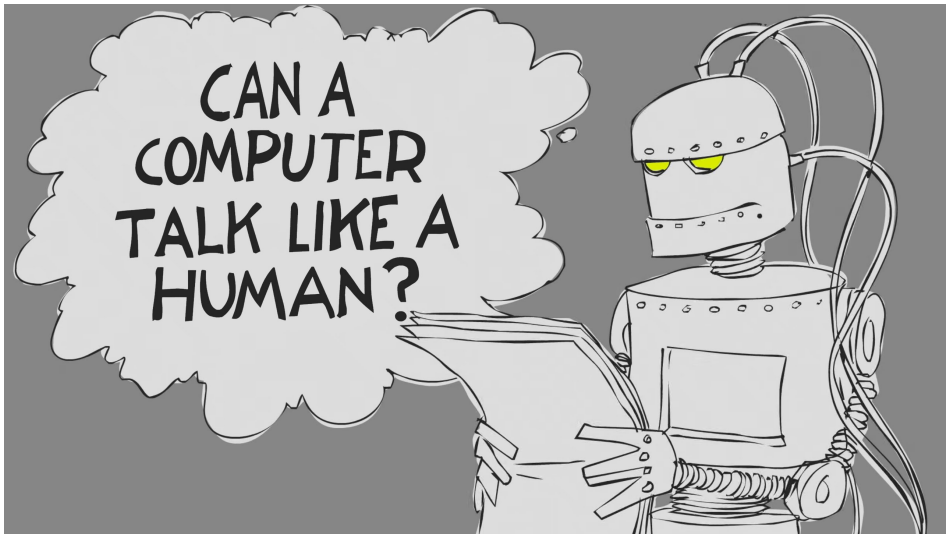
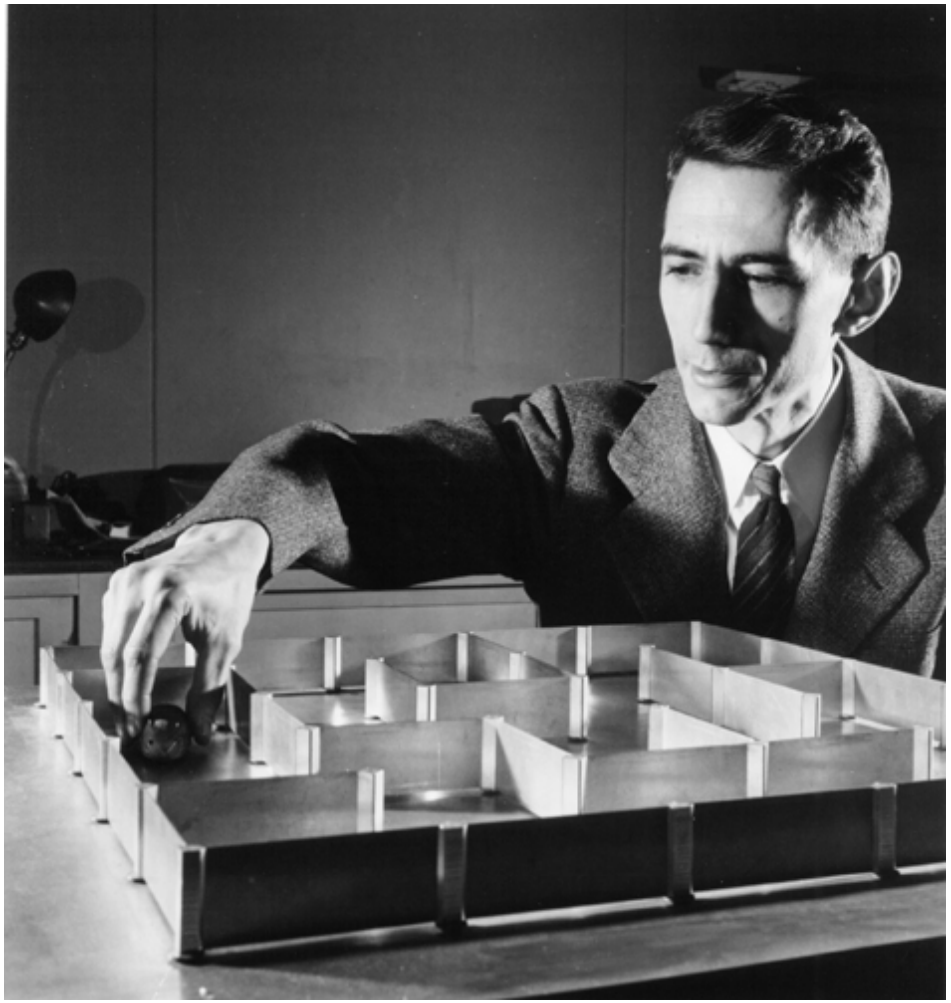
Course 1: Generalities about AI

What is not AI? (even if it ought to be)



