General introduction : what is AI and data science engineering ?

Artificial Intelligence and Data Science is a new branch of study which deals with scientific methodologies, processes, and techniques drawn from different domains like statistics, cognitive science, and computing and information science to extract knowledge from structured data and unstructured data.

In this course we are going to learn what is data ,what is AI ,what is DS, what is the difference,machine learning and much more stay tuned .
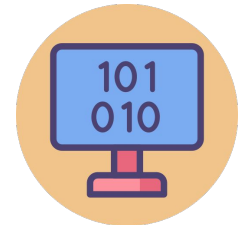
1/ What is data ?

The world today is heavily dependent on data. The amount of data that we produce grows exponentially every year. At least 2.5 quintillion bytes of data. are produced every day — in case you didn't know, that's a number followed by 18 zeros! Inside this data, we can find important insights about how to get better results in a reduced amount of time, be it manufacturing, medicine, or education.

But what is data ?

Data is any sort of information (text,image,video,music,numbers...) which gives us insights after analysis.

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                        ┌─────────────────────────┐
                        │   Data types hierarchy   │
                        └─────────────────────────┘
                                     │
              ┌──────────────────────┴──────────────────────┐
     ┌─────────────────┐                          ┌─────────────────┐
     │    Numerical    │                          │   Categorical   │
     └─────────────────┘                          └─────────────────┘
              │                                            │
      ┌───────┴────────┐                          ┌────────┴─────────┐
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| Continuous (like age,weight,..) | Discret (like shoe size..) | Ordinal (data with hierarchy like rating , satisfaction..) | Nominal (Data with no hierarchy like eye color , blood type .) |

2/ What is AI ?

Artificial intelligence (AI) is a wide-ranging branch of computer science concerned with building smart machines capable of performing tasks that typically require human intelligence and suggest that machines can mimic humans in:

- Talking
- Thinking
- Learning
- Planning
- Understanding

Artificial Intelligence is also called Machine Intelligence and Computer Intelligence.

This term appeared in the 50s with John McCarthy .
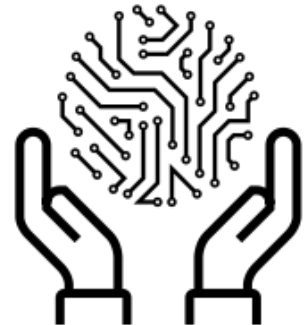
Why AI now ?

The algorithms has been here since then. Why is AI more interesting now?

The answer is:

- Computing power has not been strong enough
- Computer storage has not been large enough
- Big data has not been available
- Fast Internet has not been available

Another strong force is the major investments from big companies (Google, Microsoft, Facebook, YouTube) because their datasets became much too big to handle traditionally.

What are the 4 types of Artificial Intelligence?

1. Reactive Machines
2. Limited Memory
3. Theory of Mind
4. Self-Awareness

What are Examples of Artificial Intelligence?

- Siri, Alexa and other smart assistants
- Self-driving cars
- Robo-advisors
- Conversational bots
- Email spam filters
- Netflix's recommendations
- ......

3/ What is Data Science ?

Data science is the field of study that combines domain expertise, **programming skills**, and knowledge of **mathematics and statistics** to **extract meaningful insights** from data. Data science practitioners apply machine learning algorithms to numbers, text, images, video, audio, and more to produce **artificial intelligence (AI) systems** to perform tasks that ordinarily require human intelligence.

In turn, these systems generate insights which analysts and business users can translate into tangible business value.

"The ability to take data — to be able to understand it, to process it, to extract value from it, to visualize it, to communicate it — that's going to be a hugely important skill in the next decades."
- Hal Varian, chief economist at Google and UC Berkeley professor of information sciences, business, and economics

