Machine Learning

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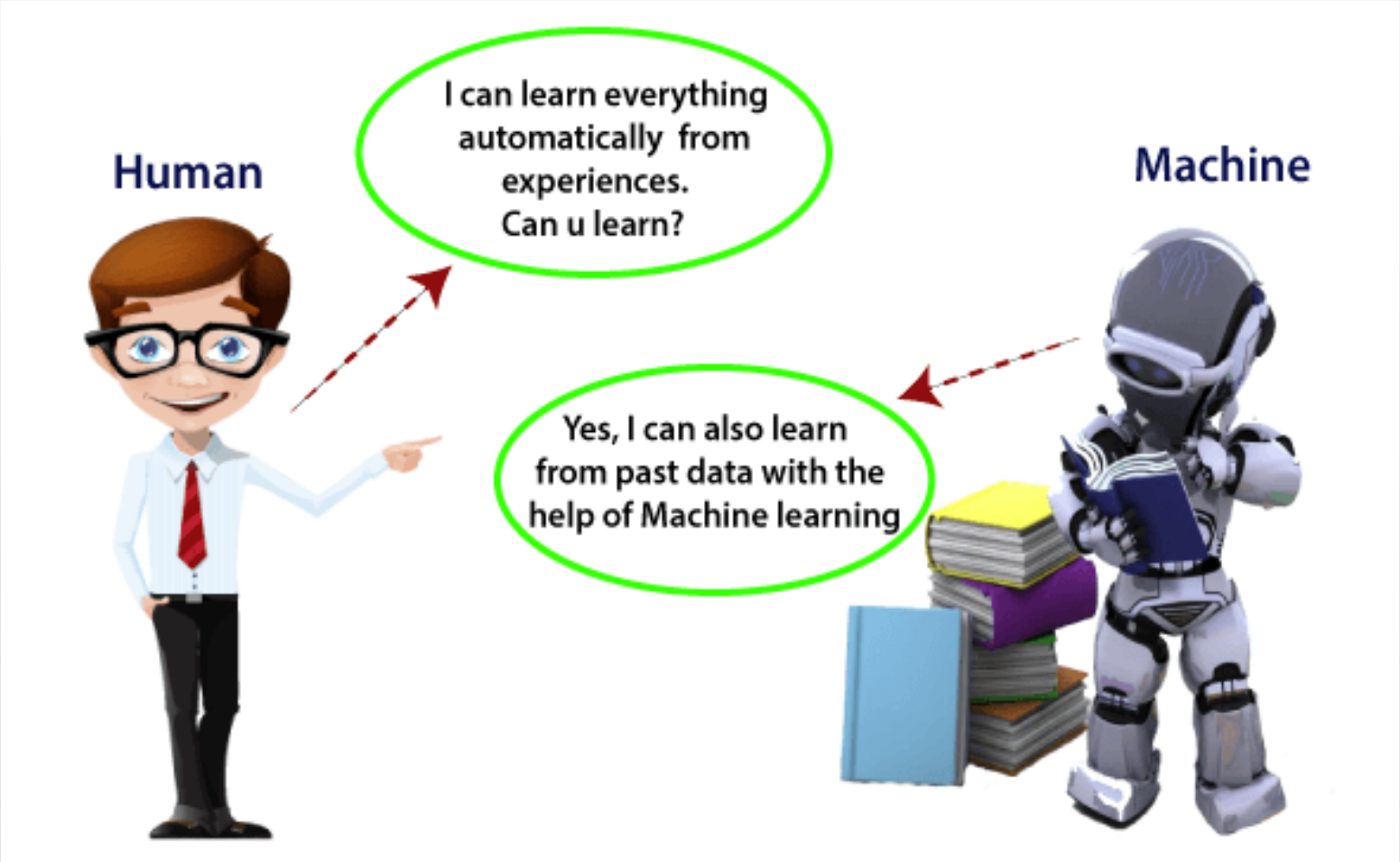
Machine Learning Fundamentals


