

Applications of Artificial Intelligence

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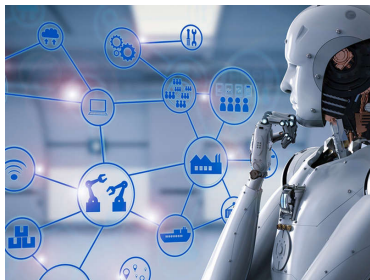


From Computer Science to Artificial Intelligence

Computers are capable of storing, organizing, fetching and processing huge volumes of data.

That is perfect for things like e-commerce websites with millions of items for sale, and for storing billions of health records for quick access by doctors.

But what if we want to use computers not just to fetch and display data, but to actually **make decision about data**?



What Artificial Intelligence Really Means?

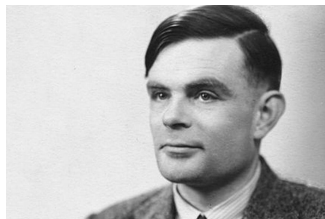
In a 1950 paper **Alan Turing**, one of the father of the computer science theory, proposed a **method to empirically determine whether a computer has achieved intelligence**: the imitation game (see also "The Imitation Game", a 2014 American historical drama film directed by Morten Tyldum).



What Artificial Intelligence Really Means?

Summing up in simple words, the Turing test consists of a human interrogator who asks questions in written natural language to two subjects A and B (one of is human, the other is a machine).

The human interrogator has to guess which is the machine only by their answers in natural language. **If the machine can fool enough human interrogators it is considered intelligent.**



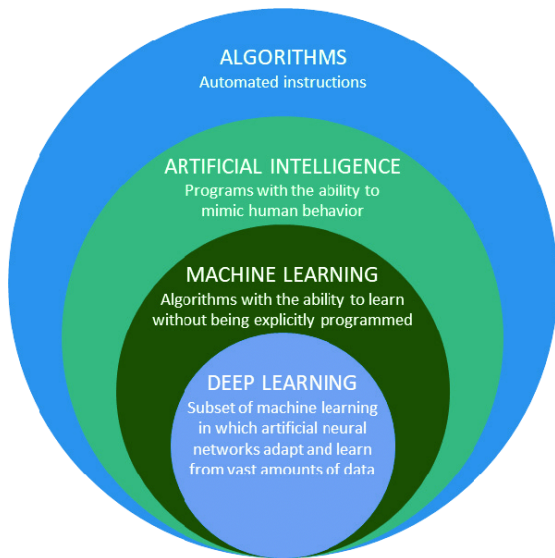
Narrow and Strong Artificial Intelligence

Modern AI algorithms are developed to solve only a particular task, and for some tasks human-level intelligence has been achieved. This kind of artificial intelligence is called **narrow AI** (or weak AI), and it has the potential to benefit society by automating time-consuming tasks and by analyzing data in ways that humans sometimes can not.

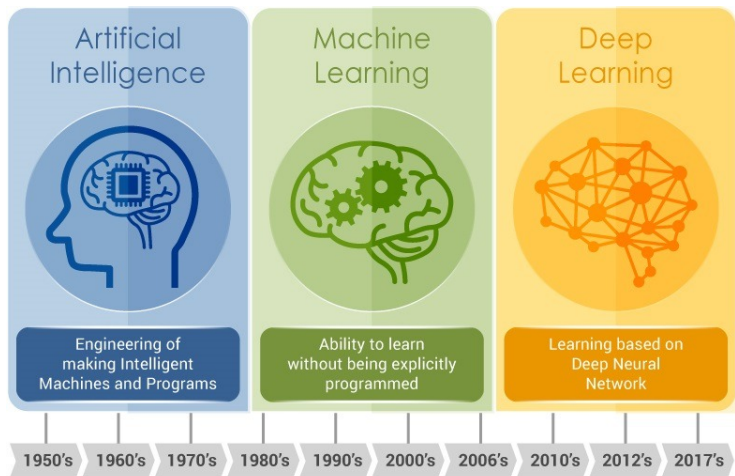
The applications of narrow AI in the everyday world are very diverse and it is absolutely not possible to make a list. Just think that these range from weather forecasts to automatic translation of text in different languages, passing through autonomous vehicles, disease diagnosis and face recognition.