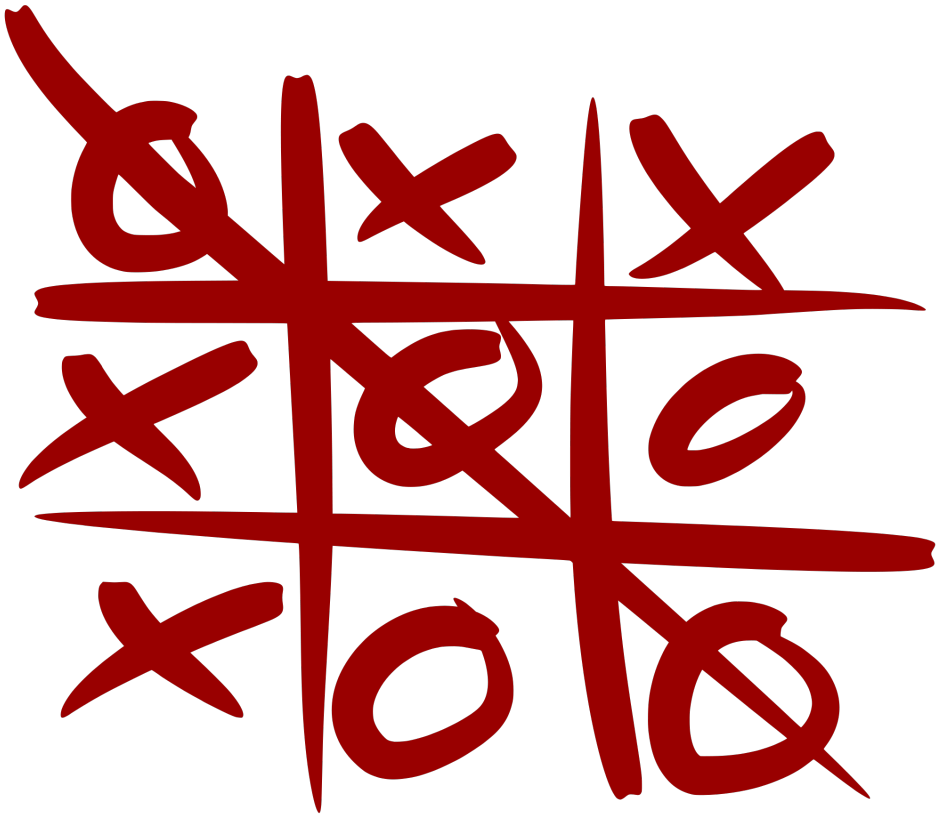
- Trying to fool a human with a computer,
- Automatically computing something that is known to be cognitively intense for a human being,
- Playing computationally solvable games,
- Designing robots,
- Something made of two parts: a weak one and a strong one...

What is not AI? (even if it ought to be)



- Trying to fool a human with a computer,
- Automatically computing something that is known to be cognitively intense for a human being,
- Playing computationally solvable games,
- Designing robots,
- Something made of two parts: a weak one and a strong one...

What is not AI? (even if it ought to be)



- Trying to fool a human with a computer,
- Automatically computing something that is known to be cognitively intense for a human being,
- Playing computationally solvable games,
- Designing robots,
- Something made of two parts: a weak one and a strong one...

What is not AI? (even if it ought to be)

- Trying to fool a human with a computer,
- Automatically computing something that is known to be cognitively intense for a human being,
- Playing computationally solvable games,
- Designing robots,
- Something made of two parts: a weak one and a strong one...

What is not AI?

- Trying to fool a human with a computer,
- Automatically computing something that is known to be cognitively intense for a human being,
- Playing computationally solvable games,
- Designing robots,
- Something made of two parts: a weak one and a strong one...

What is AI?

A modern definition

An algorithm is said to be "intelligent" if it **generalizes** a way to take **good decisions** from (potentially annotated) **examples** and/or **trials**.

Examples

- Computing the length of an edge in a rectangle triangle given the two other lengths is not intelligent,
- Inferring how to find the missing length from a set of examples is intelligent,
- Winning at chess by looking at all possible plays from the current board is not intelligent,
- Winning at chess by playing a lot of games and inferring what a good strategy is is intelligent.

What is AI?

A modern definition

An algorithm is said to be "intelligent" if it **generalizes** a way to take **good decisions** from (potentially annotated) **examples** and/or **trials**.

Examples

- Computing the length of an edge in a rectangle triangle given the two other lengths is not intelligent,
- Inferring how to find the missing length from a set of examples is intelligent,
- Winning at chess by looking at all possible plays from the current board is not intelligent,
- Winning at chess by playing a lot of games and inferring what a good strategy is is intelligent.

What is AI?

A modern definition

An algorithm is said to be "intelligent" if it **generalizes** a way to take **good decisions** from (potentially annotated) **examples** and/or **trials**.

