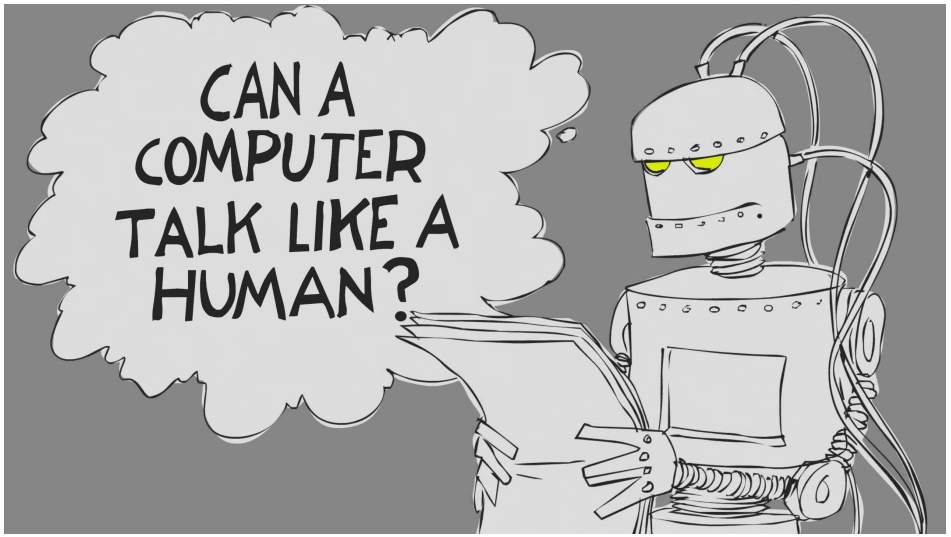
Course 1: Generalities about AI

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,
- Singularity, super-intelligence, . . .

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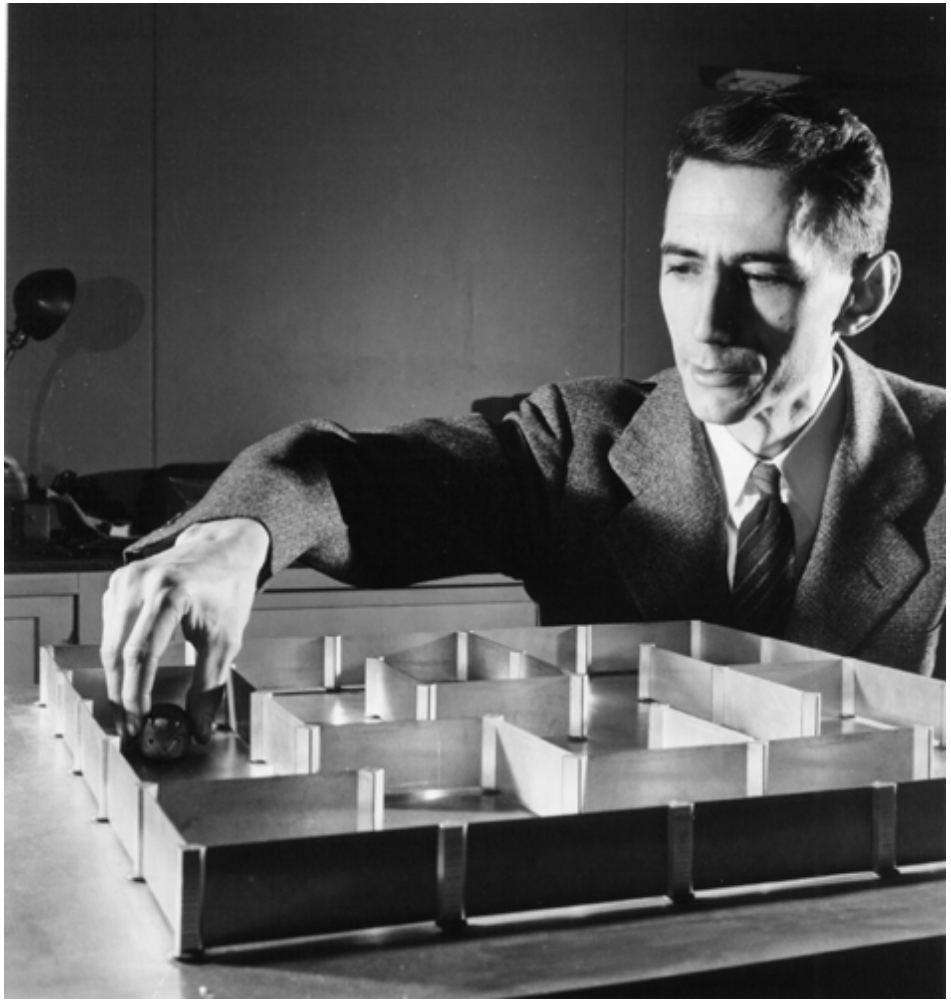

