Questo è un commento di prova.

Machine Learning–part I lez. 1

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Questo è della seconda pagina

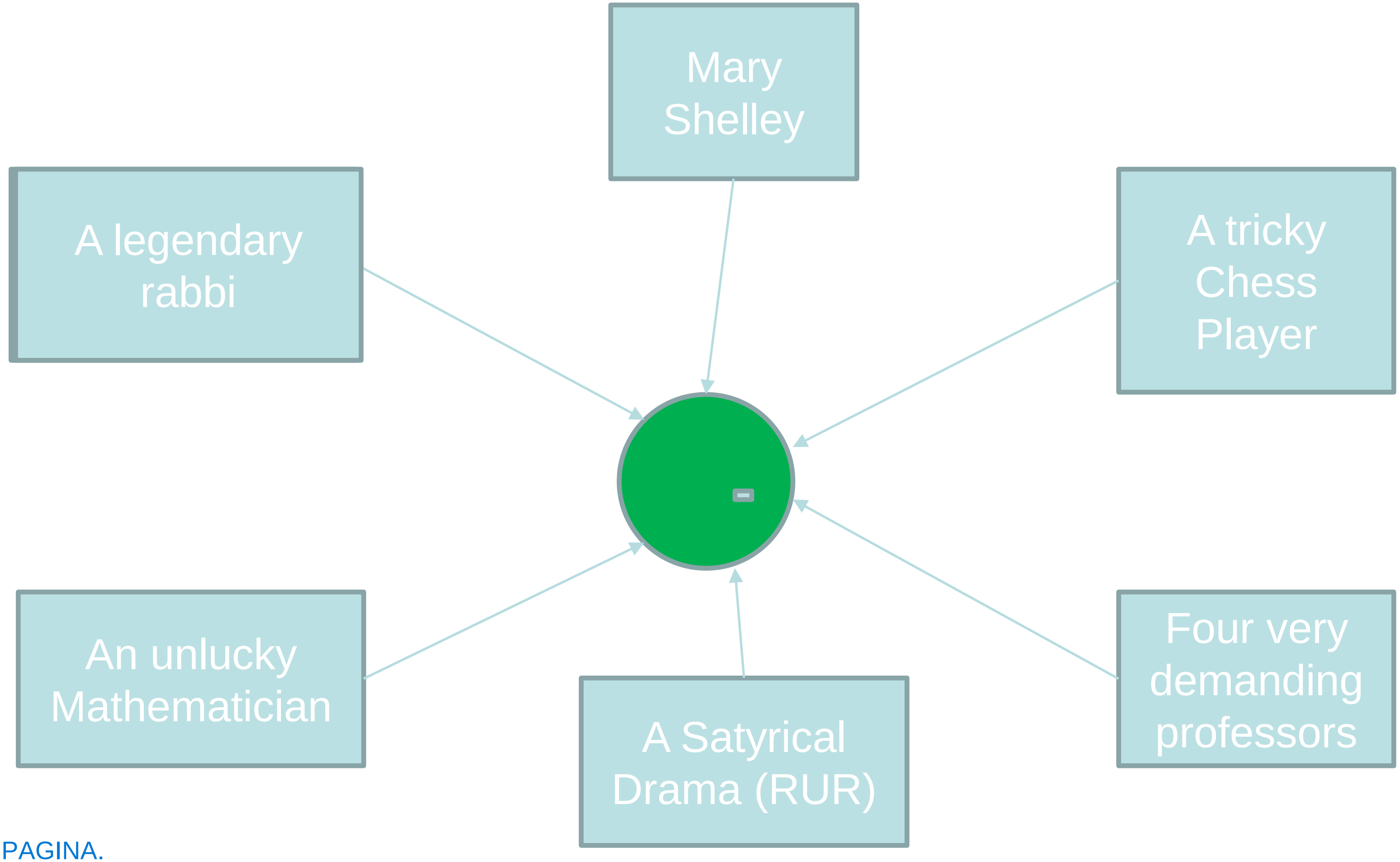
Contact Time

- Time : Tuesday 14.00-18.00 (2.00 p.m-6.00 p.m)
- Where: Room 430, Fourth floor, Centro Direzionale, Isola C4 or TEAMS
- For the meeting is COMPULSORY to send an email of reservation at least two days before the time of meeting.
- My email: francesco.camastra@uniparthenope.it
- My page: https://sites.google.com/view/francesco-camastra/home

Lection Syllabus

- Presentation of the Course
- Aim of the course
- Some Historical Sketches

A gallery for AI



TERZA PAGINA.

