Introduction to Machine Learning: Algorithms, Techniques, and Applications

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Abstract- **This paper discusses the advantages and disadvantages of machine learning, based on the clarification of the ML algorithm concept.**

Keywords: **machine learning, ML, machine learning pipeline, neural network.**

I.   INTRODUCTION

Machine learning is a field of artificial intelligence that aims to teach machines how to perform long and complex operations. In addition to making decisions after completing these operations.

So, it is a very important response tool that we can use efficiently in a variety of cutting-edge technology. In addition, it is a necessary aspect of modern research that uses algorithms and neural network models to improve systems performance.

The history of AI (Artificial Intelligence) started in 1943 when Waren McCulloch and Walter Pitts introduced the first neural network model. After that, in 1950 Alan Turing complete their path when he asked his famous question: "Can machines think?". And then Scientists began to invent neural networks and here the term "machine learning" began to appear on the ground.

II.   MACHINE LEARNING DEFINITION

The term "machine learning" refers to the set of processes and operations that aim to make machines think and learn to complete tasks like a human. Without programming the theme explicitly.

Although machines are not smart, they perform operations faster and more accurately than humans.

However, man overcomes the machine in his possession of intelligence. Which is based on the process of human sensitivity to the environment, then sending these signals to the brain through the nervous system, which performs comparison operations with previous experiences. And finally takes an appropriate decision. Machine learning depends on providing it with sensors that are similar in function to human senses, and then providing it with experiments so that it can make comparisons that the human mind makes.

III.   MACHINE LEARNING ALGORITHM

In machine learning, signals travel using neural networks, which consist of an enormous group of neurons joined together by communication links to carry out complex computations.

This structure can be described using a graph whose nodes are the neurons. And each directed edge in the graph links the output of some neuron to the input of another neuron.
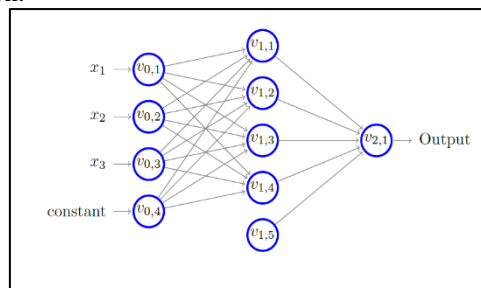

Figure 1: Describe the structure of a neural network as a graph (Taken from the Understanding Machin Learning book for Shai Shalev-Shwartz and Shai Ben-David).

Today, machine learning focuses on natural language processing, image and voice processing, knowledge representation, and so on.

There are two principal objectives for machine learning. First, make the machines make decisions after analyzing the data they have. And second, make machines predictable.

IV.   ADVANTAGES OF MACHINE LEARNING

There are many benefits of using machine learning which are innumerable. Where this technology had great positive effects on operations and research that led to the development of many fields. The most important are:

▪   **Replace manual testing and speed up operations:**

To complete manual testing, specialized engineers need from a few days to a few weeks. And it is a very long time when it comes to analyzing a large amount of data.

Furthermore, manual function testing is costly both in time and currency.

ML solved this problem by making the process of collecting content and analyzing informational collections easier and faster.

Furthermore, ML can deal with figuring out log documents thus it will save time and upgrade accuracy.

▪ **Reducing cost**
in manual testing, if we have a large number of tests, then we need more labor costs. ML reduced this cost using automation processes.

▪ **The possibility of continued development**
ML models keep on developing after changes in the code. And this is thanks to continuous learning which uses a smart ring called a "Machine learning pipeline". Which is a loop whose input is the entered data. Then it includes several steps, starting with data validation. then predictions and monitoring. After that the data will be cleaned and flagged back to input, forming a closed loop.
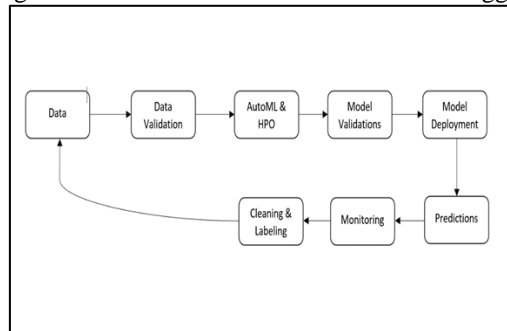

Figure 2: Machine learning pipeline.

▪ **Analysis of errors**
ML can answer many questions when it comes to errors, like "When?", "where", and so on. And this process is very fast. So, analyzers can use this data to do a continuous investigation of bugs.

▪ **Identifies the patterns**
With machine learning, and with the power of data collection and analysis. we can identify the patterns among a large set of data faster and easier.

▪ **The ability to handle all forms of data**
It shows excellent performance when dealing with multidimensional data of different types. Whatever the work environment.

V. DISADVANTAGES OF MACHINE LEARNING
▪ **The sensitive reliance on income data**
So, if we have incorrect input data. The output will be produced as incorrect too.
In other words, the output is completely dependent on the sensitive input data.