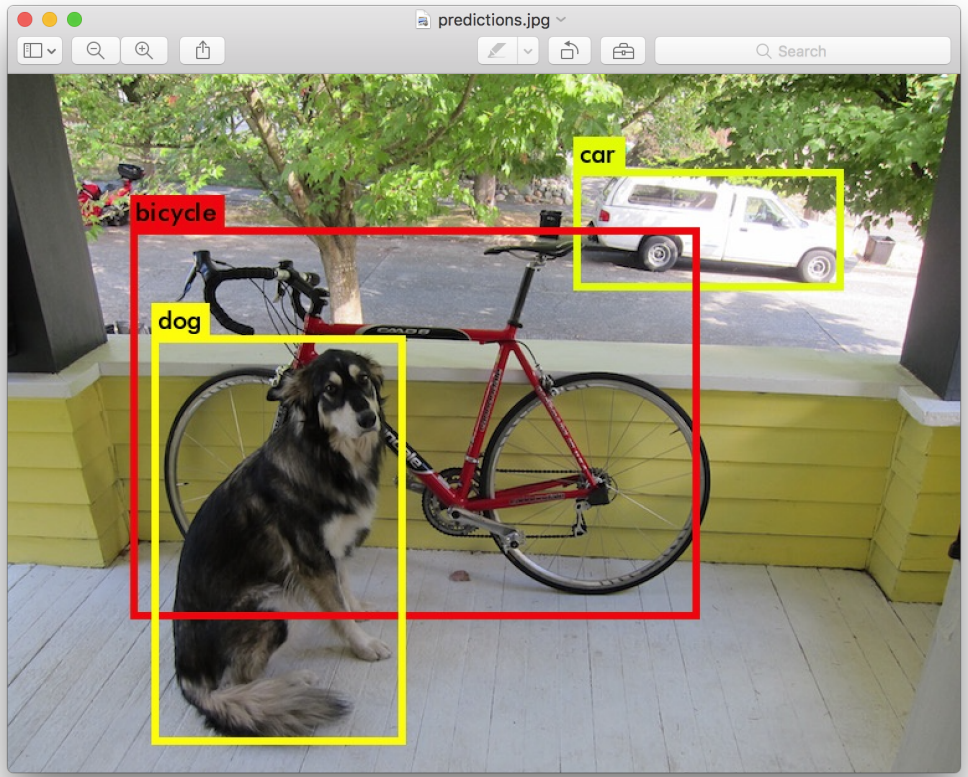
Examples

- Computing the length of an edge in a rectangle triangle given the two other lengths is not intelligent,
- Inferring how to find the missing length from a set of examples is intelligent,
- Winning at chess by looking at all possible plays from the current board is not intelligent,
- Winning at chess by playing a lot of games and inferring what a good strategy is is intelligent.

Main application domains of AI

Vision

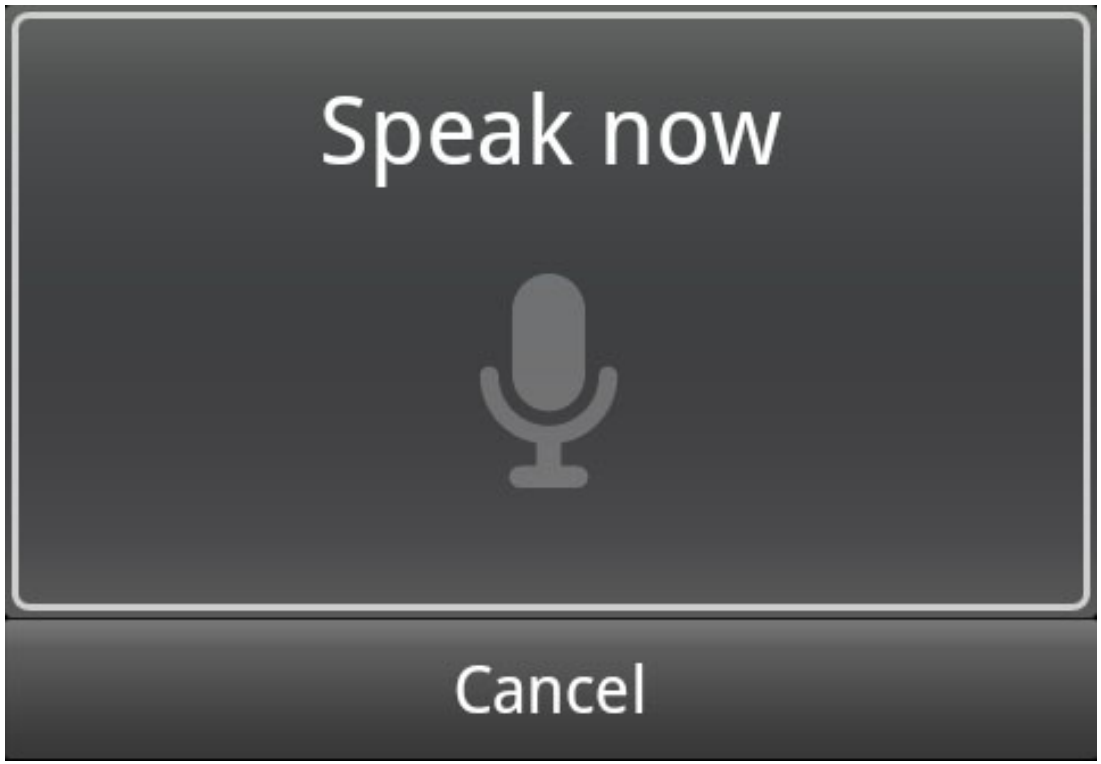
- Object/face recognition,
- Detection,
- Autonomous vehicles,
- Automatic diagnostic,
- Defects identification,
- Video applications...