Judah Loew (Rabbi Loew)

- Rabbi Loew is the subject of the legend about the creation of a **Golem**, a creature made out of clay to defend the Jews of the Prague Ghetto from antisemitic attacks, particularly the blood libel.He is said to have used mystical powers based on the esoteric knowledge of how God created.

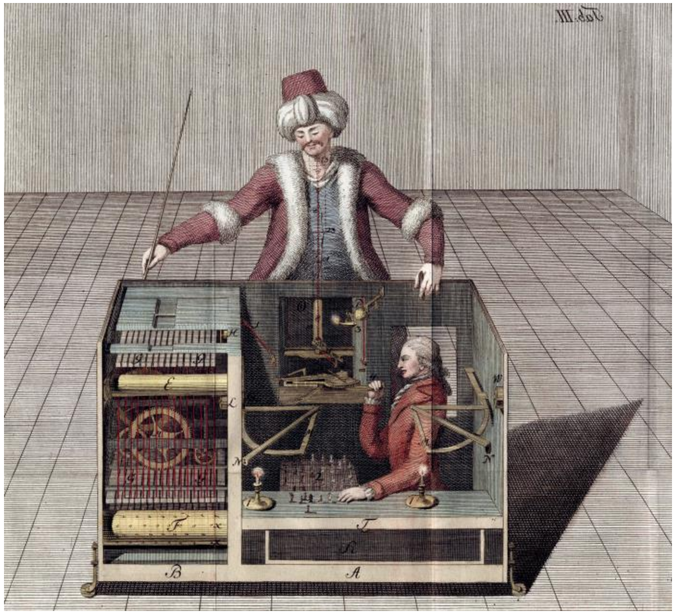
Golem

Wolfgang Von Kempelen (1734-1804)

- Von Kempelen was most famous for his construction of **The Turk**, a chess playing automaton presented to Maria Theresa of Austria in 1769. The machine consisted of a life-sized model of a human head and torso, dressed in Turkish robes and a turban, seated behind a large cabinet on top of which a chessboard was placed.

The Turk

- The machine appeared to be able to play a strong game of chess against a human opponent, but was in fact merely an elaborate simulation of mechanical automation: a human chess master concealed inside the cabinet puppeteered the Turk from below by a series of levers.



The Turk (cont.)

- With a skilled operator, the Turk won most of the games played during its demonstrations around Europe and the Americas for nearly 84 years, playing and defeating many challengers including statesmen such as Napoleon Bonaparte and Benjamin Franklin
- The trick was discovered by Edgar Allan Poe

Frankenstein

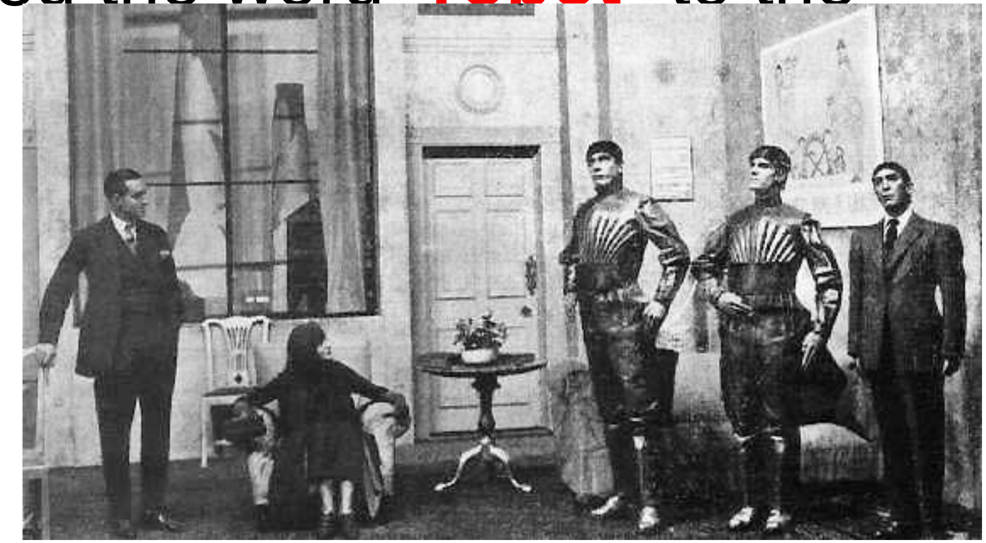
- ***Frankenstein; or, The Modern Prometheus*** is a novel written by English author Mary Shelley (1797–1851) that tells the story of **Victor Frankenstein**, a young scientist who creates a hideous, sapient creature in an unorthodox scientific experiment.