Human
I can learn everything automatically from experiences. Can u learn?
Machine
Yes, I can also learn from past data with the help of Machine learning

Machine Learning: definition

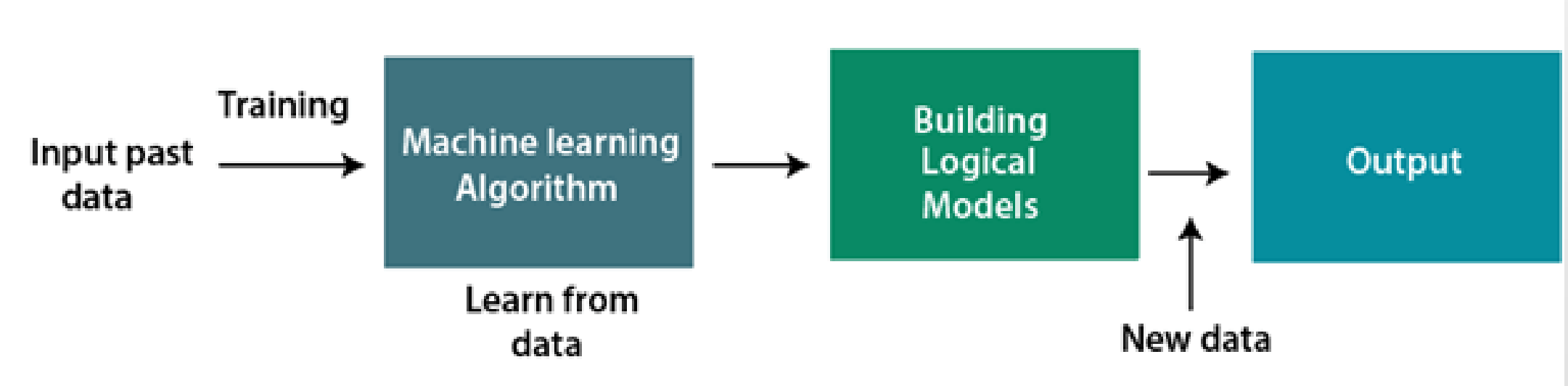
- Machine Learning is concerned with the development, the analysis, and the application of algorithms that allow computers to learn
- Learning:
  - ✓ A computer learns if it improves its performance at some task with experience (i.e. by collecting data)
  - ✓ Extracting a model of a system from the sole observation (or the simulation) of this system in some situations.
  - ✓ A model = some relationships between the variables used to describe the system.
- Two main goals: make prediction and better understand the system

Machine learning: when ?

- Learning is useful when:
  - ✓ Human expertise does not exist (navigating on Mars),
  - ✓ Humans are unable to explain their expertise (speech recognition)
  - ✓ Solution changes in time (routing on a computer network)
  - ✓ Solution needs to be adapted to particular cases (user biometrics)

- Example: It is easier to write a program that learns to play checkers or backgammon well by self-play rather than converting the expertise of a master player to a program.

How Does ML work



Features of Machine Learning

- ✓ Machine learning uses data to detect various patterns in a given dataset.
- ✓ It can learn from past data and improve automatically.
- ✓ It is a data-driven technology.
- ✓ Machine learning is much similar to data mining as it also deals with the huge amount of the data.

Need of Machine Learning

- ✓ Rapid increment in the production of data
- ✓ Solving complex problems, which are difficult for a human
- ✓ Decision making in various sector including finance
- ✓ Finding hidden patterns and extracting useful information from data.