Main application domains of AI

Natural Language Processing (NLP)

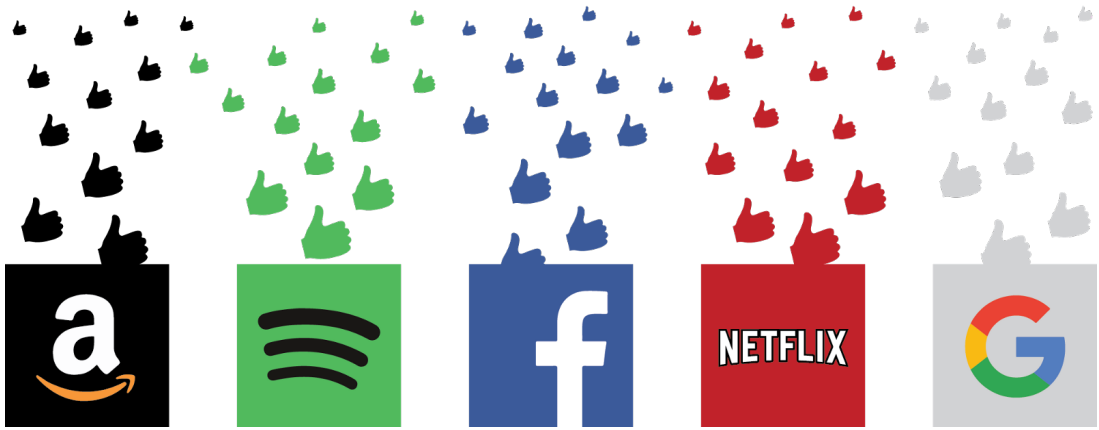
- Automatic assistant,
- Voice-to-text,
- Automatic translation,
- Automatic summarizing,
- Sentiment analysis,
- Text indexing...



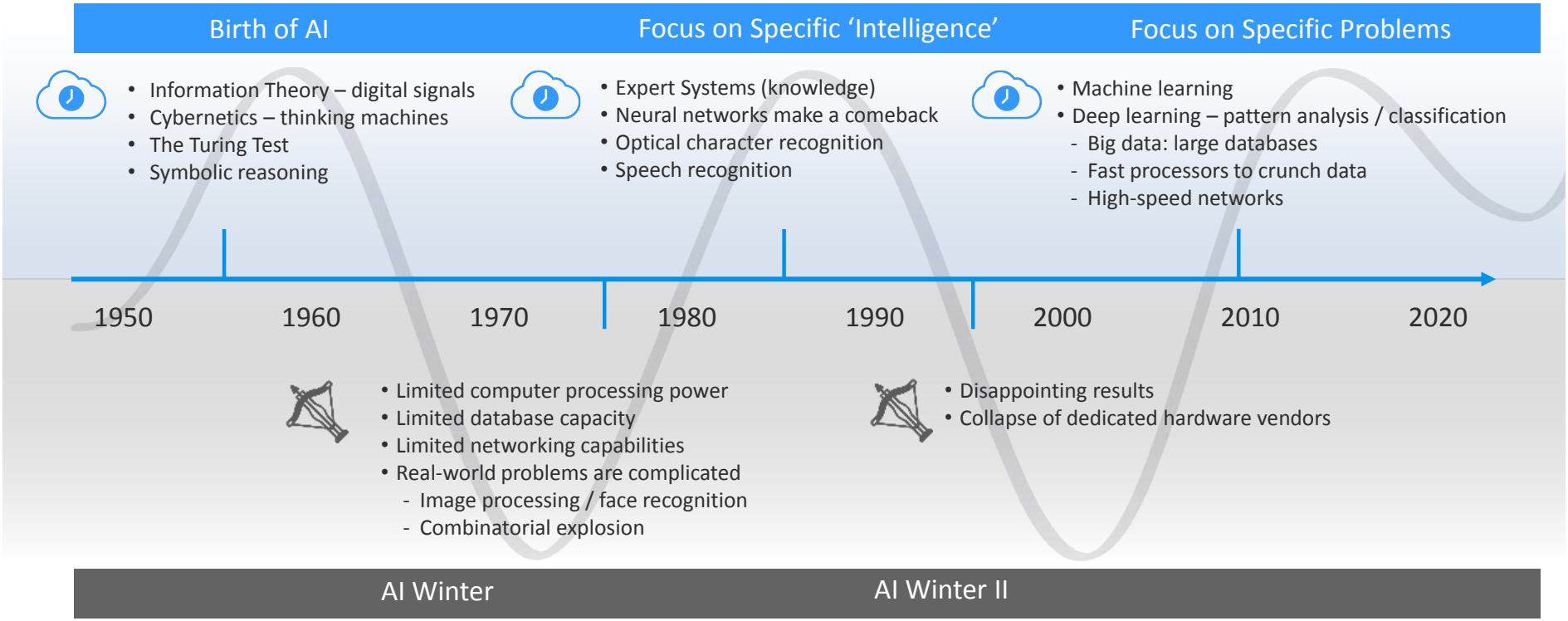
Main application domains of AI

Tons of other domains...

- Medical imaging,
- Decision aid,
- Data mining,
- Visualization,
- Recommender systems,
- Market analysis...



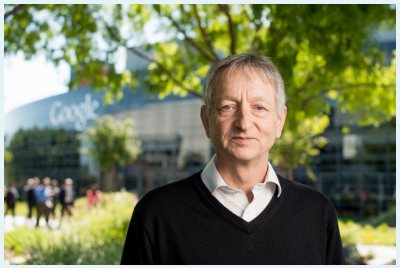
An AI Timeline



harmon.ie

The great elders of modern AI

Geoffrey Hinton



- Cognitive psychologist and computer scientist,
- Prof. at University of Toronto and works for Google,
- Known for back-propagation and Boltzmann machines.