Frankenstein (cont.)

- Since the novel's publication, the name "Frankenstein" has often been used to refer to the monster itself. This usage is considered erroneous.
- In the novel, Frankenstein's creation is identified by words such as "creature", "monster", "daemon", "wretch", "abortion", "fiend" and "it".

RuR

- ***R.U.R.*** is a 1920 science fiction play by the Czech writer Karel Čapek. *R.U.R.* stands for *Rossumovi Univerzální Roboti* (Rossum's Universal Robots).It premiered on 25 January 1921 and introduced the word "**robot**" to the English language.



RuR (cont.)

- The play begins in a factory that makes artificial people, called ***roboti*** (**robots**), from synthetic organic matter. They are not exactly robots by the current definition of the term: they are living flesh and blood creatures rather than machinery and are closer to the modern idea of androids or replicants.
- They may be mistaken for humans and can think for themselves. **They seem happy to work for humans at first, but a robot rebellion leads to the extinction of the human race**.

Isaac Asimov

- Isaac Asimov published in 1942 a short story Runaround" (included in the 1950 collection *I, Robot*), where he introduced **The Three Laws of Robotics**.

The Three Laws of Robotics

(the "**Handbook of Robotics, 56th Edition, 2058 A.D."**)

1. **First Law: A robot may not injure a human being or, through inaction, allow a human being to come to harm.**
2. **Second Law: A robot must obey the orders given it by human beings except where such orders would conflict with the First Law.**
3. **Third Law: A robot must protect its own existence as long as such protection does not conflict with the First or Second Law.**

Turing

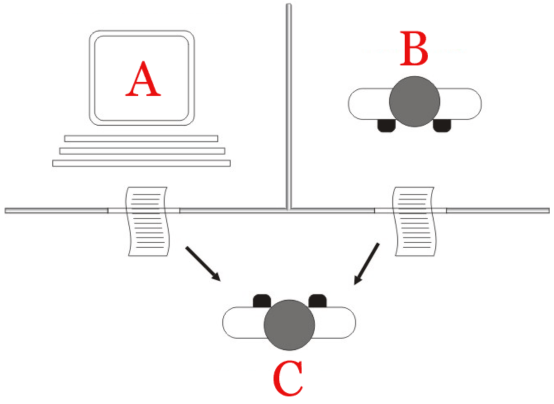
- The **Turing test**, developed by **Alan Turing** in 1950, is a **test of a machine's ability to exhibit intelligent behavior equivalent to, or indistinguishable from, that of a human**. Turing proposed that a **human evaluator would judge natural language conversations between a human and a machine designed to generate human-like responses**.

Turing test

- The evaluator would be aware that one of the two partners in conversation is a machine, and all participants would be separated from one another. The conversation would be limited to a text-only channel such as a computer keyboard and screen so the result would not depend on the machine's ability to render words as speech.

Turing

- If the evaluator cannot reliably tell the machine from the human, the machine is said to have passed the test. The test results do not depend on the machine's ability to give correct answers to questions, only how closely its answers resemble those a human would give.



A proposal for the Dartmouth Summer Research Project on Artificial Intelligence

- We (John McCarthy, Marvin L. Minsky, Nathaniel Rochester, and Claude E. Shannon) propose that a 2 month, 10 man study of artificial intelligence be carried out during the summer of 1956 at Dartmouth College in Hanover, New Hampshire. The study is to proceed on the basis of the conjecture that every aspect of learning or any other feature of intelligence can in principle be so precisely described that a machine can be made to simulate it.

A proposal for the Dartmouth Summer Research Project on Artificial Intelligence

- An attempt will be made to find how to make machines use language, form abstractions and concepts, solve kinds of problems now reserved for humans, and improve themselves. We think that a significant advance can be made in one or more of these problems if a carefully selected group of scientists work on it together for a summer.
- The following are some aspects of the artificial intelligence problem:

(cont.)