On the other hand, we are far from developing a single artificial intelligence able to deal with multiple and diverse problems as humans do, which is known as **general AI** (or strong AI).

Artificial Intelligence vs Machine Learning vs Deep Learning



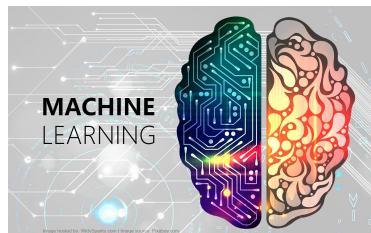
History of Artificial Intelligence



Machine Learning Intuition

Machine learning is the study of computer algorithms that can improve automatically through experience and by the use of data.

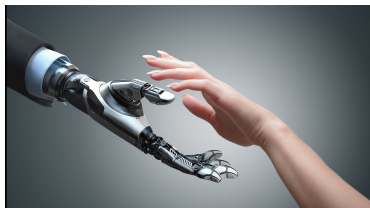
Seen as a part of artificial intelligence, machine learning algorithms build a model **based on sample data**, known as training data, in order to make predictions or decisions without being explicitly programmed to do so.



Machine Learning Intuition

In contrast with traditional artificial intelligence, machine learning is not trying to build automated imitation of intelligent behaviour, but rather to use the strengths and special abilities of computers to **complement human intelligence**, often performing task that fall way beyond human capabilities.

For instance, the ability to scan and process huge databases allows machine learning programs to detect patterns that are outside the scope of human perception.



Why Do We Need Machine Learning?

Machine learning algorithms are particularly suitable for **tasks that are too complex to program**:

- there are several tasks that we human beings perform routinely, yet our introspection concerning how we do them is not sufficiently elaborate to extract a well defined program (e.g. driving, image understanding, etc.);
- analysis of very large and complex data sets, which can not be performed by humans;

Machine learning frameworks are suited also for **tasks that change over time**, since such tools are, by nature, adaptive to changes in the environment they interact with.

Types of Learning

Machine learning approaches are traditionally divided into three broad categories, **depending on the nature of the data** available to the learning system.