Yoshua Bengio

- Computer scientist,
- Prof. at Université de Montréal and head of MILA,
- Known for its work on deep learning.

Yann le Cun

- Computer scientist,
- Prof. at New York University then he joins FAIR,
- Known for its work on back-propagation and CNNs.

Where did the revolution in AI come from?

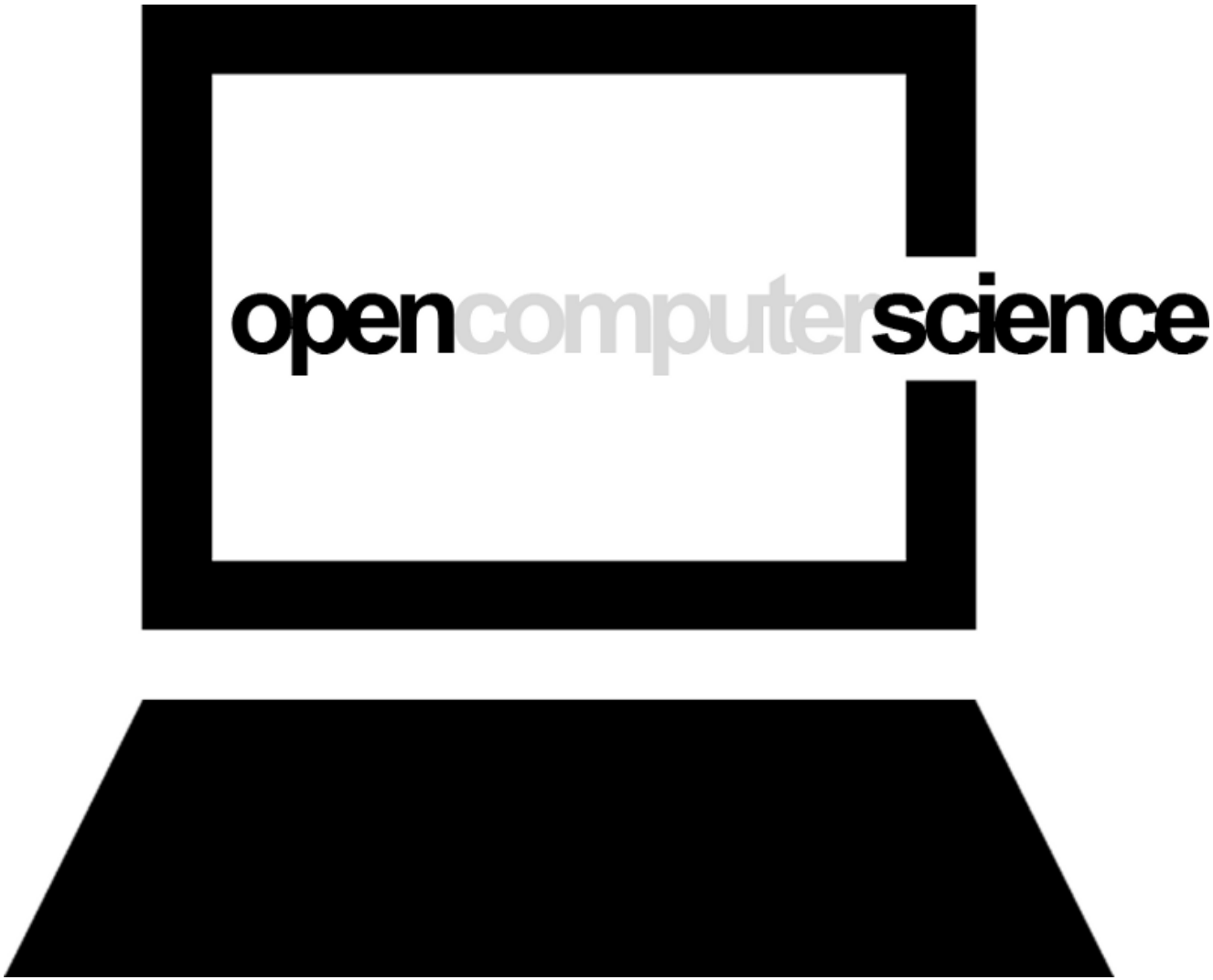
- The use of GPUs for computation.
- The share of huge datasets on Internet.
- Github/Arxiv new ways of sharing research.
- The return of representation learning.

Where did the revolution in AI come from?

- The use of GPUs for computation.
- The share of huge datasets on Internet.
- Github/Arxiv new ways of sharing research.
- The return of representation learning.

