

# A (very) Short Introduction to Artificial Intelligence

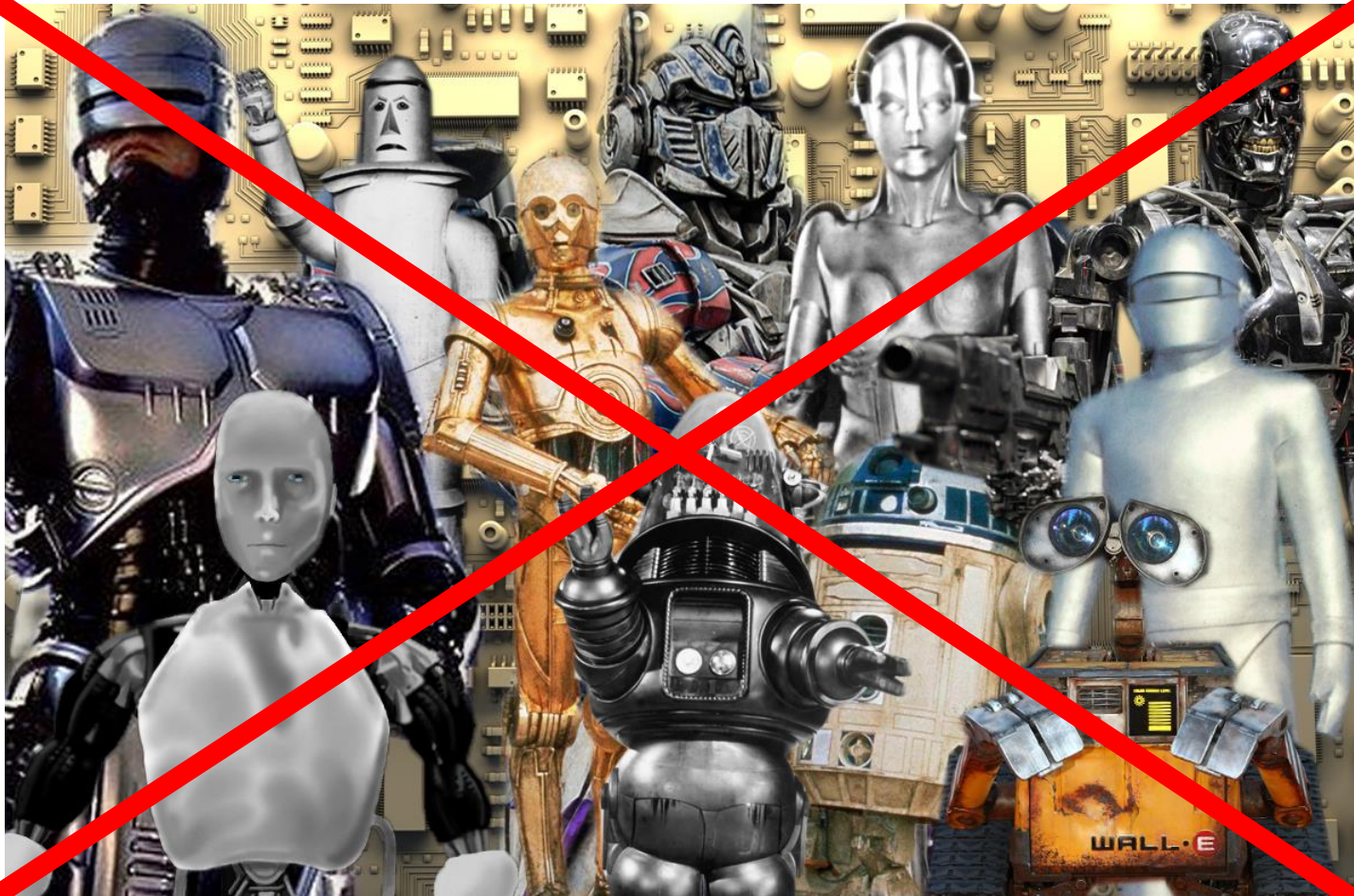


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# What is Artificial Intelligence?

