Machine Learning - Definition and application examples

Machine Learning – Definition

Machine Learning is a sub-area of artificial intelligence, whereby the term refers to the ability of IT systems to independently find solutions to problems by recognizing patterns in databases. In other words: Machine Learning enables IT systems to recognize patterns on the basis of existing algorithms and data sets and to develop adequate solution concepts. Therefore, in Machine Learning, artificial knowledge is generated on the basis of experience.

In order to enable the software to independently generate solutions, the prior action of people is necessary. For example, the required algorithms and data must be fed into the systems in advance and the respective analysis rules for the recognition of patterns in the data stock must be defined. Once these two steps have been completed, the system can perform the following tasks by Machine Learning:

•Finding, extracting and summarizing relevant data

•Making predictions based on the analysis data

•Calculating probabilities for specific results

•Adapting to certain developments autonomously

•Optimizing processes based on recognized patterns

Machine Learning: How it works

In a way, Machine Learning works in a similar way to human learning. For example, if a child is shown images with specific objects on them, they can learn to identify and differentiate between them. Machine Learning works in the same way: Through data input and certain commands, the computer is enabled to "learn" to identify certain objects (persons, objects, etc.) and to distinguish between them. For this purpose, the software is supplied with data and trained. For instance, the programmer can tell the system that a particular object is a human being (="human") and another object is not a human being (="no human"). The software receives continuous feedback from the programmer. These feedback signals are used by the algorithm to adapt and optimize the model. With each new data set fed into the system, the model is further optimized so that it can clearly distinguish between "humans" and "non-humans" in the end.

These methods are used in Machine Learning

In Machine Learning, statistical and mathematical methods are used to learn from data sets. Dozens of different methods exist for this, whereby a general distinction can be made between two systems, namely symbolic approaches on the one hand and sub-symbolic approaches on the other. While symbolic systems are, for example, propositional systems in which the knowledge content, i.e. the induced rules and the examples are explicitly represented, sub-symbolic systems are artificial neuronal networks. These work on the principle of the human brain, whereby the knowledge contents are implicitly represented.

Advantages of Machine Learning

Machine Learning undoubtedly helps people to work more creatively and efficiently. Basically, you too can delegate quite complex or monotonous work to the computer through Machine Learning - starting with scanning, saving and filing paper documents such as invoices up to organizing and editing images.

In addition to these rather simple tasks, self-learning machines can also perform complex tasks. These include, for example, the recognition of error patterns. This is a major advantage, especially in areas such as the manufacturing industry: the industry relies on continuous and error-free production. While even experts often cannot be sure where and by which correlation a production error in a plant fleet arises, Machine Learning offers the possibility to identify the error early - this saves downtimes and money.

Self-learning programs are now also used in the medical field. In the future, after "consuming" huge amounts of data (medical publications, studies, etc.), apps will be able to warn a in case his doctor wants to prescribe a drug that he cannot tolerate. This "knowledge" also means that the app can propose alternative options which for example also take into account the genetic requirements of the respective patient.

Types of Machine Learning

Basically, algorithms play an important role in Machine Learning: On the one hand, they are responsible for recognizing patterns and on the other hand, they can generate solutions. Algorithms can be divided into different categories:

Supervised learning: In the course of monitored learning, example models are defined in advance. In order to ensure an adequate allocation of the information to the respective model groups of the algorithms, these then have to be specified. In other words, the system learns on the basis of given input and output pairs. In the course of monitored learning, a programmer, who acts as a kind of teacher, provides the appropriate values for a particular input. The aim is to train the system in the context of successive calculations with different inputs and outputs and to establish connections.

Unsupervised learning: In unsupervised learning, artificial intelligence learns without predefined target values and without rewards. It is mainly used for learning segmentation (clustering). The machine tries to structure and sort the data entered according to certain characteristics. For example, a machine could (very simply) learn that coins of different colours can be sorted according to the characteristic "colour" in order to structure them.

Partially supervised learning: Partially supervised learning is a combination of supervised and unsupervised learning.

Encouraging learning: Reinforcing learning - just like Skinner's classic conditioning - is based on rewards and punishments. The algorithm is taught by a positive or negative interaction which reaction to a certain situation should take place.

Active learning: Within the framework of active learning, an algorithm is given the opportunity to query results for specific input data on the basis of pre-defined questions that are considered significant. Usually, the algorithm itself selects questions with high relevance.