- **Automatic Computers**
  - If a machine can do a job, then an automatic calculator can be programmed to simulate the machine. The speeds and memory capacities of present computers may be insufficient to simulate many of the higher functions of the human brain, but the major obstacle is not lack of machine capacity, but our inability to write programs taking full advantage of what we have.

(cont.)

- **How Can a Computer be Programmed to Use a Language**
  - It may be speculated that a large part of human thought consists of manipulating words according to rules of reasoning and rules of conjecture. From this point of view, forming a generalization consists of admitting a new word and some rules whereby sentences containing it imply and are implied by others. This idea has never been very precisely formulated nor have examples been worked out.

(cont.)

- **Neuron Nets**
  - How can a set of (hypothetical) neurons be arranged so as to form concepts. Considerable theoretical and experimental work has been done on this problem by Uttley, Rashevsky and his group, Farley and Clark, Pitts and McCulloch, Minsky, Rochester and Holland, and others. Partial results have been obtained but the problem needs more theoretical work.

(cont.)

- **Theory of the Size of a Calculation**
  – If we are given a well-defined problem (one for which it is possible to test mechanically whether or not a proposed answer is a valid answer) one way of solving it is to try all possible answers in order. This method is inefficient, and to exclude it one must have some criterion for efficiency of calculation. Some consideration will show that to get a measure of the efficiency of a calculation it is necessary to have on hand a method of measuring the complexity of calculating devices which in turn can be done if one has a theory of the complexity of functions. Some partial results on this problem have been obtained by Shannon, and also by McCarthy.

(cont.)

- **Self-Improvement**
  - Probably a truly intelligent machine will carry out activities which may best be described as self-improvement. Some schemes for doing this have been proposed and are worth further study. It seems likely that this question can be studied abstractly as well.

(cont.)

- **Abstractions**
  - A number of types of “abstraction” can be distinctly defined and several others less distinctly. A direct attempt to classify these and to describe machine methods of forming abstractions from sensory and other data would seem worthwhile

(cont.)

- **Randomness and Creativity**
  - A fairly attractive and yet clearly incomplete conjecture is that the difference between creative thinking and unimaginative competent thinking lies in the injection of a some randomness. The randomness must be guided by intuition to be efficient. In other words, the educated guess or the hunch include controlled randomness in otherwise orderly thinking.

Partecipants

- Dr. Marvin Minsky
- Dr. Julian Bigelow
- Prof. D.M. Mackay
- Mr. Ray Solomonoff
- Mr. John Holland
- Mr. John McCarthy
- (Trenchard More)
- (W. Ross Ashby)
- (Abraham Robinson)
- (Tom Etter)
- (David Sayre)
- Dr. Claude Shannon (4w)
- Mr. Nathanial Rochester (4w)
- Mr. Oliver Selfridge (4w)
- Mr. Allen Newell (2w)
- Prof. Herbert Simon (2w)
- (John Nash)
- (W.S. McCulloch)
- (Arthur Samuel)
- (Kenneth R. Shoulders)
- (Alex Bernstein)