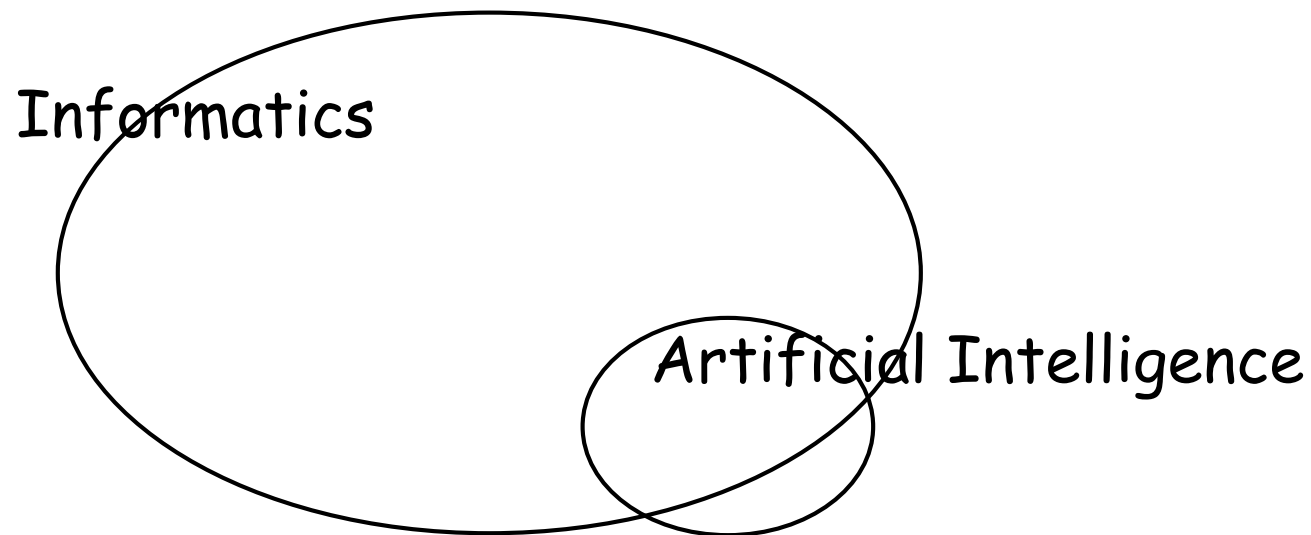


**NO!!**



# What is Artificial Intelligence?

Artificial Intelligence is a branch of Informatics with influences also from other fields of study



So... let's try to define the term Informatics....

# What is Informatics?

Informatics:

- Excel
- Word
- Power Point
- Internet
- Facebook
- ...

**NO!!**



In general:

if you are able (even good)  
in using a computer, you are  
not (necessarily) an expert  
in Informatics

# What is Informatics?

Informatics is the science that studies automatic calculation (computation).

**For instance**

- What can be calculated automatically and what cannot?
- How to make a calculation automatic?
- How to improve the efficiency of automatic calculations?
- How can we increase the set of problems that we can solve automatically?

# Why Informatics?

... in other words: why do we need to calculate automatically?

Because manually it would be too much time consuming, exhausting... or even impossible!

## Examples

- Calculate mathematic operations on billions of numbers
- Calculate statistics of the incomes of all the clients of a particular bank in Portugal
- Calculate the trajectory of all the airplanes flying over the USA in one year
- ...

# Informatics: How does it work?

Traditionally, it all starts with the manual/intellectual developemnt of a strategy to solve a problem.

Such a strategy is called algorithm.

A bit more precisely, an algorithm is a sequence of very precise and unambiguous steps. Performing the whole sequence of steps brings us to the solution of the problem.

Finally, the algorithm has to be translated into a program.



# An Important Remark

In the process that leads to the solution of a problem by means of a computation, there is a (the!) fundamental step that is done by a human being:

"thinking"/"imagining"/"developing" the strategy to solve the problem (the algorithm)

This process is often called "traditional" computational method

This name is justified by the fact that this method has been employed for decades to automatize many processes of our lives and it is still widely used nowadays!



# Why Artificial Intelligence?

There are problems for which:

- we are not able to imagine an algorithm, or
- the only algorithms that we can imagine have no chance of being executed in human time, no even by the most powerful existing computer!

Those problems (which we generally call complex problems) are becoming more and more numerous nowadays and their solution more and more useful...