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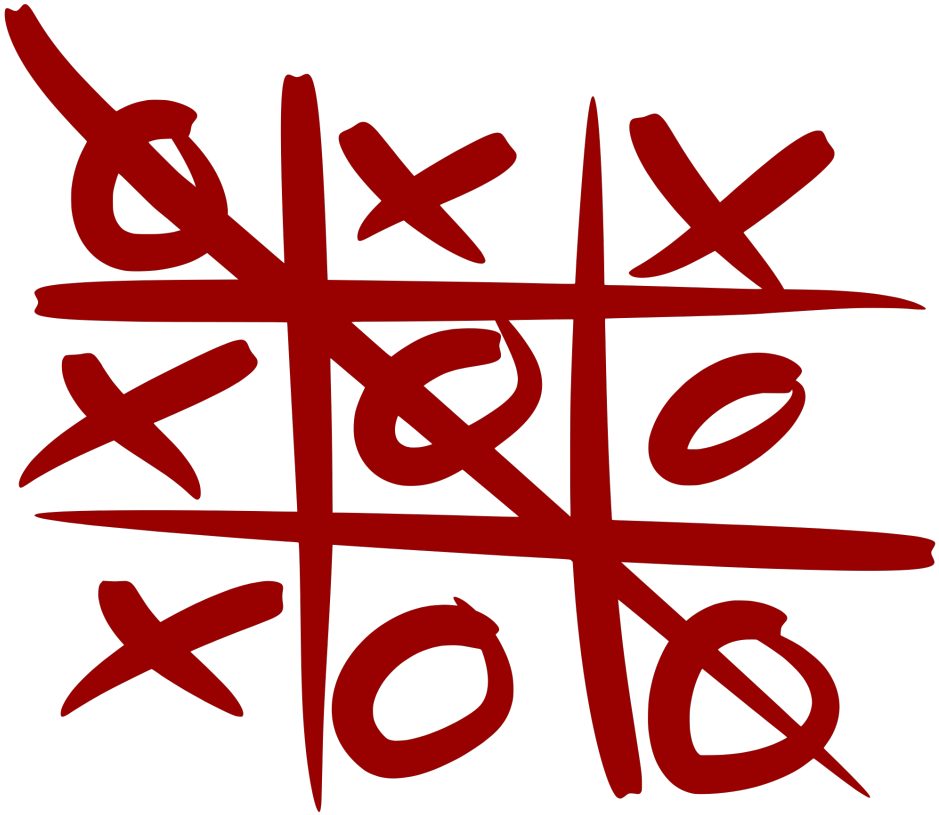

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What is AI?

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.

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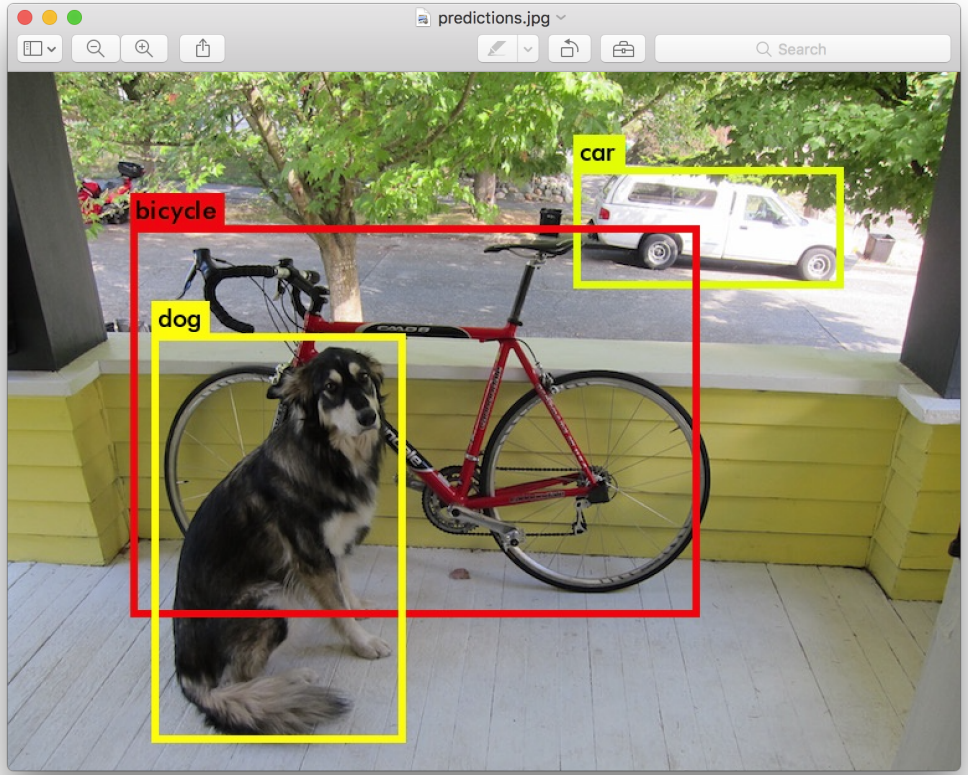
Main application domains of AI

