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Introduction to Machine Learning

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Machine Learning is an idea to learn from examples and experience, without being explicitly programmed. Instead of writing code, you feed data to the generic algorithm, and it builds logic based on the data given [1].

For example, one kind of algorithm is a classification algorithm. It can put data into different groups. The classification algorithm used to detect handwritten alphabets could also be used to classify emails into spam and not-spam.

As Tom M. Mitchell points out: “A computer program is said to learn from experience E with some class of tasks T and performance measure P if its performance at tasks in T, as measured by P, improves with experience E” [2].

Machine Learning is a field which is raised out of Artificial Intelligence (AI). Applying AI, we wanted to build better and intelligent machines. But except for few more tasks such as finding the shortest path between point A and B, we were unable to program more complex and constantly evolving challenges. There was a realization that the only way to be able to achieve this task was to let machine learn from itself. This sounds similar to a child learning from its self. So, machine learning was developed as a new capability for computers. And now machine learning is present in so many segments of technology, that we don’t even realize it while using it.

The techniques we use for data mining have been around for many years, but they were not effective as they did not have the competitive power to run the algorithms. If you run deep

learning with access to better data, the output we get will lead to dramatic breakthrough which is machine learning.

There are many examples of machine learning. Here are a few examples of classification problems where the goal is to categorize objects into a fixed set of categories.

Face detection is used to identify faces in images (or indicate if a face is present). Email filtering is applied to classify emails into spam and not-spam. The aim of medical diagnosis using machine learning is to diagnose a patient as a sufferer or non-sufferer of some disease. In weather prediction machine learning is useful to predict, for instance, whether or not it will rain tomorrow.

There are three kinds of Machine Learning Algorithms:

a. Supervised Learning

b. Unsupervised Learning

c. Reinforcement Learning

A majority of practical machine learning uses supervised learning. In supervised learning, the system tries to learn from the previous examples that are given. Supervised learning problems can be further divided into two parts, namely classification, and regression.

A classification problem is when the output variable is a category or a group, such as “black” or “white” or “spam” and “no spam”. A regression problem is when the output variable is a real value, such as “Rupees” or “height”.

In unsupervised learning, the algorithms are left to themselves to discover interesting structures in the data. This is called unsupervised learning because unlike supervised learning above, there are no given correct answers and the machine itself finds the answers.

Unsupervised learning problems can be further divided into association and clustering problems. An association rule learning problem is where you want to discover rules that

describe large portions of your data, such as “people that buy X also tend to buy Y”.

A clustering problem is where you want to discover the inherent groupings in the data, such as grouping customers by purchasing behavior.

A computer program will interact with a dynamic environment in which it must perform a particular goal (such as playing a game with an opponent or driving a car). The program is provided feedback in terms of rewards and punishments as it navigates its problem space.

Using this algorithm, the machine is trained to make specific decisions. It works this way: the machine is exposed to an environment where it continuously trains itself using trial and error method.

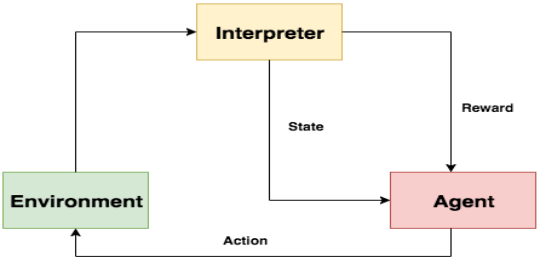

Fig.1 Reinforcement learning process

Machine Learning theory is a field that meets statistical, probabilistic, computer science and algorithmic aspects arising from learning iteratively from data which can be used to build intelligent applications.

The foremost question when trying to understand a field such as Machine Learning is the amount of mathematics necessary and the complexity of mathematics required to understand these systems [3].

The answer to this question is multidimensional and depends on the level and interest of the individual. Here is the minimum level of mathematics that is needed for Machine Learning Engineers / Data Scientists.

1. Linear Algebra
2. Probability Theory and Statistics
3. Calculus
4. Algorithms and Complex Optimizations

According to the statistics the importance of mathematic topics needed for Machine Learning accounts for 35% of Linear Algebra, 25% of Probability Theory and Statistics, 15% of Algorithms and Complexity, and also 15% of Calculus.

In conclusion, finding patterns in data is possible only for human brains so far. The data is becoming very massive, the time taken to compute it increases, and this is where Machine Learning comes into action, to help people with large data in minimum time.

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