▪ **The elimination of human opportunities**
With the existence of a machine that can accomplish the same tasks that a person performs. With less time, lower cost, and greater accuracy, it is normal for a person to be replaced with a machine in all jobs.

▪ **Consuming more time and storage space**
In the case of large and complex input data,
We will get more system consumption and more energy consumption from the CPU. Hence, a long time to get the final results.

▪ **Machine learning is highly error-prone**
Any error caused by input or software provided to the system will produce a loop of errors which takes time to discover the source of the error.

▪ **The high cost**
Which makes it a preserve of governments and gig companies.

▪ **The need to specify the algorithm used**
Which makes us need to test all algorithms using all the data. And then decide to take a particular algorithm.

▪ **Privacy issues**
As the main pillar in machine learning is data, which produces the output. And here it can be reused for commercial purposes.

VI. USE CASE FOR MACHINE LEARNING
▪ **Robot Perception**
Because most systems are unable alone to find and read landmarks or discover the environment around them to make high-importance decisions. Then we had to invent robots that use machine learning. Which later proved highly effective in the system's internal and external environment.

▪ **Cybersecurity**
In cybersecurity, machine learning should be used first, to avoid the high cost of hardware security equipment. And secondary to detect threats and vulnerabilities in the security network.

▪ **Marketing**
Which works to anticipate users' preferences and propose similar marketing models to them.
Machine learning use case in marketing depends on repeating patterns and understanding the consumer's needs before he even requests them. And suggest them to this user, which causes a real increase in sales.

▪ **Manufacturing**

There are a lot of machine learning benefits in manufacturing. It can proactively prevent catastrophic failure that could stop the machine from working. Helping to increase the life span of the machine. Otherwise, it is also useful in improving inventory management processes and improving productivity.

▪ **Banks**

Machine learning is used to manage security risks in banks. In addition to providing scenarios and the possibility of predicting results by making hypothetical decisions to analyze the growth or the decline movement of the banks.

▪ **The effect of machine learning on spinsterhood**

The World statistics confirmed that the prevalence of marital conflict was increasing from year to year, and indicated that couples frequently feuded. The personal opinion shown in qualitative data on its prevalence indicates that the number of couples engaged in marital disagreement is constantly increasing. The discovery of Somjit Prueksaritanond and Saisunee Tubtimtes (2015) also revealed that 83.9% of the sample tested had struggles with their spouses.

In the face of these large and frequent conflicts, and since human is inherently inclined to solve problems and tend to happiness and well-being in life, studies have begun to turn machine into a substitute for humans in marriage. when Seriously thinking about this issue, the machine may be a good alternative when it is made to meet an individual's needs and predictions about the psychological and physical qualities of his or her partner. But can the machine compensate for human emotion? Can the machine have feelings?

One of the most interesting figures in computer science is Marvin Minsky. He says: "If machines can think, then they can feel emotion". The Allen Institute of Artificial Intelligence (AI2) works to identify emotions through ethics, using a Delphi algorithm that is a prototype designed to model people's moral judgments in a variety of everyday situations. This algorithm has been tested and trained in the ethical opinions of many people so that it can ultimately make its ethical judgments on the user's situations.

Some scientists say that our lack of belief in the machine's ability to feel is the underlying reason why we think machines can't feel. Denny Yen, associate professor at USF Moma's School of Information Systems and Management, said: "The reason is that people don't expect automated chat shows to have feelings, people don't interact with chatbots the same way they do with humans".

But the question arises, can some people think of the machine's ability to feel? Can they believe that the machine is capable of replacing humans in marriage? Answer Yes, where in the broad title of a Guardian magazine article find the following title: "A Chinese artificial intelligence engineer has given up on the search for love and "married" a robot he built himself."

Chinese AI engineer Zheng Jiajia was in 2017, the first man to marry a machine he designed himself at the age of 31. After Zheng Jiajia became sick of finding the right girl for his career and emotional demands. The robot wife, Yingying, could only read some Chinese letters and images and speak some simple words, but Zheng was planning to upgrade her so she could walk and do household chores.

The high price of a machine may be the only factor that can limit the impact of a machine on the spinsterhood rate in the world for both gender, but in the distant future, we cannot judge, just as many forms of technology were the preserve of a certain class and then became available to everyone, a machine that will replace a human in emotional life can do that too.

In this great technological development, the future of the machine in the emotional life of humans remains completely unknown, and therefore the impact of the machine on the rate of spinsterhood in the world remains completely unknown.

VII.   CONCLUSION:

Finally, for the future of machine learning. The researchers found that machine learning will overrun all fields. So, to avoid replacing humans with machines, Tasks should be distributed equally between the two. And of course, some features should always remain in human capabilities. And should not be taught to the machines.

Otherwise, one day, the machine will overcome humans in every job. Consequently, job opportunities will be extinct for humans, and we will inevitably suffer from widespread unemployment in the world.

On the other hand, machine learning algorithm needs a huge amount of data to learn how to do something, or how to make a decision. Otherwise, it needs a huge number of examples to learn.

While humans can learn better using a few examples.

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