Vision

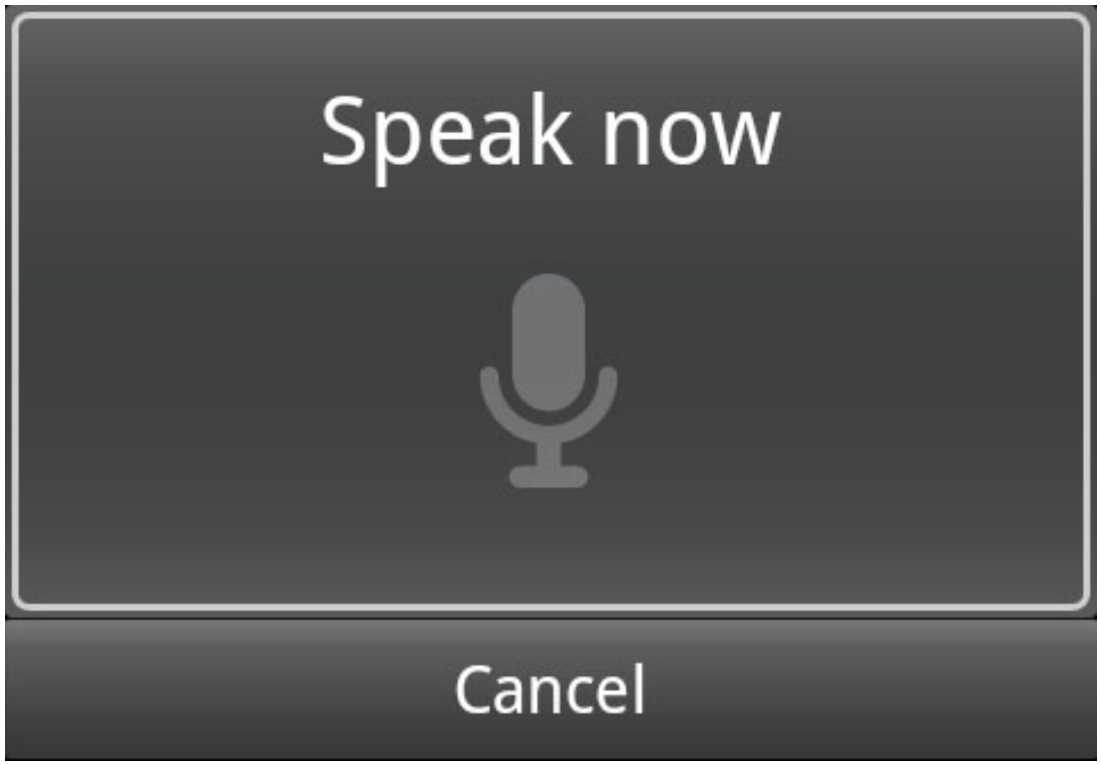
- Object/face recognition,
- Detection,
- Autonomous vehicles,
- Automatic diagnostic,
- Defects identification,
- Video applications...



Main application domains of AI

Natural Language Processing (NLP)

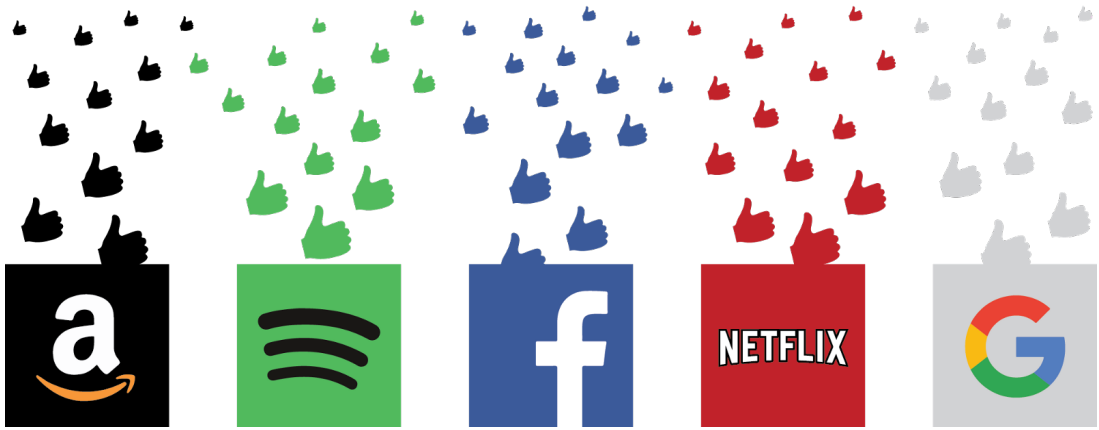
- Automatic assistant,
- Voice-to-text,
- Automatic translation,
- Automatic summarizing,
- Sentiment analysis,
- Text indexing...



