2. LET'S TALK ABOUT AI

2.1. WHAT IS AI?

Artificial Intelligence (AI) is a term describing computers performing human tasks. It can simply be defined as: "Human intelligence performed by a machine".

The I of AI refers to the implementation of the algorithms by the machines. It is Artificial since it is a branch of computer science. It employs statistical, mathematical methods through software scripts and techniques to automate decision making.

The independent high-level expert group on artificial intelligence set up by the European Commission in 2018 produced the first EU-wide definition of AI in April 2019

"Artificial intelligence (AI) systems are software (and possibly also hardware) systems designed by humans that, given a complex goal, act in the physical or digital dimension by perceiving their environment through data acquisition, interpreting the collected structured or unstructured data, reasoning on the knowledge, or processing the information, derived from this data and deciding the best action(s) to take to achieve the given goal. AI systems can either use symbolic rules or learn a numeric model, and they can also adapt their behaviour by analysing how the environment is affected by their previous actions.

As a scientific discipline, AI includes several approaches and techniques, such as machine learning (of which deep learning and reinforcement learning are specific examples), machine reasoning (which includes planning, scheduling, knowledge representation and reasoning, search, and optimization), and robotics (which includes control, perception, sensors and actuators, as well as the integration of all other techniques into cyber-physical systems)."

Briefly speaking,

- **Machine learning (ML)**, as a part of AI, is mostly considered as the methodology for implementing algorithms and statistical models that computer systems use to effectively perform a specific human task without explicit instructions to the machine.
- **Deep learning (DL)** is a subset of machine learning that imitates the workings of the human brain (like artificial neural networks) in processing data and creating patterns for use in recognition and in decision making.

[1] High-Level Expert Group on Artificial Intelligence - A DEFINITION OF AI: MAIN CAPABILITIES AND DISCIPLINES, 8 April 2019. Available at https://ec.europa.eu/futurium/en/ai-alliance-consultation/guidelines#Top

Tabular data

x_1	x_2	...	x_p	y
0	1	...	4	3
3	2	...	1	1

Computer vision

Natural language processing

"Project Brainwave is a hardware architecture designed to accelerate real-time. AI calculations. The Project Brainwave

Machine Learning

Deep Learning

The main difference between machine learning and deep learning is the implementation of the algorithmic solutions that suit the given type and quantity of the data:

- **Computer vision** is an interdisciplinary scientific field that deals with how computers can see, identify and process images in the same way that human vision does from digital images or videos.
- **Natural language processing (NLP)** is the technology used to aid computers to read, decipher and understand human languages from speech or text.

2.2. WHY IS NOW THE TIME TO FOCUS ON AI?

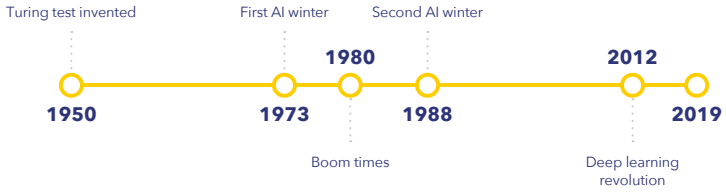
You might have heard that the first development of machine intelligence started in the 1950s. The famous British mathematician Alan Turing devised the "Turing Test" as a measure of a machine's ability to exhibit intelligent behaviour equivalent to, or indistinguishable from a human.

Early results were disappointing, however, because of over-optimism and under-estimation of the technical challenges. Two periods known as "AI winters" followed in the 1970s and the 1990s. Scientific interest diminished and funding from governments and industry fell. So why is everyone now focusing on AI?

From the early 2010s, a new era for AI became possible for two main reasons:

1. A huge **increase of data** (Big Data), with billions of interconnected devices (computers, phones, tablets, cameras, television, sensors, etc.) and online interactions generating vast amounts of **real-time** electronic data. Companies realised, however, that they also had a lot of unproductive complex data capital.

2. **A large increase in computational power** and storage capacities with a sharp decrease in costs from the 1990s.



Source: Schuchmann, Sebastian. (2019). Analyzing the Prospect of an Approaching AI Winter.