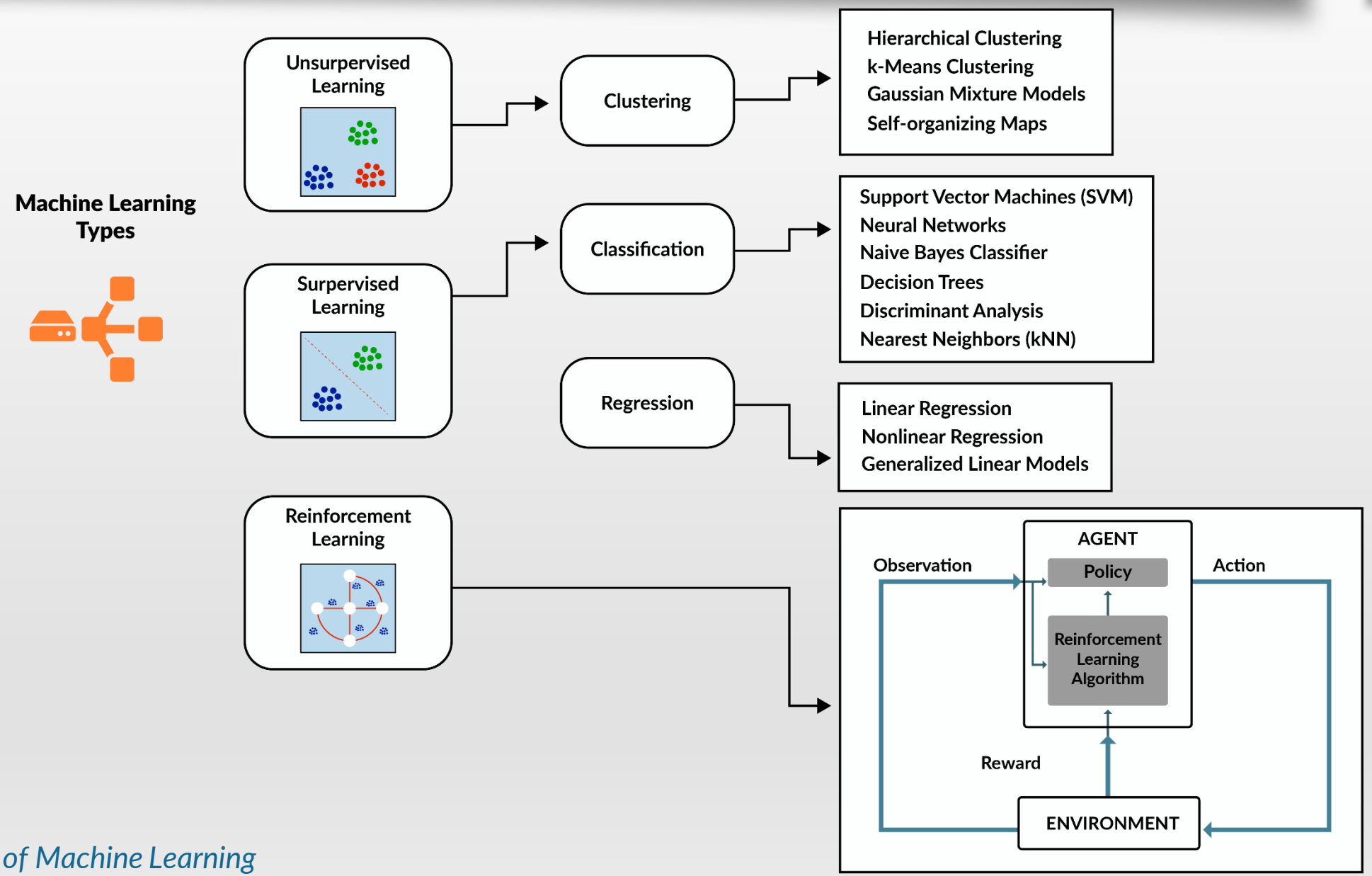