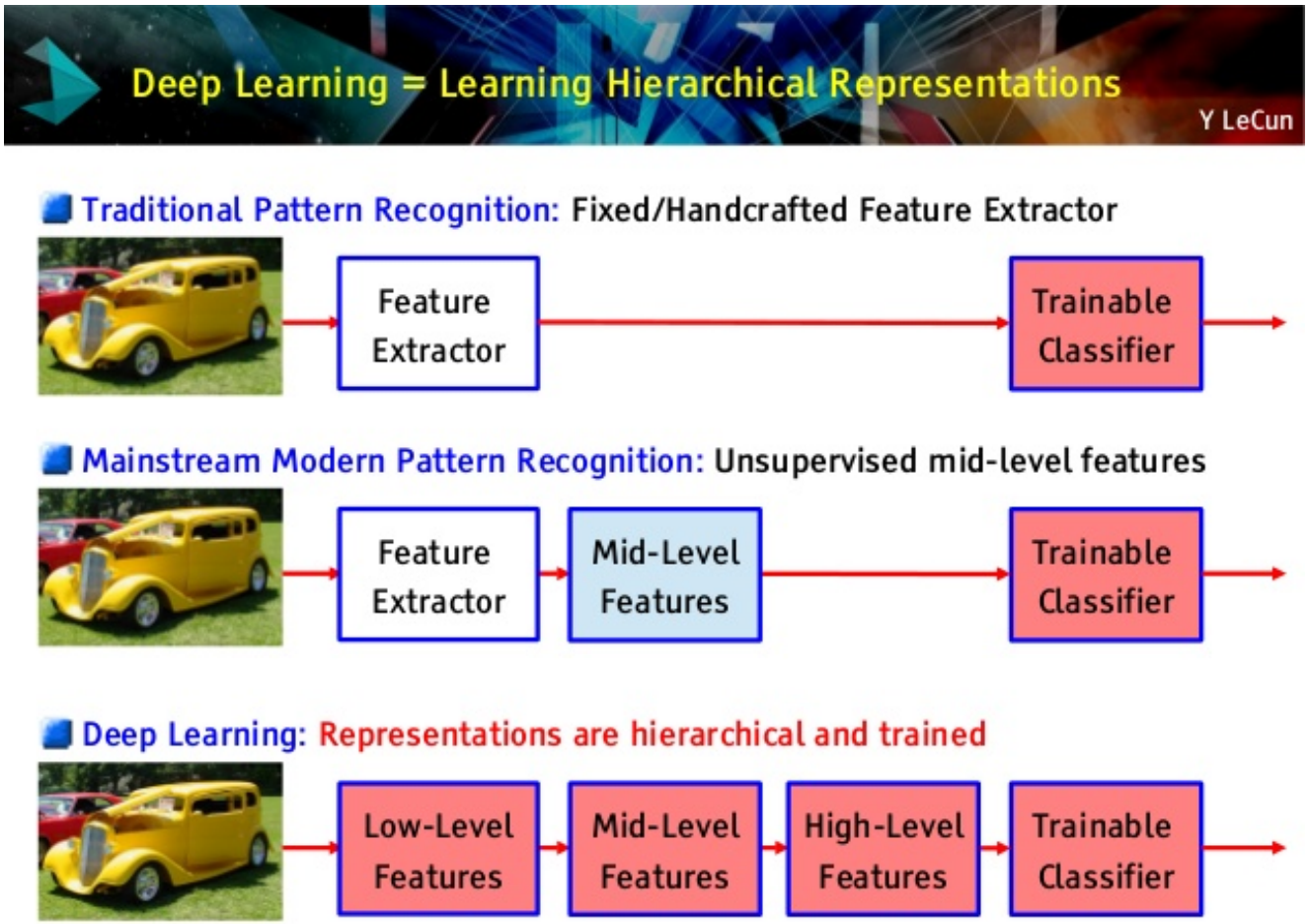
Where did the revolution in AI come from?

- The use of GPUs for computation.
- The share of huge datasets on Internet.
- Github/Arxiv new ways of sharing research.
- The return of representation learning.



Where did the revolution in AI come from?

- The use of GPUs for computation.
- The share of huge datasets on Internet.
- Github/Arxiv new ways of sharing research.
- The return of representation learning.



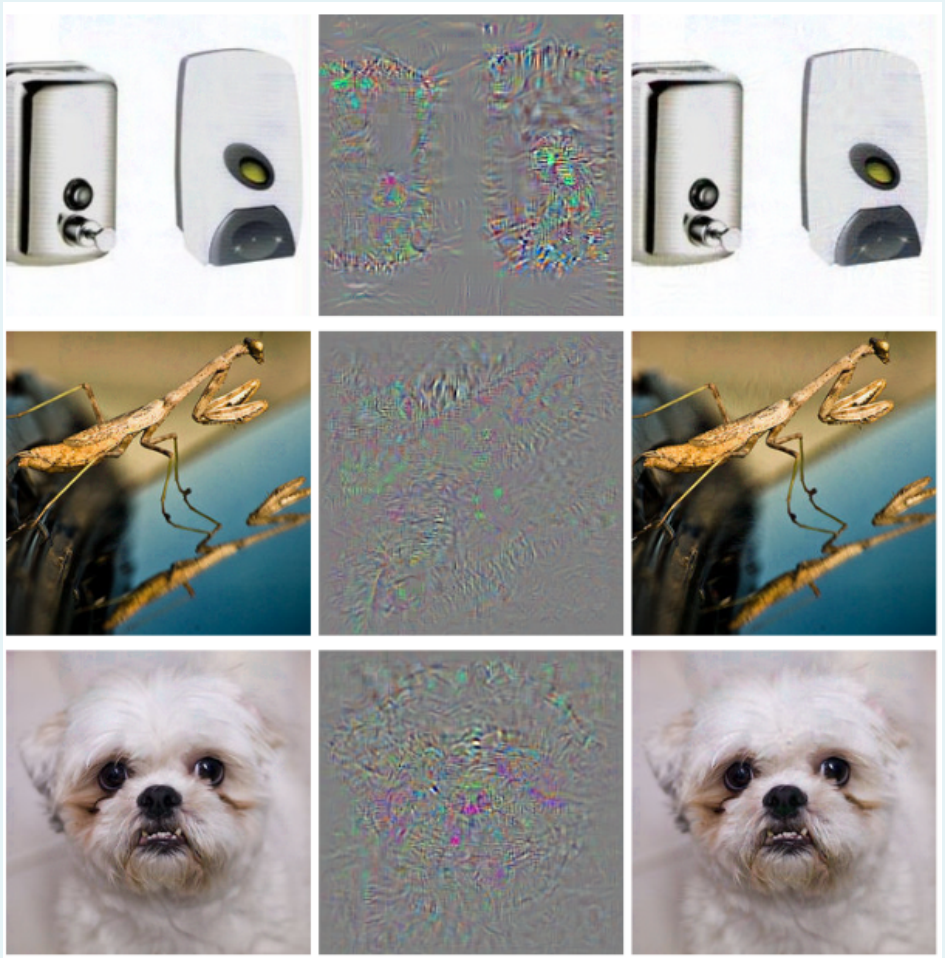
Some key open challenges (core AI research)