Graphical representation :
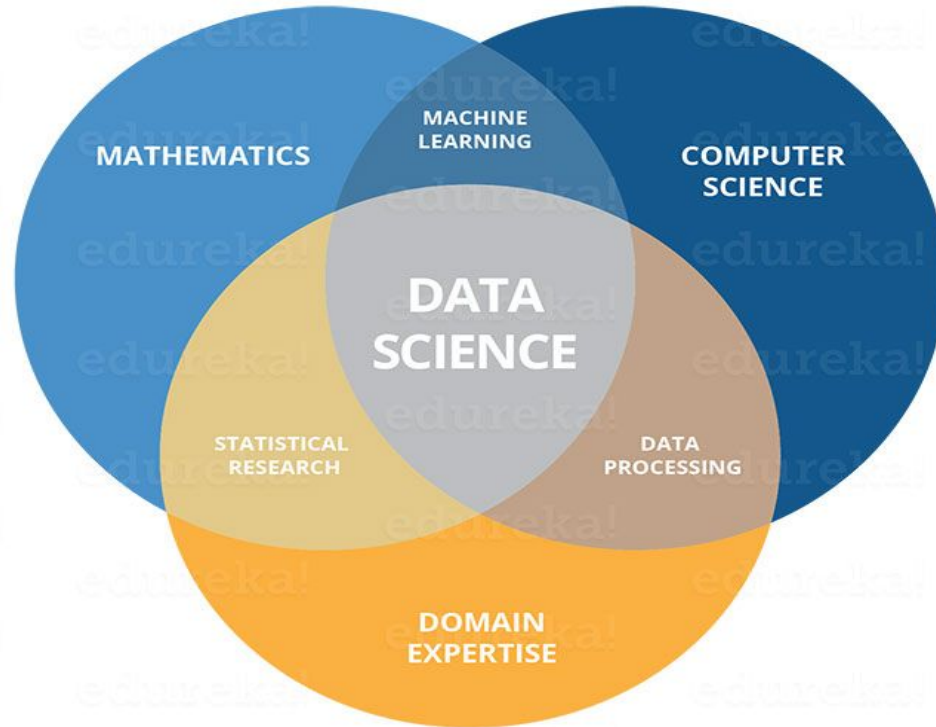
Why Data Science is Important?

More and more companies are coming to realize the importance of data science, AI, and machine learning. Regardless of industry or size, organizations that wish to remain competitive in the age of big data need to efficiently develop and implement data science capabilities or risk being left behind.

Difference between AI & DS ?

Data Science and Artificial Intelligence, are the two most important technologies in the world today. While Data Science makes use of Artificial Intelligence in its operations, it does not completely represent AI.

Data Science vs Artificial Intelligence

Factors	Data Science	Artificial Intelligence
Scope	Involves various underlying data operations	Limited to the implementation of ML algorithms
Type of Data	Structured and unstructured	Standardized in the form of embeddings and vectors
Tools	R, Python, SAS, SPSS, TensorFlow, Keras, Scikit-learn	Scikit-learn, Kaffe, PyTorch, TensorFlow, Shogun, Mahout
Applications	Advertising, Marketing, Internet Search Engines	Manufacturing, Automation, Robotics, Transport, Healthcare

4/ What is Machine Learning ?

Artificial intelligence and machine learning are the part of computer science that are correlated with each other. These two technologies are the most trending technologies which are used for creating intelligent systems.

Machine learning is a subfield of artificial intelligence, which enables machines to learn from past data or experiences without being explicitly programmed.
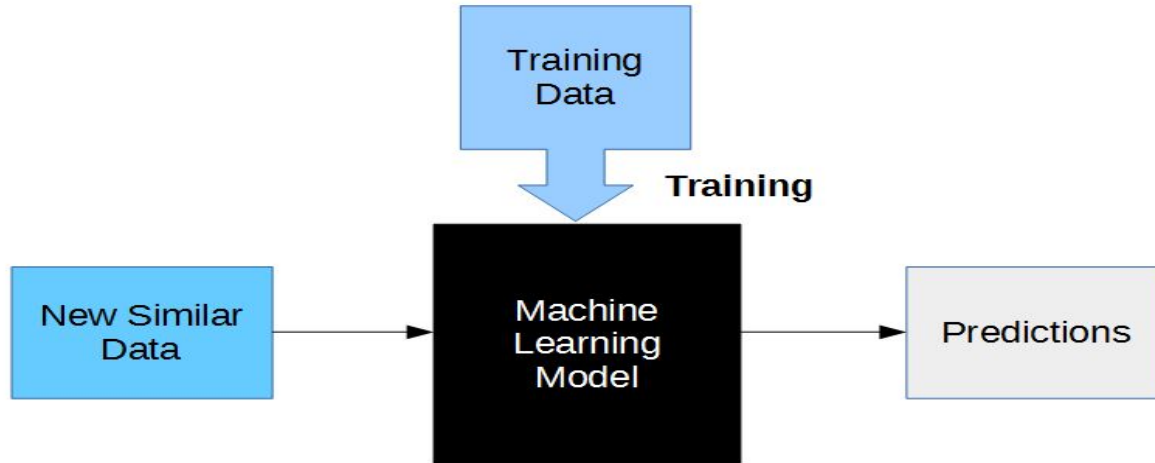
It can be divided into three types:

- Supervised learning
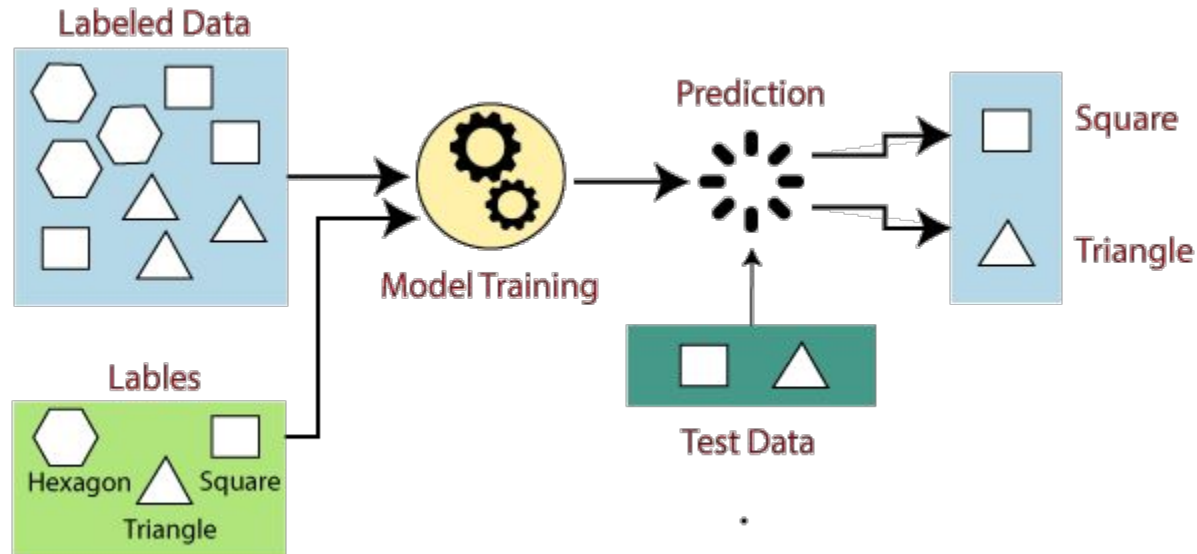- Unsupervised learning
- Reinforcement learning

MACHINE
LEARNING

To simplify it :