Applications of Machine Learning

Traffic Alerts (Maps)

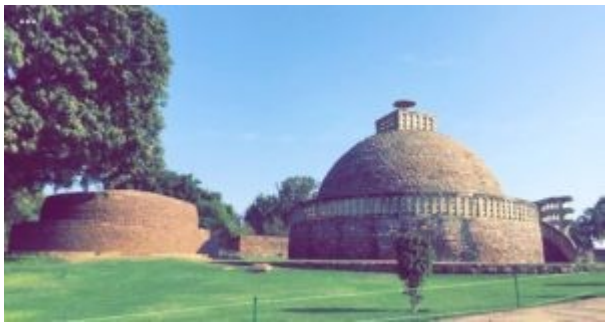
Now, **Google Maps** is probably **THE** app we use whenever we go out and require assistance in directions and traffic. The other day I was traveling to another city and took the expressway and Maps suggested: "**Despite the Heavy Traffic, you are on the fastest route**". But, **How does it know that?**

Well, It's a combination of People currently using the service, Historic Data of that route collected over time and few tricks acquired from other companies. Everyone using maps is providing their location, average speed, the route in which they are traveling which in turn helps Google collect massive Data about the traffic, which makes them predict the upcoming traffic and adjust your route according to it.

Social Media (Facebook)

One of the most common applications of Machine Learning is **Automatic Friend Tagging Suggestions** in Facebook or any other social media platform. Facebook uses **face detection** and **Image recognition** to automatically find the face of the person which matches it's Database and hence suggests us to tag that person based on DeepFace.