Learning from few examples

"How to grow a mind: statistics, structure, and abstraction", Science, 2011.

Some key open challenges (core AI research)

Learning what should be learnt



Random noise added to input images can dramatically change the end result.

"Intriguing properties of neural networks", Arxiv research report, 2013.

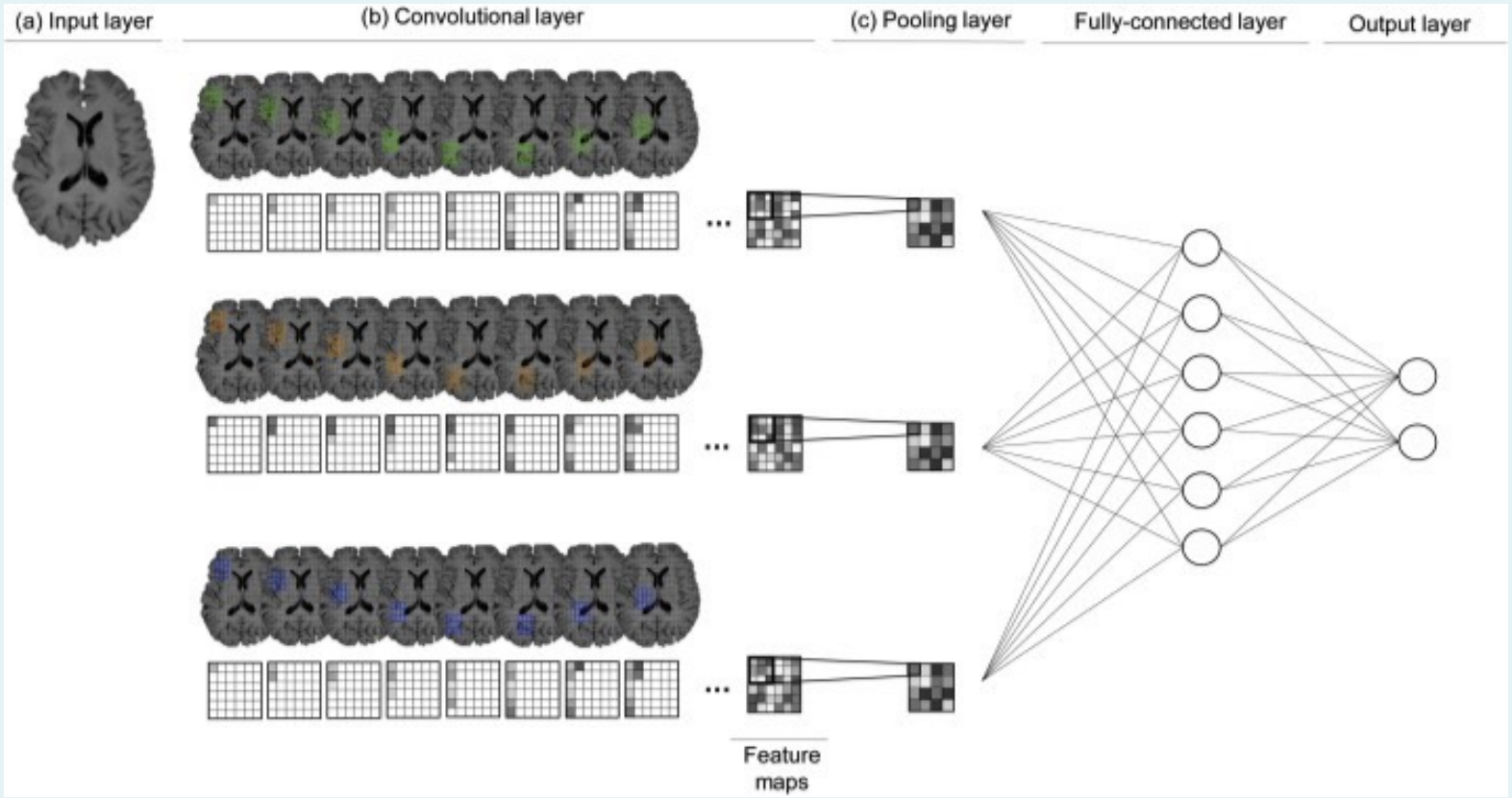
Some key open challenges (core AI research)

Incremental learning

Adding new classes of object one by one without forgetting previous knowledge.