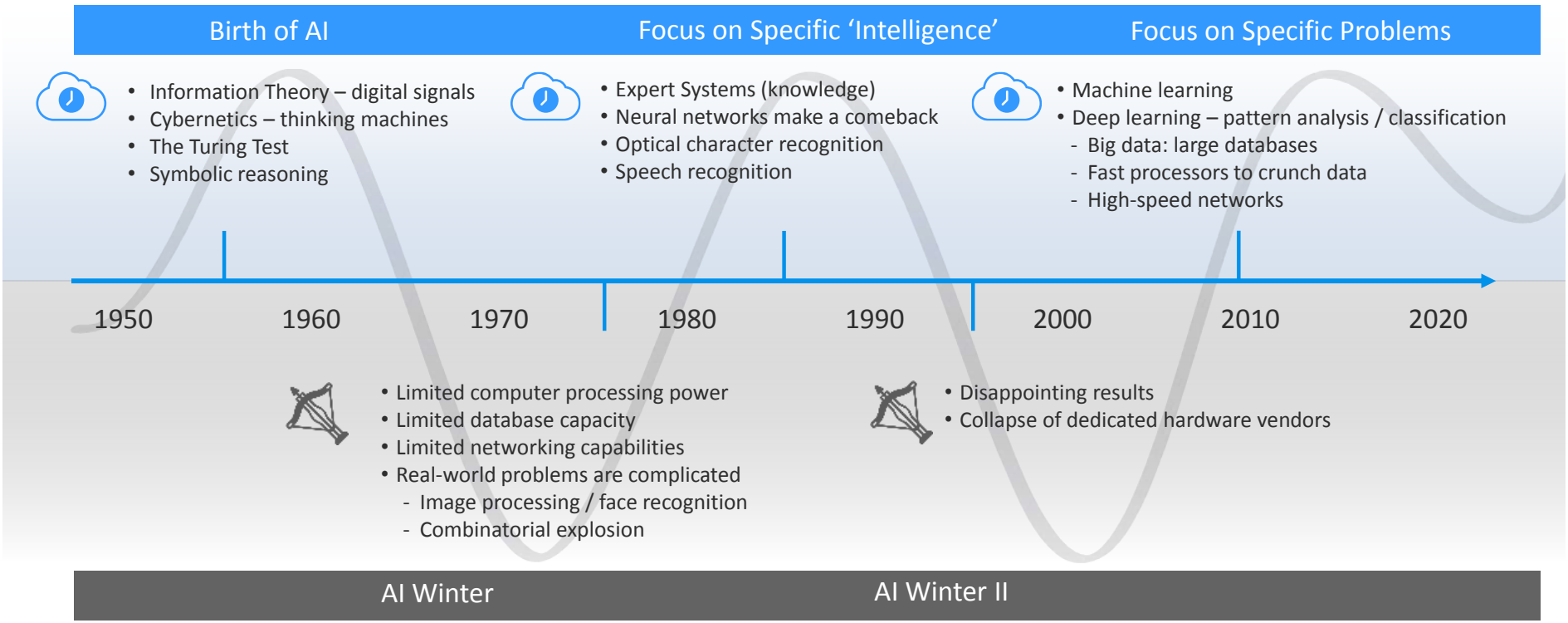
Main application domains of AI

Tons of other domains...

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



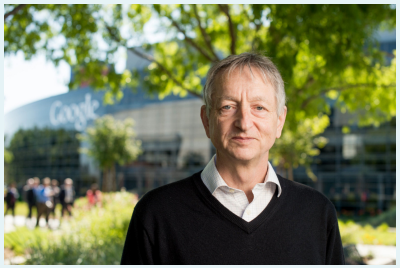
An AI Timeline



harmon.ie

The great elders of modern AI (Turing Prize 2018)

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 his work on deep learning.

Yann le Cun

- Computer scientist,
- Prof. at New York University then he joins FAIR,
- Known for his 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.