Training
Data

Training

New Similar
Data

Machine
Learning
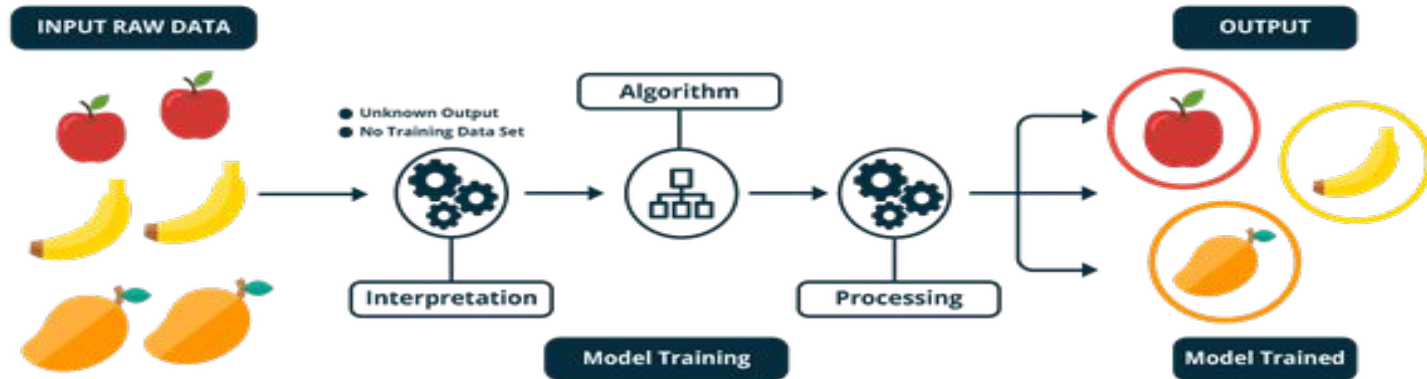Model

Predictions

supervised learning

Given a labeled data the model try to find a pattern with the goal of mapping an output function "f" predicting future outputs
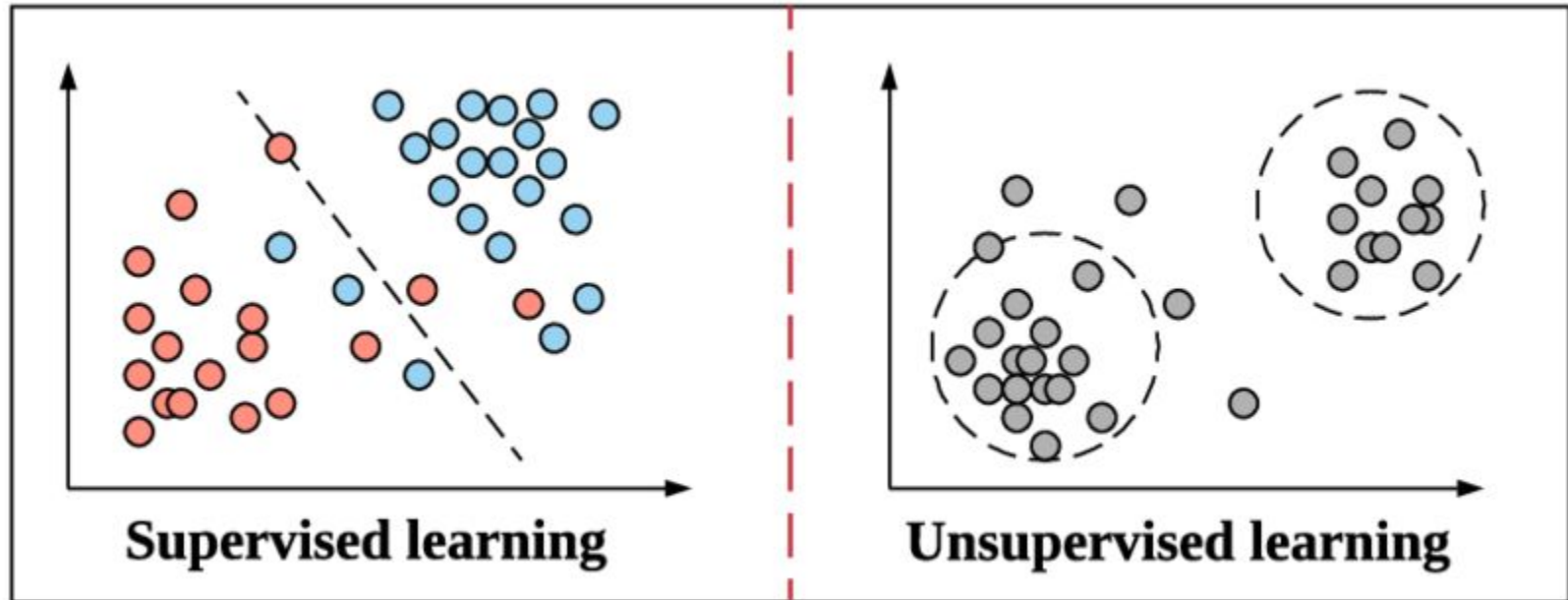
Unsupervised learning

Unsupervised learning is a type of machine learning in which models are trained using unlabeled dataset and are allowed to act on that data without any supervision.