Some key open challenges (core AI research)

Interpretability



A trained model might be very accurate, but how does it take its decision ?

"Vieira et al. 2017.

Some key open challenges (core AI research)

Computational and memory footprints

Training a large algorithm: thousands to millions of parameters using Gigabytes of data.

Course organisation

Outline

1. Generalities about AI,
2. Supervised learning,
3. Unsupervised learning,
4. Combinatorial game theory,
5. Ethics in AI,
6. Reinforcement learning,
7. Challenge.

Lab Sessions and Challenge

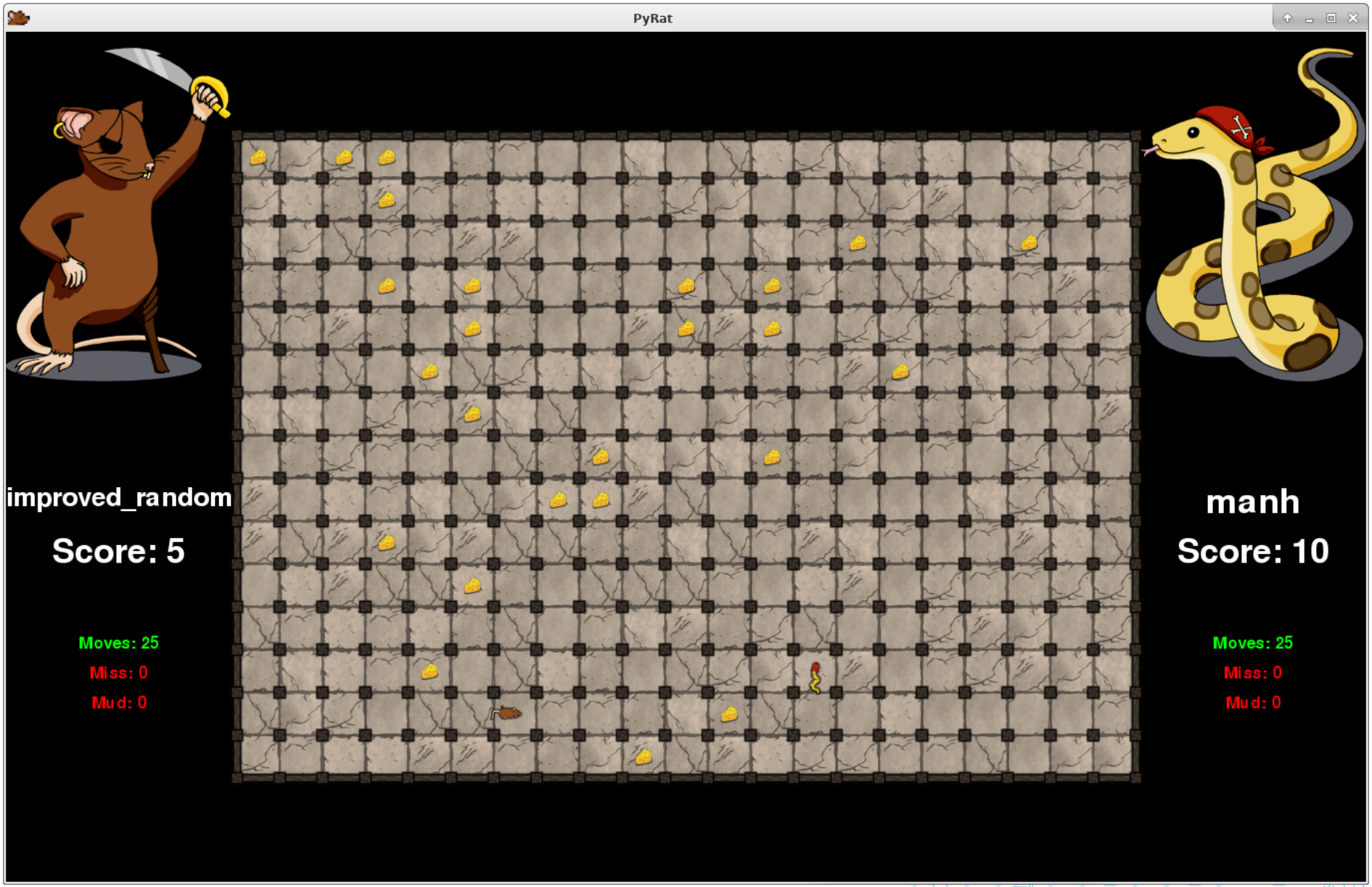
By groups of two / three, you are given a machine with complete access.

Sessions schedule

Each session has the same structure:

- Short written exam about the previous lesson (10 min),
- Short lesson (20 min),
- Lab Session including an introductory "TP" (50 min),
- Project (1h20)
- Sessions 2, 3, 4 and 7 include students' presentations

Non-symmetric PyRat without walls / mud



Lab Session 1 and assignments for Session 2

Introductory TP (TP0)

- Introduction to Jupyter Notebook
- Crash course in Numpy, Scipy
- Visualisation using Matplotlib

Project 0 (P0)

You will be assigned a topic on an application of AI.
You have to prepare a 7 minutes presentation (for session 2) in which you quickly explain :

- What the topic is about
- What solutions already exist
- Examples of companies / existing products on this topic
- Example of ethical considerations related to the topic
- Current limitations and hard problems