

Artificial Intelligence Applied to Engineering



source

Lluís Talavera, 2022



Syllabus summary (I)

Instructor

Lluís Talavera `talavera@cs.upc.edu`

ETSEIB: 8.45 (8th floor)

Office hours: by appointment

Meeting Day/Time

Tues./Thurs. 2:30 p.m. - 4:00 p.m.

Location: Computer lab H-5.2

Content (Machine Learning)

- Data Exploration/Preparation
- Supervised ML
- Unsupervised ML
- Deep Learning
- Other ML topics

Grading

- Project (50%)
- Laboratory assignments (50%)

Syllabus summary (II)

Technical requirements

- Atenea Digital Campus: Information, materials, assignments and projects.
- Google Drive
- Google Collab (Jupyter Notebooks)

Recommended prerequisites

- Programming experience in Python
- Familiarity with Pandas library

Assignment/Project delivery

- Jupyter Notebook

Artificial Intelligence

AI is difficult to define because we do not have a clear definition of what is intelligence. But we can recognize what we would call intelligent behaviors.

Artificial (General) Intelligence: Do anything a human can do.

Artificial (Narrow) Intelligence: Mimic intelligent behaviors: self-driving, Google Assistant, facial recognition,...

Lots of progress in ANI as a result of dividing AI into specific areas:

- Natural Language Processing (NLP)
- Knowledge Representation
- Automated Reasoning
- Computer Vision
- Robotics
- and...

...what this course is about: **Machine Learning**.

Machine learning definitions

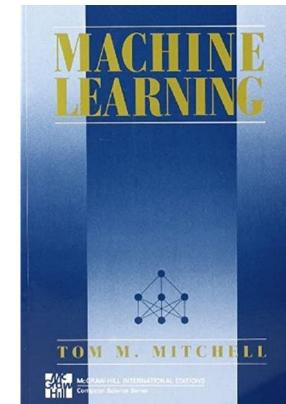


"Field of study that gives computers the ability to learn without being explicitly programmed"

Arthur Samuel, AI pioneer, 1959

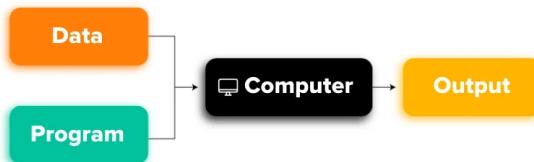
*"Each machine learning problem can be precisely defined as the problem of improving some **measure of performance P** when executing some **task T**, through some type of **training experience E**."*

Tom Mitchell, Machine Learning, McGraw Hill, 1997
(additional chapter)

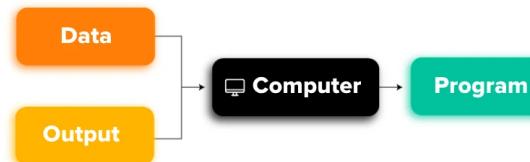


ML vs traditional programming

TRADITIONAL PROGRAMMING

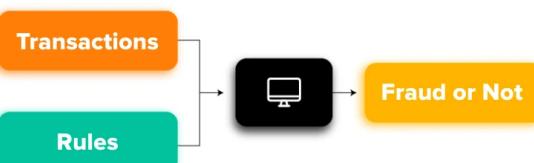


MACHINE LEARNING



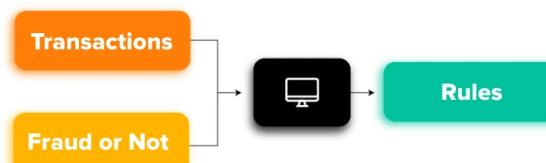
An example: predicting fraudulent claims

TRADITIONAL PROGRAMMING



- Rule1. Claim time - Submit time < 1 h
- Rule2. Agreement review time > 5 m
- Rule3. ...