Supervised vs Unsupervised learning

Supervised learning

Unsupervised learning

Reinforcement learning

Reinforcement Learning (RL) is the science of decision making. It is about learning the optimal behavior in an environment to obtain maximum reward. This optimal behavior is learned through interactions with the environment and observations of how it responds, similar to children exploring the world around them and learning the actions that help them achieve a goal.

In the absence of a supervisor, the learner must independently discover the sequence of actions that maximize the reward. This discovery process is akin to a trial-and-error search. The quality of actions is measured by not just the immediate reward they return, but also the delayed reward they might fetch. As it can learn the actions that result in eventual success in an unseen environment without the help of a supervisor, reinforcement learning is a very powerful algorithm.
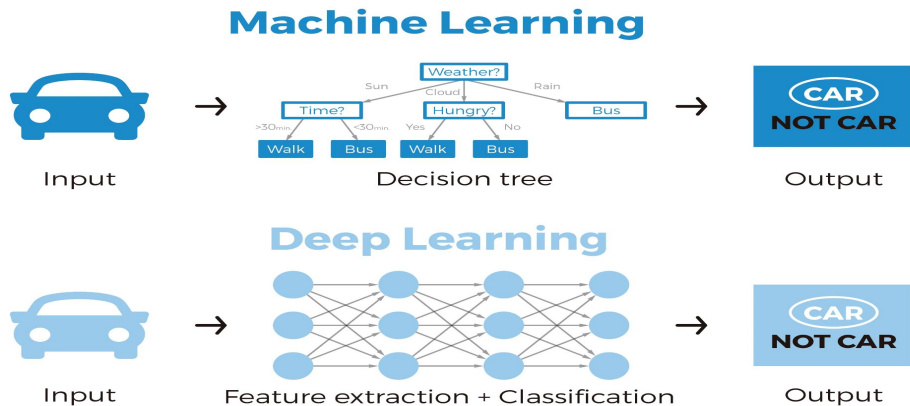
Reinforcement Learning