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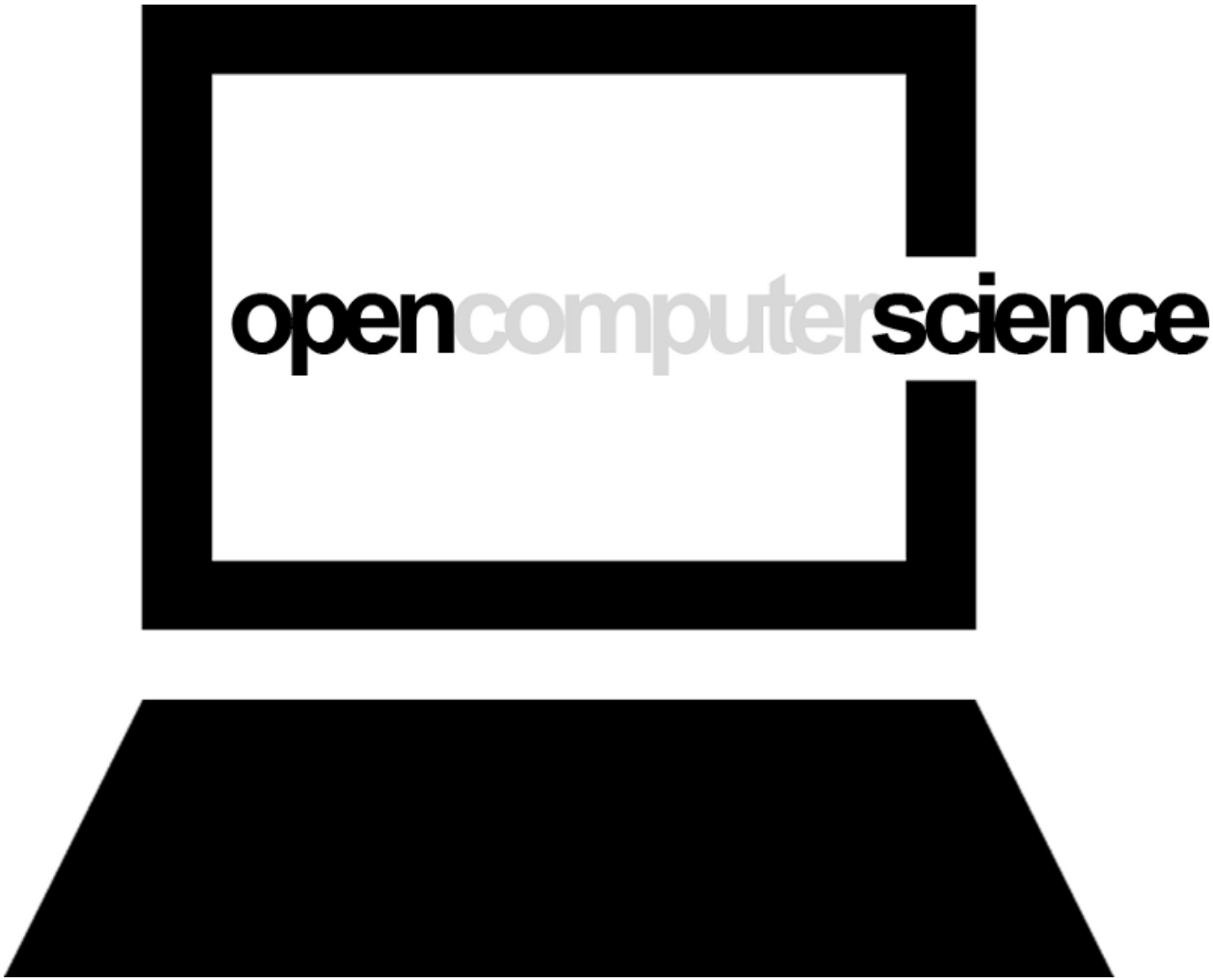

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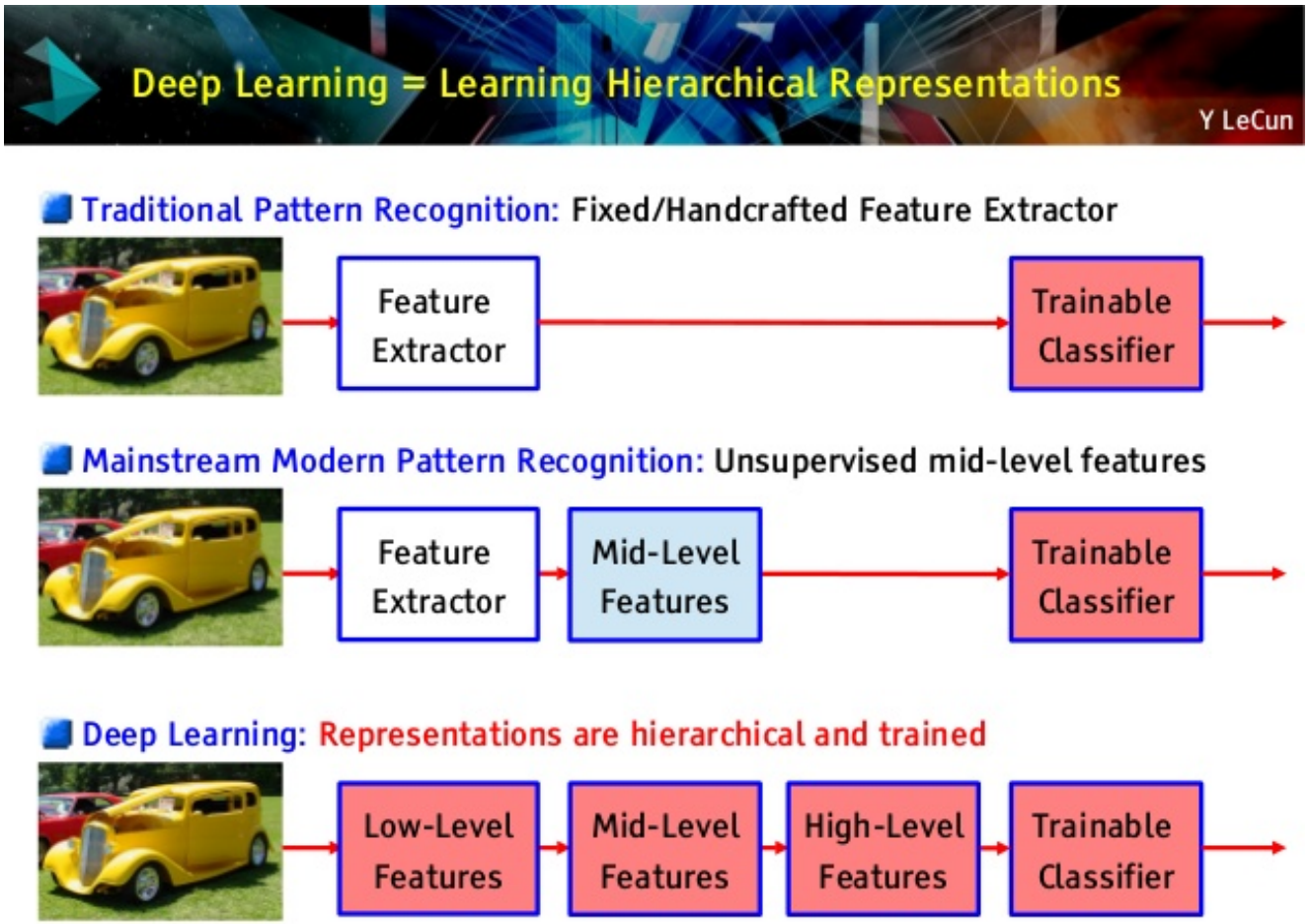


