

# Machine Learning, Data Science and Artificial intelligence

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# 1 Introduction

The purpose of this lecture is to emphasize the meaning of these three big words, the differences, the relationship and the links connecting them.

## 2 ML, DS and AI

A lot of people confuse these three different domains. Even some ML engineers and some Data Scientists have trouble drawing a line between them. In this section, we will clear that out. In 2018, a report released regarding the misuse from companies claiming to use artificial intelligence on their products and services. According to the Verge, 40% of European startups claimed to use AI don't use the technology. In 2017 TechTalks, also stumbled upon such misuse by companies claiming to use machine learning and advanced artificial intelligence to gather and examine thousands of users' data to enhance user experience in their products and services

Let us start with with this quote that summarizes the relationship between the three technologies: *"AI is a bigger concept to create intelligent machines that can simulate human thinking capability and behavior, whereas, machine learning is an application or subset of AI that allows machines to learn from data without being programmed explicitly. Data science tackles big data and includes data cleansing, preparation, and analysis. A data scientist gathers data from multiple sources and applies machine learning"*.

For those who would like to see the difference between the three tools/notions, from end-goal point of view, we can say that:

- Data science is about using data to provide value (money, growth, reputation, etc.) to an organization.
- Machine learning is about using data to make optimized inferences and predictions.
- Artificial intelligence is about using data to impart human-like decision making to machines.

However, we can see that even from the end-goal point of view, the three overlap with each others.

### 2.1 Artificial Intelligence

English mathematician Alan Turing created the phrase "artificial intelligence" in the 1950s. The goal was (and is) to build machines (computers) that we consider "smart," and that can perform various tasks. AI is a science like mathematics or biology. It studies ways to build intelligent programs and machines that can creatively solve problems, which has always been considered a human prerogative.

AI is different from Machine Learning, because it is working to create an intelligent system which can perform various complex tasks, whereas ML is working to create machines that can perform only those specific tasks for which they are trained.

AI is divided into Weak AI, General AI, and Strong AI.

## 2.2 Machine Learning

Machine learning is the study of computer algorithms that allow computer programs to automatically improve through experience. Machine learning is a subset of artificial intelligence (AI) that provides systems the ability to automatically learn and improve from experience without being explicitly programmed. The basic premise here is to develop algorithms that can receive input data and leverage statistical models to predict an output while updating outputs as new data becomes available.

ML is mainly divided into Supervised learning, Unsupervised learning, and Reinforcement learning.

In business ML AI, Artificial Intelligence and Machine Learning usually refer to the same thing in business. Why? Because most business applications of AI amount to Supervised Learning, which is a subfield of Machine Learning.

“99% of the economic value created by AI today is through one type of AI, which is learning A to B or input to output mappings.” Andrew Ng.

However, let me give you an example of a problem that can be solved using ML and without ML (thus AI without ML): object detection. For example, giving an image and an object, I want to find on the image where this object appear, for this problem we can use ML (object detection, score, probabilistic approach) or without ML (template matching, score, OpenCV).

Machine Learning works on datasets, AI not necessarily.

## 2.3 Data Science

Data science is a concept used to tackle big data and includes data cleansing, preparation, and analysis. A data scientist gathers data from multiple sources and applies machine learning, predictive analytics, and sentiment analysis to extract critical information from the collected data sets.

Because data science is a broad term for multiple disciplines, machine learning fits within data science. Machine learning uses various techniques, such as regression and supervised clustering. On the other hand, the data in data science may or may not evolve from a machine or a mechanical process. The main difference between the two is that data science as a broader term not only focuses on algorithms and statistics but also takes care of the entire data processing methodology.

## 2.4 Data Scientist vs Machine Learning Engineer

In few words, data science is the researching, building, and interpretation of the model you have built, while machine learning is the production of that model.

Overall, a data scientist can be many things, but the main functions are to

- meet with stakeholders to define the business problem
- pull data (SQL)
- EDA, feature engineering, model building, prediction (Python and Jupyter Notebook)
- depending on workplace, compile code to .py format and/or pickled model

Whereas the work of Machine Learning engineer could be:

- pkl file of data science model
- storage bucket (GCP — Google Cloud Composer)
- DAG (for scheduling the trainer and evaluator of the model)
- Airflow (visualizes the process — ML pipeline)
- Docker (containers and virtualization)

The differences between the two:

Data Science: focuses on statistics and algorithms, unsupervised and supervised algorithms, regression and classification, interprets results, presents and communicates results.

Machine Learning: focus on software engineering and programming, automation, scaling, scheduling, incorporating model results into a table/warehouse/UI.

So a Machine Learning engineer deploys the model constructed by the Data Scientists.

## 2.5 Deep Learning

When we talk about Deep Learning, we are talking about algorithms capable of mimicking the actions of the human brain thanks to neural networks, hence the term Artificial Intelligence. It is often explained that the difference between Machine Learning and Deep Learning is that Machine Learning algorithms will process quantitative and structured data (numeric values), while Deep Learning algorithms will process unstructured data, such as sound, text, image. This being true, we explain here why this difference is real: the Feature Extraction.



## Machine Learning VS Deep Learning