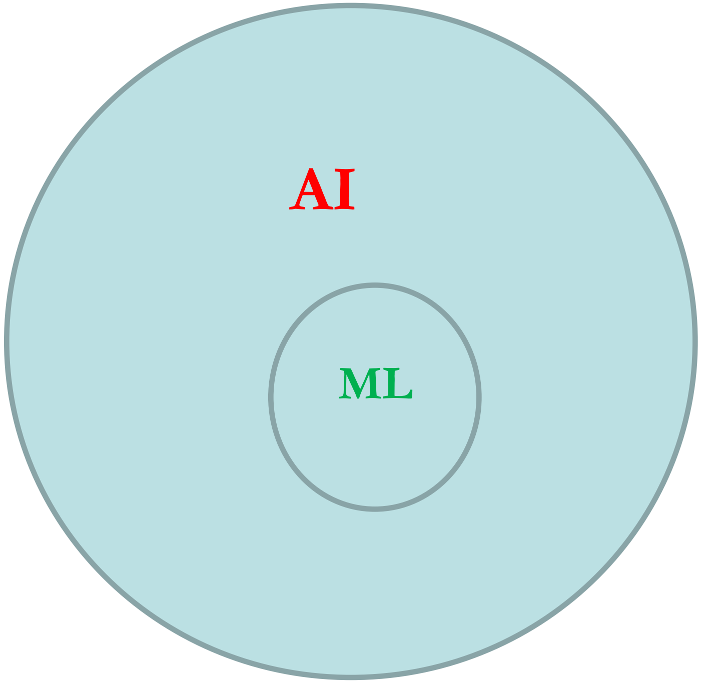
Learning

- The ability to learn is one of the **distinctive attributes of intelligent behavior**. Following Carbonell et al, we can say that “*Learning process includes the acquisition of new declarative knowledge, the development of motor and cognitive skills through instruction or practice, the organization of new knowledge into general, effective representations, and the discovery of new facts and theories through observation and experimentation*”

Machine Learning

- The **study and computer modeling of learning process in their multiple manifestations constitutes the topic of *Machine learning***.

Artificial Intelligence (AI) vs. Machine Learning (ML)



Machine Learning (by Michalski's book)

- Machine learning has been developed around the following primary research lines:
  - ***Task-Oriented Studies***, that is the development of learning systems to improve performance in a predetermined set of tasks.
  - ***Cognitive Simulation***, namely the investigation and computer simulation of human learning processes.
  - ***Theoretical Analysis***, i.e., the theoretical investigation of possible learning methods and algorithms independently of application domain.

Machine Learning Systems

- Although machine learning systems can be classified according to different view points, a common choice is **to classify machine learning systems on the basis of the *underlying learning strategies* used**.

The Teacher and The Learner

- In machine learning two entities, the ***teacher*** and the ***learner***, play a crucial role.
- The ***teacher is the entity that has the required knowledge to perform a given task***.
- The ***learner is the entity that has to learn the knowledge to perform the task***.
- We can **distinguish learning strategies by the amount of inference the learner performs on the information provided by the teacher**.

First Case

- If a computer system (the learner) is programmed directly, **its knowledge increases but it performs no inference since all cognitive efforts are developed by the programmer** (the teacher).

Second Case

- On the other hand, **if a system independently discovers new theories or invents new concepts**, **it must perform a very substantial amount of inference**; it is deriving organized knowledge from experiments and observations.

Intermediate Case

- An intermediate case it could be a student determining how to solve a math problem by analogy to problem solutions contained in a textbook. This process requires inference but much less than discovering a new theorem in mathematics.
- Increasing the amount of inference that the learner is capable of performing, the burden on the teacher decreases.

Taxonomy of machine learning

- The taxonomy tries to capture the notion of trade-off in the amount of effort required by both the learner and the teacher. We can identify four different learning types:
  - **Rote Learning**
  - **Learning from instruction**
  - **Learning by analogy**
  - **Learning from examples**

Rote Learning

- Rote learning consists in the direct implanting of new knowledge in the learner. No inference or other transformation of the knowledge is required on the part of the learner.

Rote Learning (cont.)

- Variants of this method include:
  - **Learning by being programmed or modified by an external identity.** It requires no effort on the part of the learner. For instance, the usual style of computer programming.
  - **Learning by memorization of given facts and data with no inferences drawn from the incoming information.** For instance, the primitive database systems.

Learning from Instruction

- Learning from instruction (or ***Learning by being told***) consists in **acquiring knowledge from a teacher or other organized source**, such as a textbook, requiring that the **learner transform the knowledge from the input language to an internal representation**.

Learning from Instruction (cont.)

- The new information is integrated with prior knowledge for effective use. The learner is required to perform some inference, but a large fraction of the cognitive burden remains with the teacher, who must present and organize knowledge in a way that incrementally increases the learner's actual knowledge. **Learning from instruction mimics education methods**.

Learning from Instruction (cont.)

- Therefore, the machine learning task is to build a system that can accept instruction and can store and apply this learned knowledge effectively.

Learning by Analogy

- Learning by analogy consists in **acquiring new facts or skills by transforming and increasing existing knowledge that bears strong similarity to the desired new concept** or skill into a form effectively useful in the new situation.
- A Learning-by-analogy system might be applied to convert an existing computer program into one that performs a closely-related function for which it was not originally designed.

Learning by Analogy (cont.)

- Learning by analogy **requires more inference on the part of the learner that does rote learning or learning from instruction**.
- A fact or skill analogous in relevant parameters must be retrieved from memory; then the retrieved knowledge must be transformed, applied to the new situation, and stored for future use.