Today

Companies in many industries are now using AI techniques to exploit data and optimise business and production processes. They process information in more productive ways and create value, with faster and more accurate decisions, reduced operational costs and personalised customer experiences. Increasing capacity for data storage and new software for data-driven AI solutions are yielding paradigm changes in the analytic environment.

As a result, both companies and governments have heavily increased their investments, which are driving today's boom and achievements in AI.

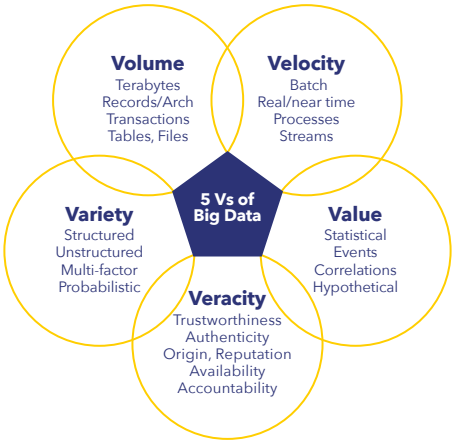
2.3. DATA IS KEY

No data, no AI! The very first requirement for a successful AI solution is a sufficient amount and quality of data. Data can be a text, number, image, audio or video.

Generally speaking, a three-fold data capacity problem arises for companies: they have too much data, too little data or they have not yet collected data.

The following chart summarises the complexity of dealing with "big" data in business solutions:

Any data can be qualified in terms of 5V items.

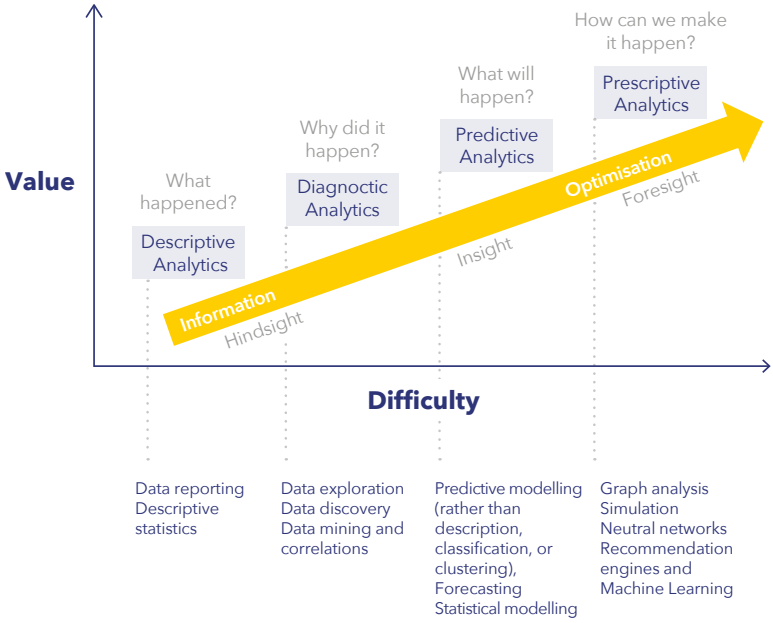


- **Variety and veracity** mostly inform about the quality of the existing data.
- **Volume and velocity** determine which data ecosystem must be used in the AI solution. The ecosystem is the set of infrastructure, analytics and applications used to capture and analyse data.
- **Velocity and value** have role in the determination of algorithmic components of the solution.

Source: Ramadan, Rabie. (2017). Big Data Tools-An Overview. International Journal of Computer Science and Software Engineering. 2. 10.15344/2456-4451/2017/125.

When the organisation has the data, it must adapt its infrastructure to better explore the quantity and quality of information available.

As the organisation increases its use of data and provides more products and services, the result is still more data. The organisation has to be careful about its use of these data and the methods to exploit them during the production process.



The Gartner's analytic value escalator describes the different types of business analytics (descriptive, diagnostic, predictive and prescriptive) as well as their impact on corporate value.

Each type of business analytic has the capacity to respond to a specific question from "what happened?" or "why did it happen?", to "what will happen?" or "how we can make it happen?".

Source: Gartner's analytic value escalator. https://www.flickr.com/photos/27772229@N07/8267855748