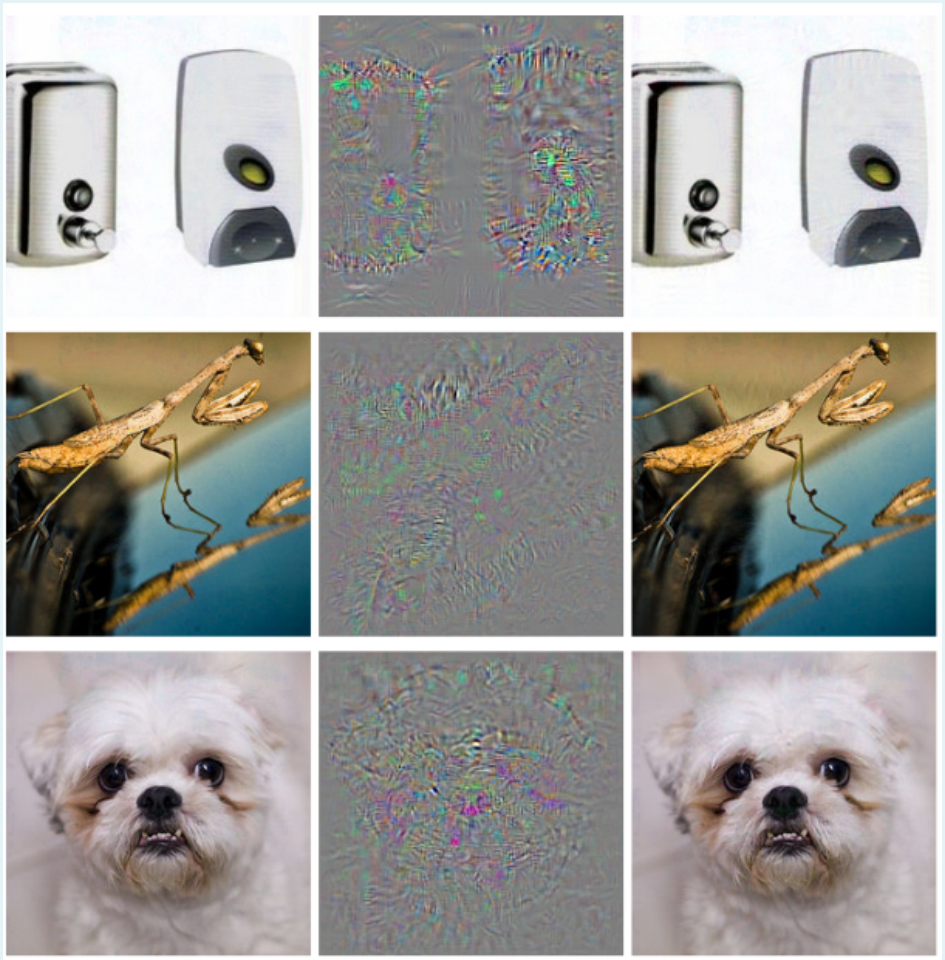
Some key open challenges (core AI research)

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 (robustness / adverserial attacks)



