







INTELLIGENCE FOR A MACHINE

Turing Test is passed when a machine's behaviour is not distinguishable from a human's behaviour (1950).

The academic discipline of AI was founded shortly after the Turing Test was introduced (1956, Dartmouth conference)

"Artificial neurones" had already been studied (McCullouch & Pitts, 1943) and **the first robot dates back to c.a. 400 BC!**

Alan Turing's seminal paper: Computing Machinery and Intelligence,1950 Full text: https://academic.oup.com/mind/article-pdf/LIX/236/433/9866119/433.pdf



THE FIRST ROBOT

Talos (or Talus) was a giant automaton made of bronze to **protect Europa** from pirates and invaders.

The sorceress Medea killed him after promising to **make** him immortal.

His grandson was a wise king of Crete who became a **judge** of the dead due to his inflexible integrity...

https://gantzmythsources.libs.uga.edu/chapter-8-minos-and-crete/section-1-rhadamanthys/p-259/



THE MODERN TIMES

In the 50s, Herbert Simon "borrowed elements from [his PhD on] Administrative Behaviour. **To make a computer "think" as a human**, **Simon made it think like a corporation**.

[...]

The tradition lives on. Many contemporary AI systems do not so much mimic human thinking as they do the less imaginative minds of bureaucratic institutions."

Jonnie Penn https://www.economist.com/open-future/2018/11/26/ai-thinks-like-a-corporation-and-thats-worrying





TYPES OF AI

1. Purely Reactive: Acts only on what it see. Limited to predefined tasks. Does not evolve from past experiences.

2. Limited Memory: Can evolve from past experiences. Yet limited to predefined tasks and actions.

3. Theory of Minds: Understands human thoughts, emotions, motives and expectations. Can interact socially.

4. Self-Aware: Sentient and evolutive. Can make abstractions and inferences. Human-like intelligence, or even more.

https://futurism.com/images/types-of-ai-from-reactive-to-self-aware-infographic/



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WHAT IS MODEL DRIVEN AI?

It uses an **explicit model** of the situation of interest, that specifies the **entities** and **relationships** at play.









EXAMPLE

How would you use rules on something happening at GGD?





WHAT IS DATA DRIVEN AI

It uses **sets of examples** as an **implicit model** of the situation of interest.













TYPES OF DATA DRIVEN AI

There are 3 kinds of data-driven AI:



Classification: predicts an object's category, a.k.a. its class.



Regression: predicts a number, such as a price.



Reinforcement Learning: predicts an optimal set of actions, such as how to win a game.









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REINFORCEMENT LEARNING



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REINFORCEMENT LEARNING

Once trained, agents can operate without rewards.







SUPERVISED CLASSIFICATION

Main classification techniques:

- ► SVM
- Logistic Regression
- Bayesian Classifier
- Decision Tree
- Random Forest
- Neural Network



<text>

SVM A.K.A. SUPPORT VECTOR MACHINE

Drawing non-linear boundaries: the kernel trick.









DECISION TREE

Rules are **learned** by trying to **split** training data into refined subsets, trying all possible splits...trying all possible splits...



DECISION TREE

Trees are **finished** when **all leaves** contain (almost) **only one class**.





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IMPLEMENTING CLASSIFIERS

R is relatively **easy to program**, but may be too **slow** for very large datasets.

Python is generally **faster**, but may require **more programming** skills.













OVER-FITTING

Perfect results are **suspicious**. Errors may be minimal for the training dataset, but not for other datasets.

























PRACTICAL ISSUES

Choices & tradeoffs are involved at all steps of the implementation.

- **Training & test sets** are only samples (outliers, biases, variability).
- **Tuning parameters** cannot optimise all real-life cases.
- **Error measurements** may be abstract, complex and incomplete.
- **Real-life conditions** may differ from the test conditions.