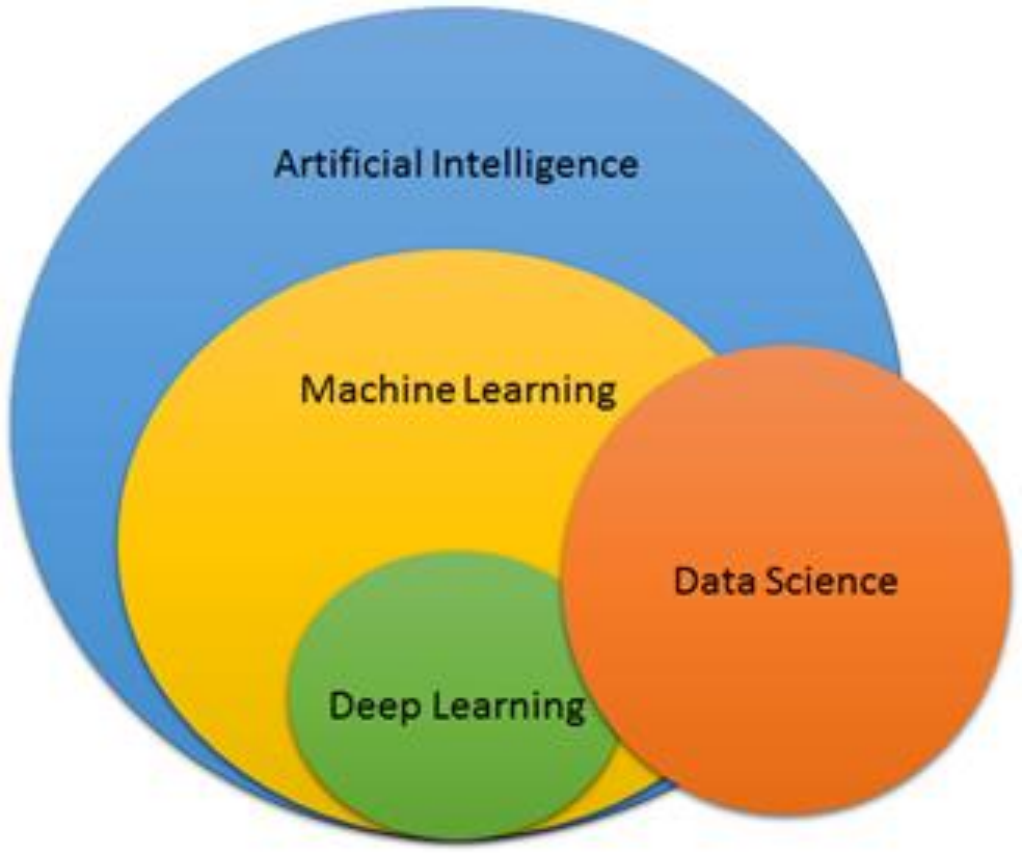