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

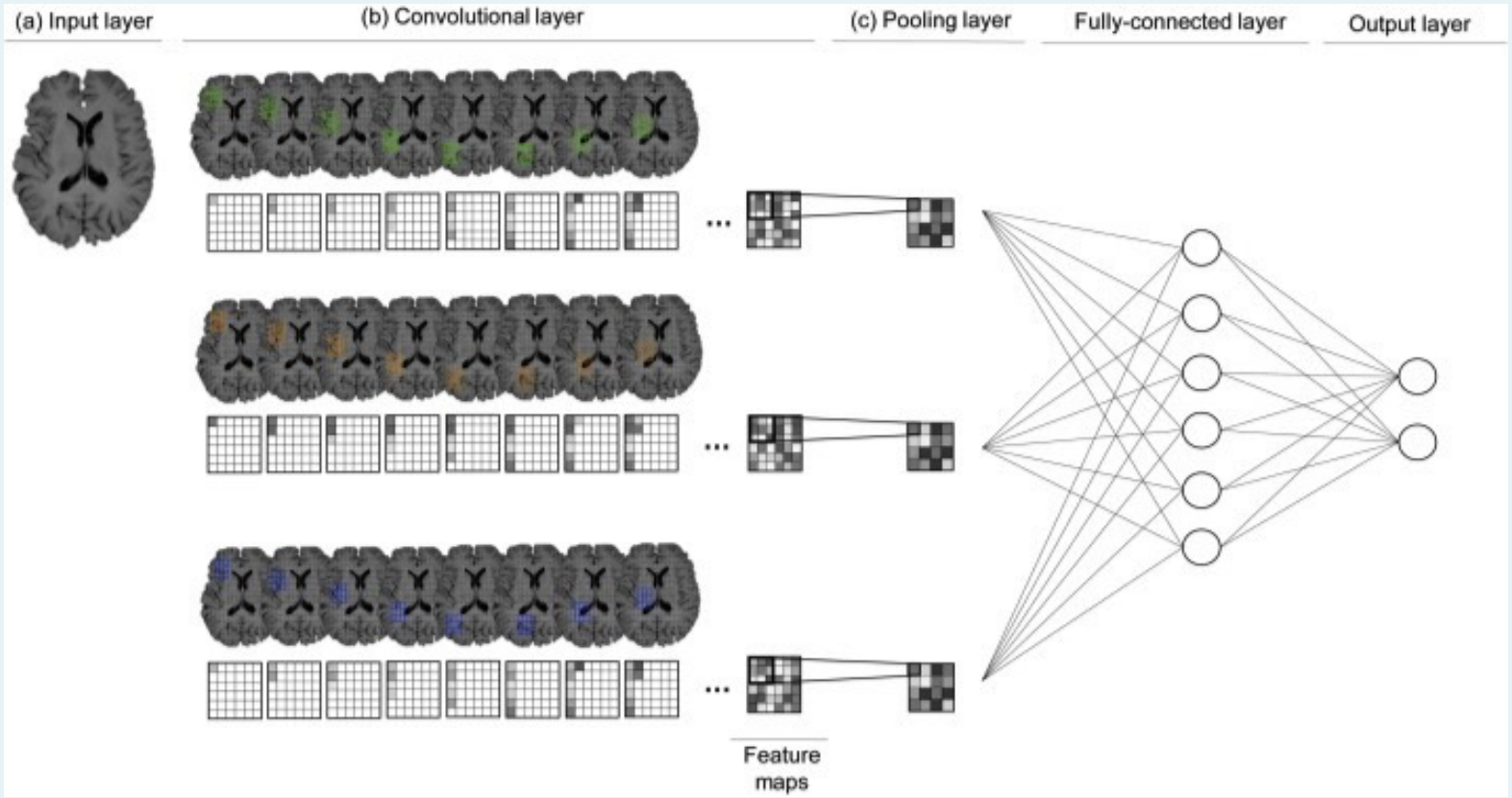
Some key open challenges (core AI research)

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

Sessions

1. Generalities about AI (today),
2. Supervised learning,
3. Unsupervised learning,
4. Practical ethics in AI,
5. Combinatorial game theory,
6. Reinforcement learning,
7. Challenge.

Lab Sessions and Challenge

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

Sessions schedule

Each session has (roughly) 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 3, 4 and 7 include students' presentations

Evaluation

Student :	Working with :	Room :	ELU616 – Autumn 2018

Written evaluations

Evaluation 1 – AI generalities (during Session 2) :

Correct answers	Q1 | Q2 | Q3
	Q4 | Q5 | Q6

Evaluation 2 – Supervised Learning (during Session 3) :

Correct answers	Q1 | Q2 | Q3
	Q4 | Q5 | Q6

Evaluation 3 – Unsupervised Learning (during Session 4) :

Correct answers	Q1 | Q2 | Q3
	Q4 | Q5 | Q6

Evaluation 4 – Practical Ethics in AI (during Session 5) :

Correct answers	Q1 | Q2 | Q3
	Q4 | Q5 | Q6

Evaluation 5 – Combinatorial Game Theory (during Session 6) :

Correct answers	Q1 | Q2 | Q3
	Q4 | Q5 | Q6

Evaluation 6 – Reinforcement Learning (during Session 7) :

Correct answers	Q1 | Q2 | Q3
	Q4 | Q5 | Q6

Self-evaluation

All answers: 1-poor, 5 – excellent, pre / post

Programming Skills: /
Scientific Python: /
Linear Algebra: /
Machine Learning: /
Artificial Intelligence: /

Notes

Final mark : if #green < 30, then (#green / 3) , else { min(20, #green /3 + #blue / 5 + #red /2}
+/- Adjustement : huge personal implication, plagiarism, progress, ..