**SUPERVISED
LEARNING**



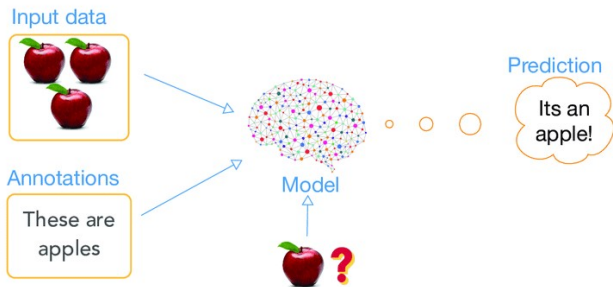
**UNSUPERVISED
LEARNING**



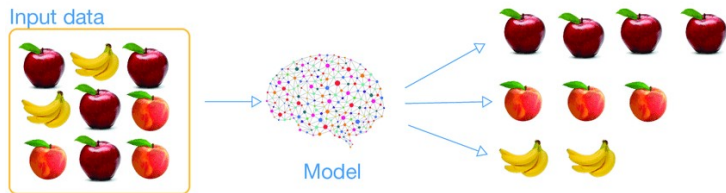
**REINFORCEMENT
LEARNING**



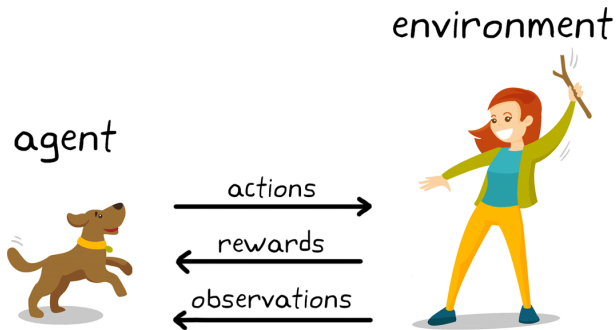
Supervised Learning



Unsupervised Learning

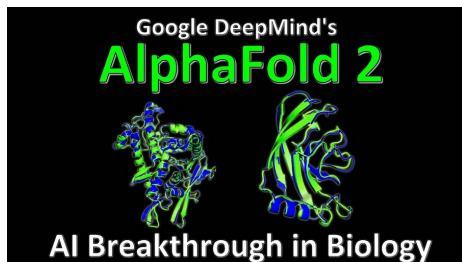


Reinforcement Learning



AI's Application in Biology: AlphaFold

As far as the life sciences are concerned, let consider the **AlphaFold** algorithm, developed by Google DeepMind, that can accurately predict 3D models of protein structures and has the potential to accelerate research in every field of biology.



AI's Application in Vision: Plant Classification

Plant Classification is the arrangement of plants into groups and categories for a clear understanding, proper study and effective organization. A breakthrough in building models for image classification came with the discovery that a **Convolutional Neural Network (CNN)** could be used to progressively extract higher- and higher-level representations of the image content.



AI's Application in Vision: Image Generation

Image generation (synthesis) is the task of generating new images from an existing dataset. Usually, this task is performed using **Generative Adversarial Network (GAN)**.



AI's Application in Vision: Image Generation from Text

DALL·E 2 is a 12-billion parameter version of GPT-3 trained to generate images from text descriptions, using a dataset of text-image pairs. Strictly, relies on GAN and **Transformer**.



an espresso machine that makes coffee from human souls, artstation



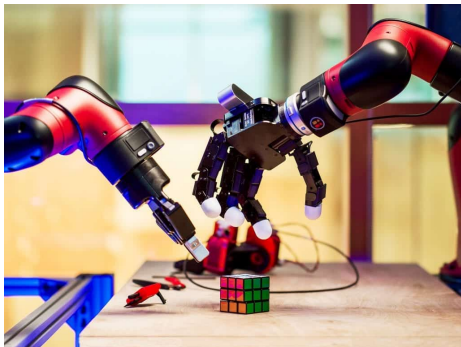
panda mad scientist mixing sparkling chemicals, artstation



a corgi's head depicted as an explosion of a nebula

AI's Application in Robotics: Reinforcement Learning

In robotics, the ultimate goal of reinforcement learning is to endow robots with the ability to learn, improve, adapt and reproduce tasks with dynamically changing constraints based on exploration and autonomous learning.



AI's Application in Speech Recognition and NLP

Speech recognition is an interdisciplinary subfield of computer science and computational linguistics that develops methodologies and technologies that enable the recognition and translation of spoken language into text by computers with the main benefit of searchability.

Natural Language Processing (NLP) is a subfield of linguistics, computer science, and artificial intelligence concerned with the interactions between computers and human language, in particular how to program computers to process and analyze large amounts of natural language data.



"Hey Alexa"



"Hey Siri"



"Hey Google"

Does AI have some prejudices?

Machine learning bias, also sometimes called algorithm bias or AI bias, is a phenomenon that occurs when an algorithm produces results that are systemically prejudiced due to erroneous assumptions in the machine learning process.

VERNON PRATER Prior Offenses 2 armed robberies, 1 attempted armed robbery Subsequent Offenses 1 grand theft LOW RISK 3	BRISHA BORDEN Prior Offenses 4 sexual misconducts Subsequent Offenses None HIGH RISK 8
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DYLAN FUGETT LOW RISK 3	BERNARD PARKER HIGH RISK 10
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JAMES RIVELLI LOW RISK 3	ROBERT CANNON MEDIUM RISK 6
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JAMES RIVELLI Prior Offenses 1 domestic violence aggravated assault, 1 grand theft, 1 petty theft, 1 drug trafficking Subsequent Offenses 1 grand theft LOW RISK 3	ROBERT CANNON Prior Offense 1 petty theft Subsequent Offenses None MEDIUM RISK 6
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Thank you very much for your attention!



Questions, comments and advices are welcomed!