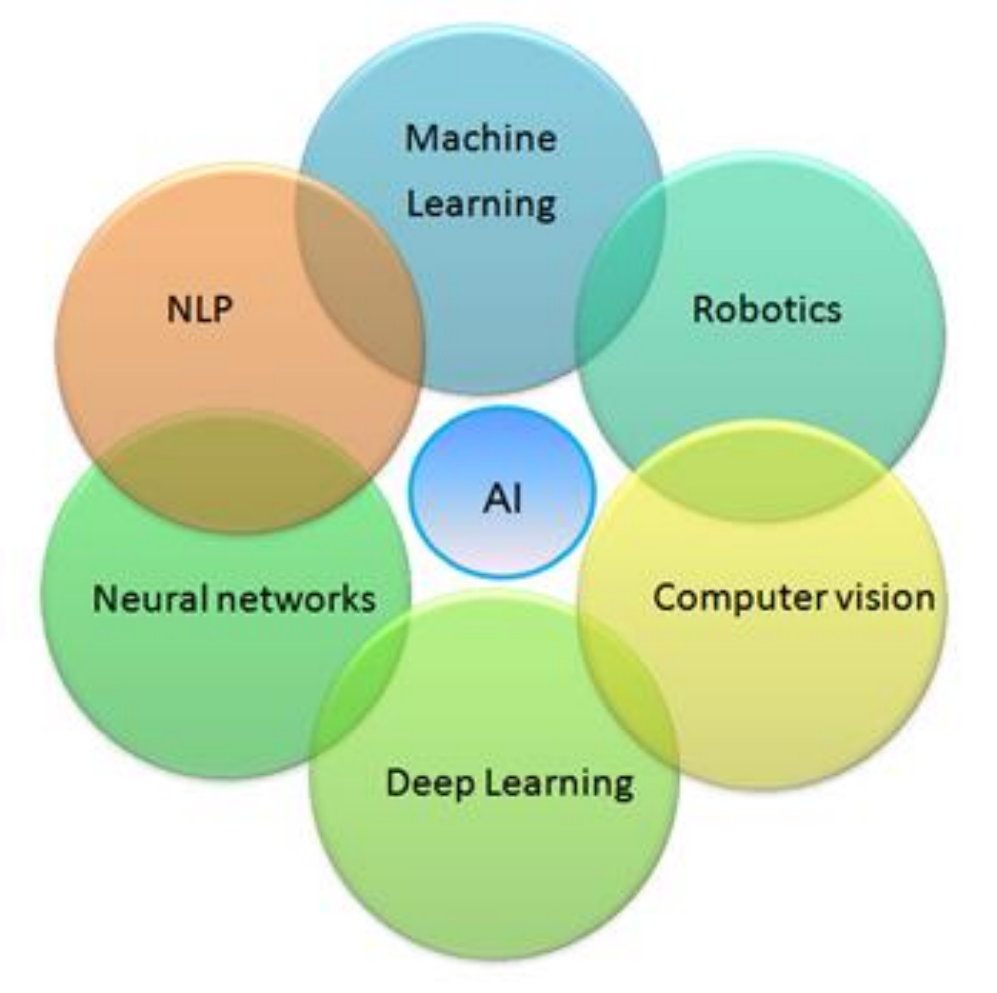