Oral evaluations

Oral eval 1 - Applications of AI (Project P0):

Visual quality of the presentation	Ok	Sharp
Description of the topic / state of art	Clear and documented	Interesting
Description of Open Issues	Ok	Critical comparison
Ethical considerations		ok

Oral eval 2 - Supervised Learning (Project P1):

Theoretical understanding	Basic	Advanced
Experimentations – relevance and discussion	Basic	Advanced
Quality of the code and visual aspects of the notebook		ok
Advanced aspects (++ creativity, ++ metrics, tests, statistics, …)		ok
Notes:		

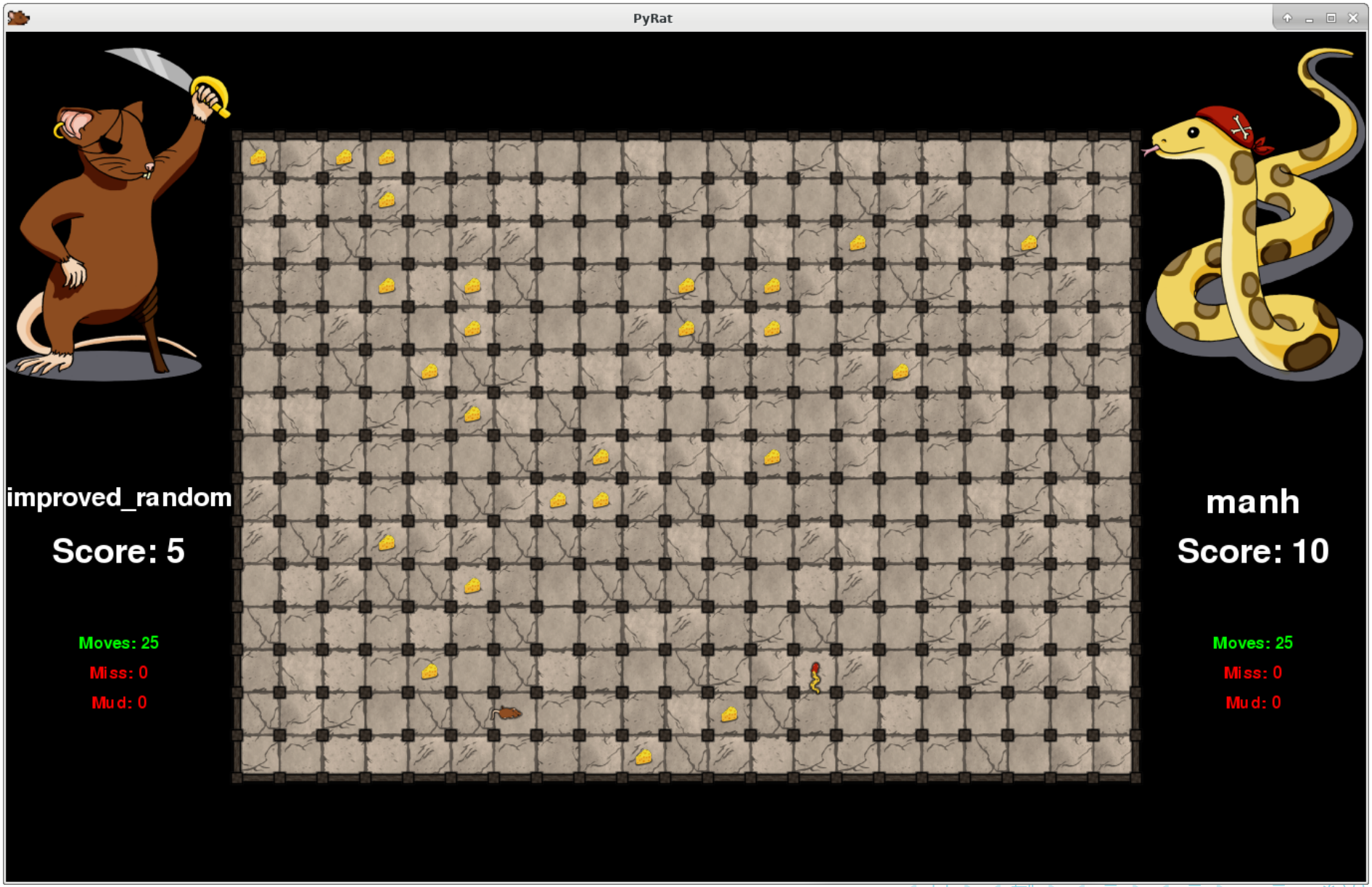
Oral eval 3 - Unsupervised Learning (Project P2):

Theoretical understanding	Basic	Advanced
Experimentations – relevance and discussion	Basic	Advanced
Quality of the code and visual aspects of the notebook		ok
Advanced aspects (++ creativity, ++ metrics, tests, statistics, …)		ok
Notes:		

Final Presentation – (during Session 7) :

Description of the approach	Clear	Thorough	Critical comparison
Evaluate the AI	Basic tests	Statistics	Other tests
Creativity	Basic	Rich	Exceptional
Quality of the presentation	Clear	Convincing	Interesting
Q&A	Convincing	Thoughtful	Justified
Notes :			

Non-symmetric PyRat without walls / mud



Lab Session 1 and assignment

Introductory TP (TP0)

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

Project 0 (P0) (oral presentation)

You will choose a topic on an application of AI.
You have to prepare a 7 minutes presentation (for session 3) 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