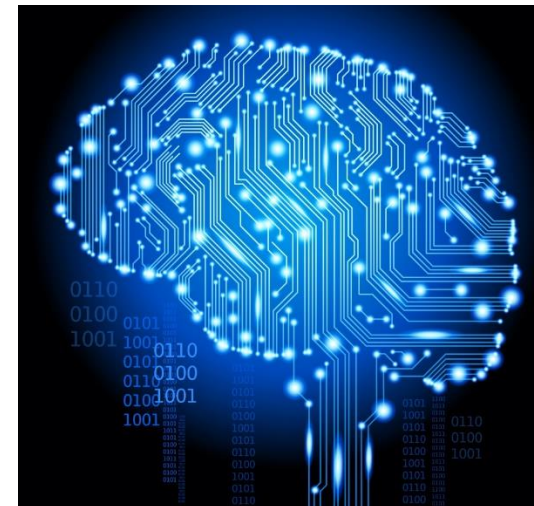
It is clear that for these problems the traditional computational method fails!

# Examples of Complex Problems

- Client characterization  
Will this person be a good client? What product does he/she prefer?
- Face recognition  
I give you a photo of a face, you have to tell me the owner of that face
- Development of new drugs  
What molecular compound has these very precise characteristics?
- Predicting diseases  
Will a person get a particular disease 20 years from now?
- ...

# What is Artificial Intelligence?

A set of computational methods aimed at solving (or at least approximating!) complex problems



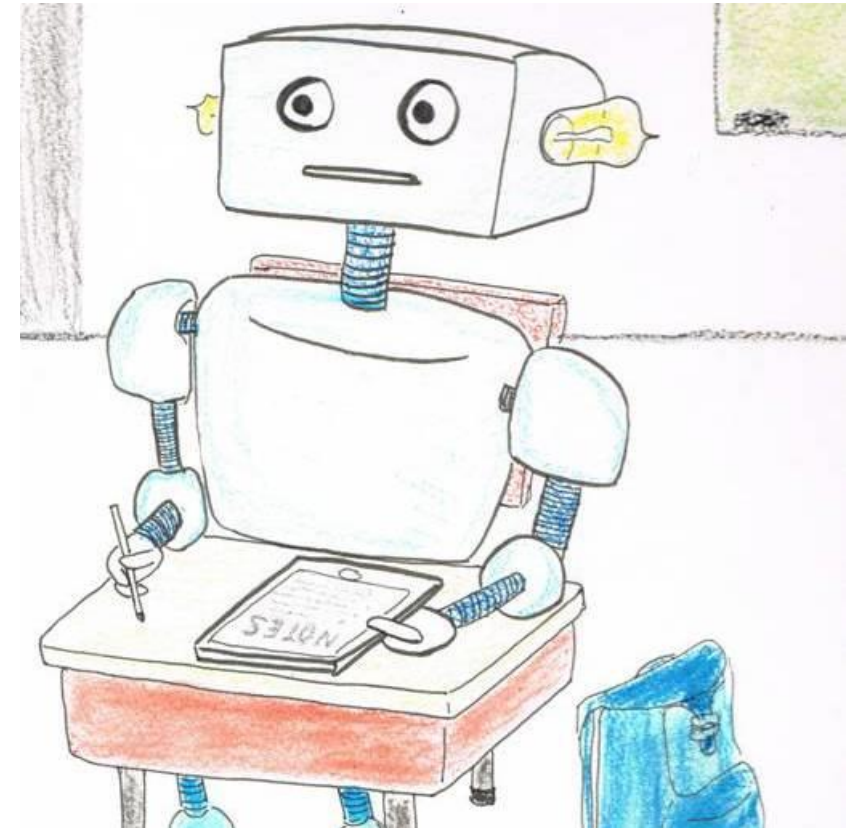
# How does Artificial Intelligence work?

We are not able to imagine a solution (or a feasible solution) to our problem

So...

we try to give the computer the ability to learn how to solve it!

[Machine Learning]



# Some Artificial Intelligence Methods

- **Neural Networks**  
Computational systems that mimick the architectural structure of the human brain
- **Evolutionary Computation**  
Computational systems that mimick the principles of the Darwinian theory of evolution
- **Swarm Intelligence**  
Computational systems that mimick the dynamics of swarms of insects (their way of collectively solving problems)
- **Fuzzy Systems**  
Computational systems that mimick the human ability of dealing with imprecise and vague information

# Two Typical Scenarios

- **Predictive Modelling**

Prediction on the basis of past information (data)

- **Descriptive Modelling**

Similarity between different observations and interpretation (data)

# A Case Study

- Recognition of the textual content of a new legislation and definition of similarity measures with existing legislations
- Prediction of the costs of a new legislation

A project that is going to start in 2020 at NOVA IMS



# Thank you

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