Input Raw Data

Environment

Output

Reward

Best Action

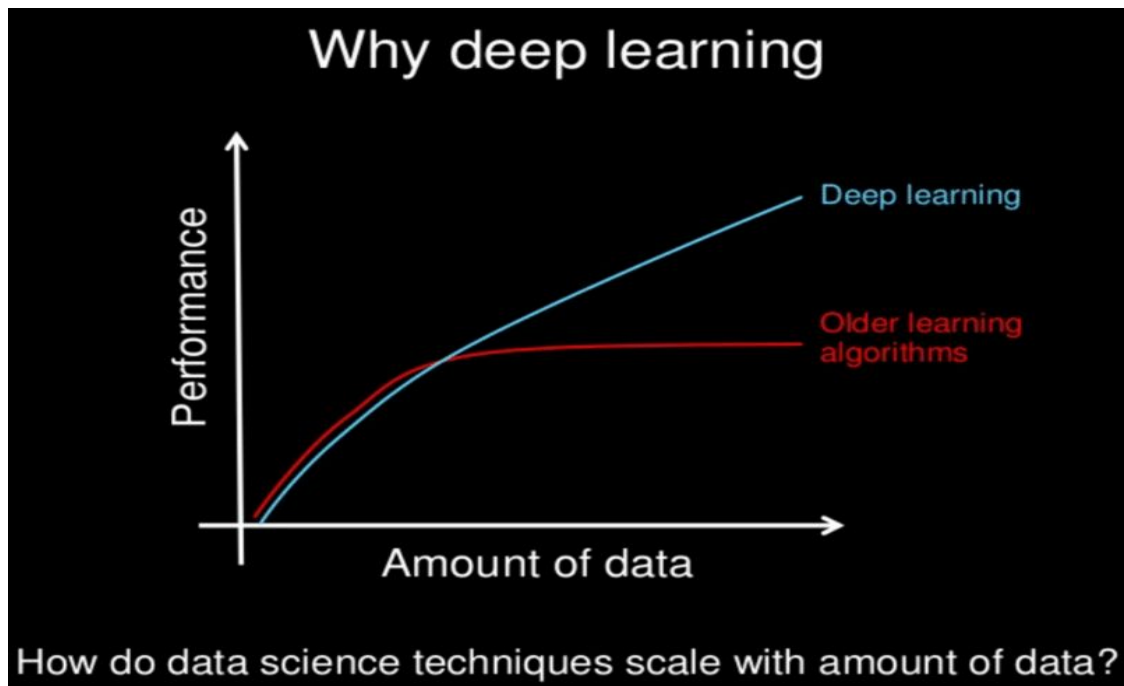**Selection of Algorithm**

State

Agent
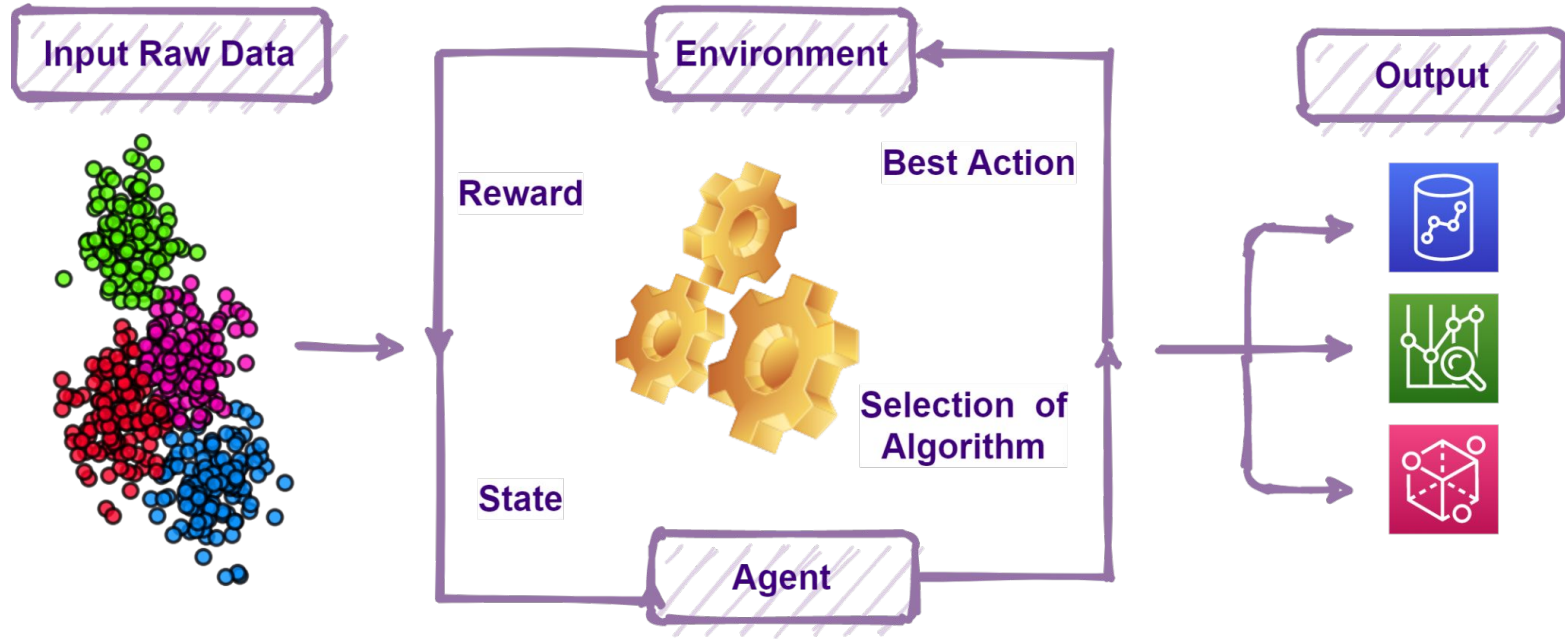
5/ Deep Learning

Deep learning is a subset of machine learning, which is essentially a neural network with three or more layers. These neural networks attempt to simulate the behavior of the human brain—albeit far from matching its ability—allowing it to "learn" from large amounts of data. While a neural network with a single layer can still make approximate predictions, additional hidden layers can help to optimize and refine for accuracy.
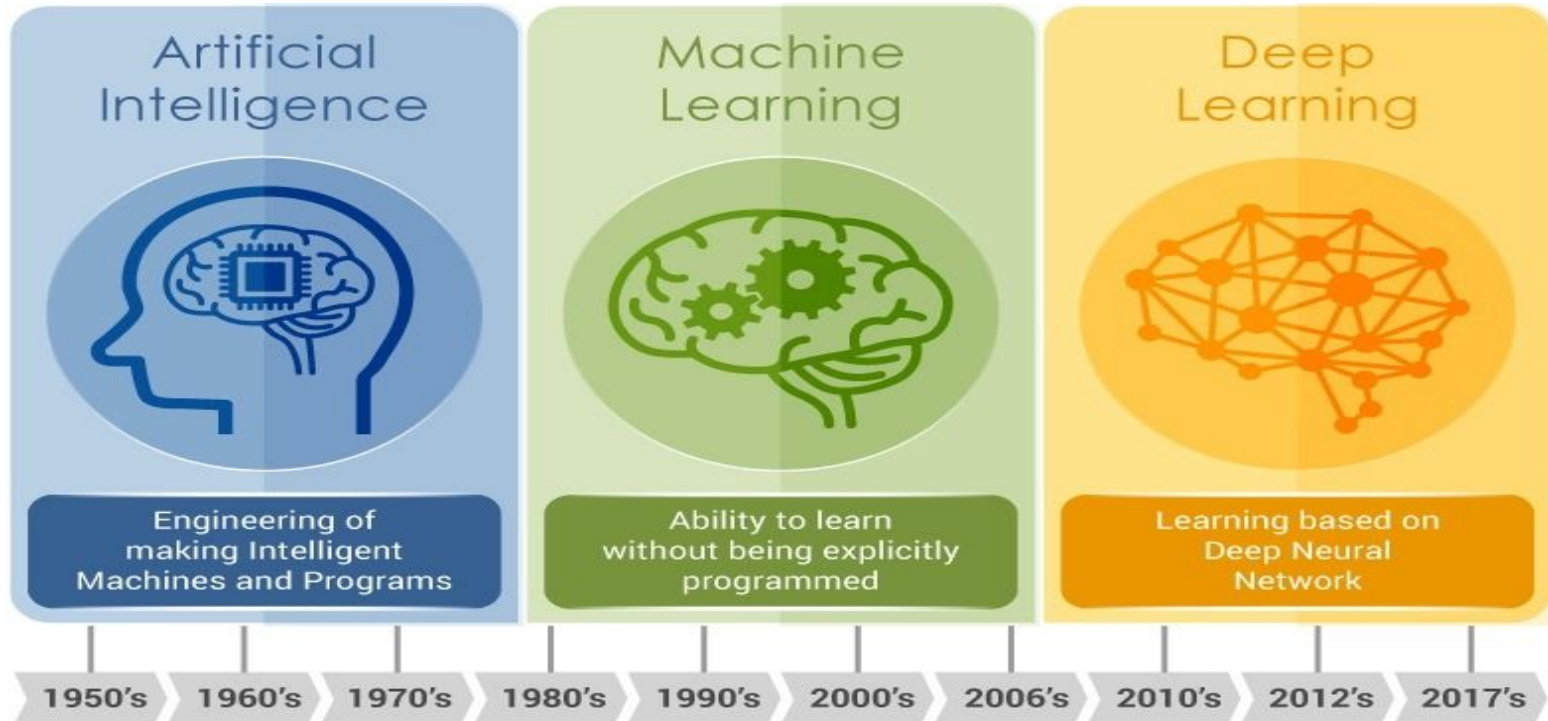
Machine Learning

Input → Decision tree → Output

Deep Learning

Input → Feature extraction + Classification → Output

Why deep learning ?

AI vs ML vs DL

Artificial Intelligence	Machine Learning	Deep Learning
Engineering of making Intelligent Machines and Programs	Ability to learn without being explicitly programmed	Learning based on Deep Neural Network

1950's 1960's 1970's 1980's 1990's 2000's 2006's 2010's 2012's 2017's

So what's next ?

- python (numpy and pandas)
- Data Understanding and Preparation
- Data Visualisation
- Supervised learning (Classification & regression)
- Unsupervised learning (Clustering & Dimension reduction)
- Reinforcement Learning
- Artificial Neural Networks
- Convolutional Neural Networks
- Recursive Neural Network

THANK YOU