Figure 1.Types of Machine Learning

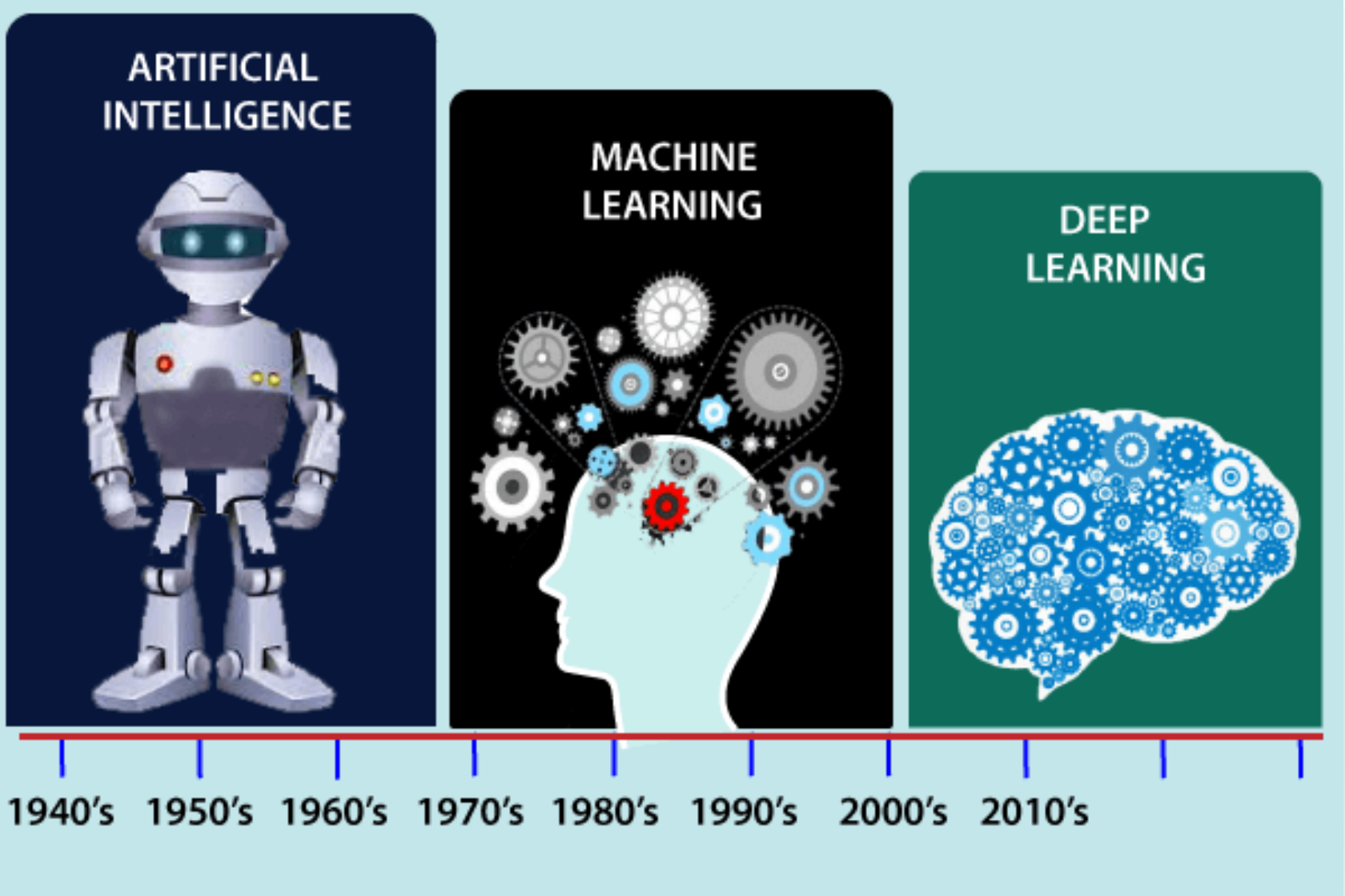
Related Fields

- Artificial Intelligence: smart algorithms
- Big Data: any thing which is crash Excel
- Statistics: inference from a sample
- Computer Science: efficient algorithms and complex models
- Systems and control: analysis, modeling, and control of dynamical systems
- Data Mining: searching through large volumes of data


Artificial Intelligence
Machine Learning
Data Science
Deep Learning


Machine Learning
NLP
Robotics
AI
Neural networks
Computer vision
Deep Learning

History of Machine Learning



In 1959, Arthur Samuel, a computer scientist who pioneered the study of artificial intelligence, described machine learning as “the study that gives computers the ability to learn without being explicitly programmed.” Alan Turing’s seminal paper (Turing, 1950) introduced a benchmark standard for demonstrating machine intelligence, such that a machine has to be intelligent and responsive in a manner that cannot be differentiated from that of a human being.

Machine Learning is an application of artificial intelligence where a computer/machine learns from the past experiences (input data) and makes future predictions. The performance of such a system should be at least human level.

In this material, we will focus in clustering problems for unsupervised machine learning with K-Means algorithm. For Supervised machine learning we will describe the classification problem with a demonstration of design trees algorithm and the regression one with an example of linear regression. Here is a summary that represents the types of machine learning and some algorithms as examples in the following figure:

Machine Learning at Present

- **Self-driving cars**, **Amazon Alexa**, **Catboats**, **recommender system**, and many more.
- It includes **Supervised**, **unsupervised**, and **reinforcement learning with clustering**, **classification**, **decision tree**, **SVM algorithms**
- Predictions, including **weather prediction**, **disease prediction**, **stock market analysis**, etc.