Facebook's Deep Learning project **DeepFace** is responsible for the recognition of faces and identifying which person is in the picture. It also provides Alt Tags (Alternative Tags) to images already uploaded on facebook. For eg., if we inspect the following image on Facebook, the alt-tag has a description.



```
<img class="spotlight" alt="Image may contain: sky, grass, outdoor and nature"
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Transportation and Commuting (Uber)

If you have used an app to book a cab, you are already using Machine Learning to an extent. It provides a personalized application which is unique to you. Automatically detects your **location** and provides options to either go home or office or any other frequent place based on your **History and Patterns.**

It uses Machine Learning algorithm layered on top of Historic Trip Data to make a more accurate **ETA prediction**. With the implementation of Machine Learning, they saw a 26% accuracy in Delivery and Pickup.

Products Recommendations

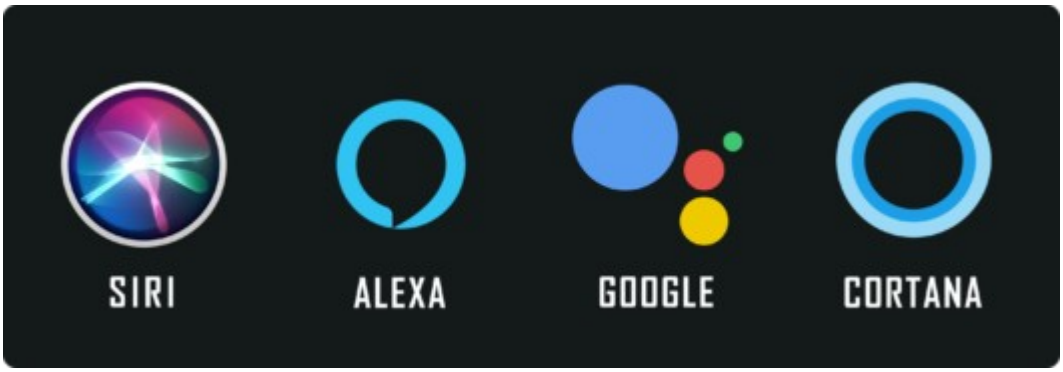
Suppose you check an item on Amazon, but you do not buy it then and there. But the next day, you're watching videos on YouTube and suddenly you see an ad for the same item. You switch to Facebook, there also you see the same ad. So how does this happen?

Well, this happens because Google **tracks your search history**, and recommends ads based on your search history. This is one of the coolest applications of Machine Learning. In fact, **35%** of Amazon's revenue is generated by Product Recommendations.

Virtual Personal Assistants

As the name suggests, Virtual Personal Assistants assist in finding useful information, when asked via text or voice. Few of the major Applications of Machine Learning here are:

- •Speech Recognition
- •Speech to Text Conversion
- •Natural Language Processing
- •Text to Speech Conversion



All you need to do is ask a simple question like "**What is my schedule for tomorrow?**" or "**Show my upcoming Flights**". For answering, your personal assistant searches for information or recalls your related queries to collect info. Recently personal assistants are being used in Chatbots which are being implemented in various food ordering apps, online training websites and also in Commuting apps.

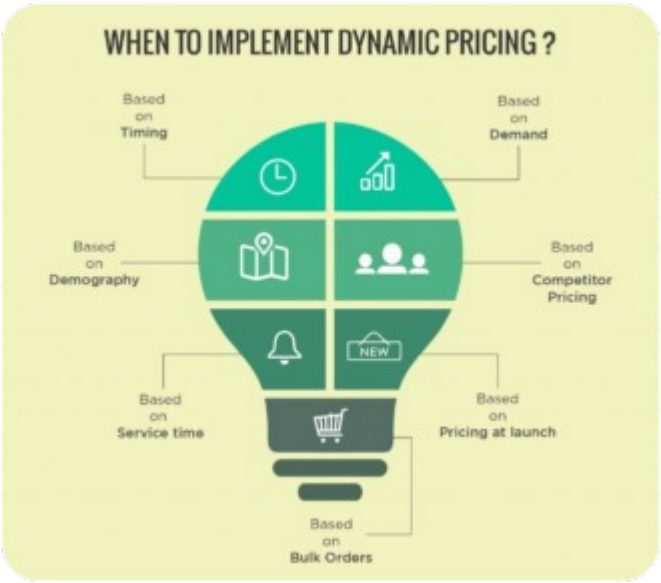
Self Driving Cars

Well, here is one of the coolest application of Machine Learning. It's here and people are already using it. Machine Learning plays a very important role in Self Driving Cars and I'm sure you guys might have heard about **Tesla**. The leader in this business and their current **Artificial Intelligence** is driven by hardware manufacturer **NVIDIA**, which is based on Unsupervised Learning Algorithm.

NVIDIA stated that they didn't train their model to detect people or any object as such. The model works on ***Deep Learning*** and it crowdsources data from all of its vehicles and its drivers. It uses internal and external sensors which are a part of **IOT**. According to the data gathered by McKinsey, the automotive data will hold a tremendous value of **$750 Billion.**

Dynamic Pricing

Setting the right price for a good or service is an old problem in economic theory. There are a vast amount of pricing strategies that depend on the objective sought. Be it a movie ticket, a plane ticket or cab fares, everything is dynamically priced. In recent years, artificial intelligence has enabled pricing solutions to track buying trends and determine more competitive product prices.



How does Uber determine the price of your ride?

Uber's biggest uses of Machine Learning comes in the form of surge pricing, a machine learning model nicknamed as "**Geosurge**". If you are getting late for a meeting and you need to book an Uber in a crowded area, get ready to pay twice the normal fare. Even for flights, if you are traveling in the festive season the chances are prices will be twice the original price.

Google Translate

Remember the time when you traveled to a new place and you find it difficult to communicate with the locals or finding local spots where everything is written in a different language.

Well, those days are gone now. Google's **GNMT**(Google Neural Machine Translation) is a Neural Machine Learning that works on thousands of languages and dictionaries, uses **Natural Language Processing** to provide the most accurate translation of any sentence or words. Since the tone of the words also matters, it uses other techniques like POS Tagging, NER (Named Entity Recognition) and Chunking. It is one of the best and most used Applications of Machine Learning.

Online Video Streaming (Netflix)

With over 100 million subscribers, there is no doubt that Netflix is the daddy of the online streaming world. Netflix's speedy rise has all movie industrialists taken aback – forcing them to ask, "**How on earth could one single website take on Hollywood?"**. The answer is Machine Learning.

The Netflix algorithm constantly gathers massive amounts of data about users' activities like:

- When you pause, rewind, or fast forward
- What day you watch content (TV Shows on Weekdays and Movies on Weekends)
- The Date and Time you watch
- When you pause and leave content (and if you ever come back)
- The ratings Given (about 4 million per day), Searches (about 3 million per day)
- Browsing and Scrolling Behavior

And a lot more. They collect this data for each subscriber they have and use their Recommender System and a lot of Machine Learning Applications. That's why they have such a huge customer retention rate.

Fraud Detection

Experts predict online credit card fraud to soar to a whopping **$32 billion** in **2020**. That's more than the profit made by Coca Cola and JP Morgan Chase combined. That's something to worry about. Fraud Detection is one of the most necessary Applications of Machine Learning. The number of transactions has increased due to a plethora of payment channels – credit/debit cards, smartphones, numerous wallets, UPI and much more. At the same time, the amount of criminals have become adept at finding loopholes.

Whenever a customer carries out a transaction – the Machine Learning model thoroughly x-rays their profile searching for suspicious patterns. In Machine Learning, problems like fraud detection are usually framed as classification problems.