MACHINE LEARNING



source

Spam prediction as a ML problem

*"Each machine learning problem can be precisely defined as the problem of improving some **measure of performance P** when executing some **task T**, through some type of **training experience E**."*

The task (T) = Given an e-mail, output a label of spam/not spam

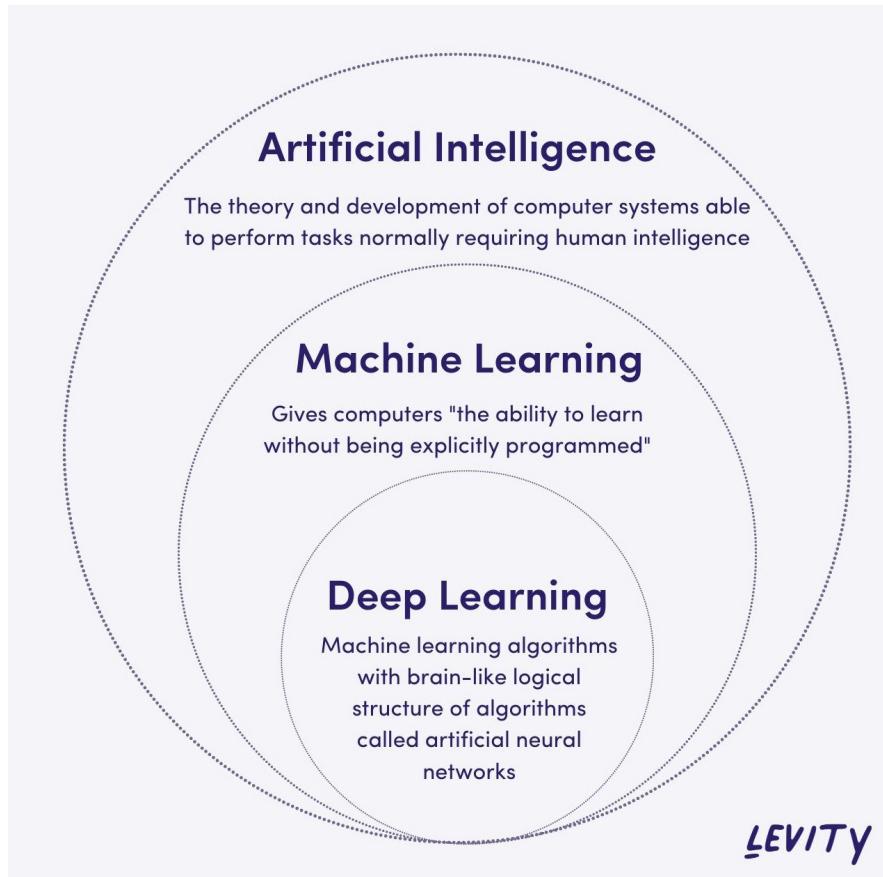
The training experience (E) = Collection of e-mails labeled as spam/not spam

The performance measure (P) = Accuracy (number of correct predictions)

E may need some preprocessing to transform it into a suitable form (for example, a tabular representation).

It is important to choose the performance measure (P) best suited for the task (T).

AI vs ML vs Deep Learning



source

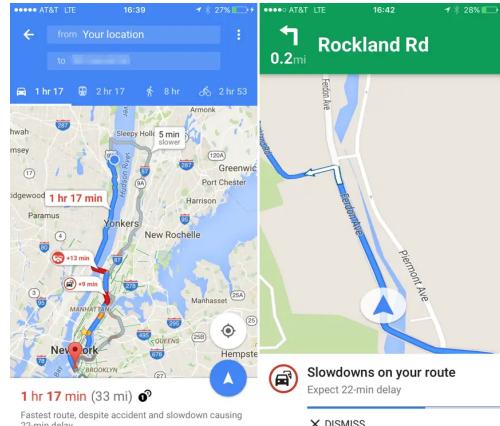
Deep Learning is well suited for large datasets and complex data structures.

Some ML applications

AlphaGo ([source](#))



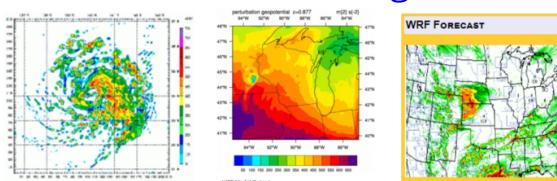
Google Maps ([source](#))



Autonomous Driving ([source](#))



Weather Forecasting ([source](#))



CycleGAN ([source](#))



A lot of daily life ML applications!

- Music recommendations
- Spam mail detection
- Fraudulent bank transactions
- Tagging users in photos on social media
- Medical diagnosis
- Customer churn prediction
- Improve e-commerce conversion rates
- Customer segmentation
- Document retrieval

Types of Machine Learning

