Machine Learning: A Solution Approach for Complex Problems

Dr.H.R.Vyawahare

Sipna College of Engineering &
Technology, Amravati
Amravati, harsha.vyawahare@gmail.com

Abstract—**Machine learning is a growing technology which enables computers to learn automatically from past data. Machine learning uses various algorithms for building mathematical models and making predictions using historical data or information.It is being used for various tasks such as image recognition, speech recognition, email filtering, Facebook auto-tagging, recommender system, and many more. Machine Learning is said as a subset of artificial intelligence that is mainly concerned with the development of algorithms which allow a computer to learn from the data and past experiences on their own.Machine learning enables a machine to automatically learn from data, improve performance from experiences, and predict things without being explicitly programmed.Machine learning brings computer science and statistics together for creating predictive models. Machine learning constructs or uses the algorithms that learn from historical data. This paper provides over all views of Machine Learning.**

Keywords—machine learning, artificial intelligence, data,learning,algorithm.

I. INTRODUCTION

Machine learning brings computer science and statistics together for creating predictive models. Machine learning constructs or uses the algorithms that learn from historical data. . Machine learning is important because it gives enterprises a view of trends in customer behavior and business operational patterns, as well as supports the development of new products. Many of today's leading companies, such as Facebook, Google and Uber, make machine learning a central part of their operations. Machine learning has become a significant competitive differentiator for many companies.Classical machine learning is often categorized by how an algorithm learns to become more accurate in its predictions.Machine Learning has proven valuable because it can solve problems at a speed and scale that cannot be duplicated by the human mind alone. With massive amounts of computational ability behind a single task or multiple specific tasks, machines can be trained to identify patterns in and relationships between input data and automate routine processes.ML algorithms build a mathematical model based on sample data, known as "training data," to make predictions or decisions without being explicitly programmed to do so. This can reveal trends within data that information businesses can use to improve decision making, optimize efficiency and capture actionable data at scale.ML provides the foundation for AI systems that automate processes and solve data-based business problems autonomously. It enables companies to replace or augment certain human capabilities. Common machine learning applications you may find in the real world include chatbots, self-driving cars and speech recognition. A Machine Learning system learns from historical data, builds the prediction models, and whenever it receives new data, predicts the output for it. The accuracy of predicted output depends upon the amount of data, as the huge amount of data helps to build a better model which predicts the output more accurately.

Suppose we have a complex problem, where we need to perform some predictions, so instead of writing a code for it, we just need to feed the data to generic algorithms, and with the help of these algorithms, machine builds the logic as per the data and predict the output. Machine learning has changed our way of thinking about the problem. The below block diagram explains the working of Machine Learning algorithm:
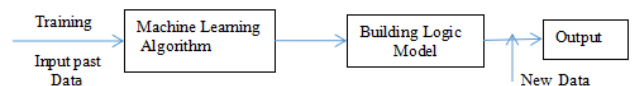

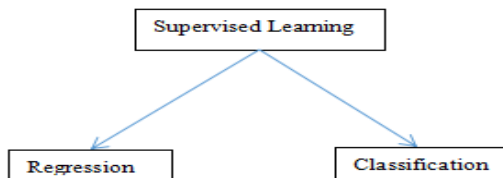Figure1:block diagram for working of Machine Learning

There are four basic approaches : supervised learning, unsupervised learning, semi-supervised learning and reinforcement learning. The type of algorithm data scientists choose to use depends on what type of data they want to predict.

II. SUPERVISED LEARNING

Supervised Learning, this type of machine learning, data scientists supply algorithms with labeled training data and define the variables they want the algorithm to assess for correlations. Both the input and the output of the algorithm is specified.Supervised learning is the types of machine learning in which machines are trained using well "labelled" training data, and on basis of that data, machines predict the output. The labelled data means some input data is already tagged with the correct output.

In supervised learning, the training data provided to the machines work as the supervisor that teaches the machines to predict the output correctly. It applies the same concept as a student learns in the supervision of the teacher.

Supervised learning is a process of providing input data as well as correct output data to the machine learning model. The aim of a supervised learning algorithm is to find a mapping function to map the input variable(x) with the output variable(y).In the real-world, supervised learning can be used for Risk Assessment, Image classification, Fraud Detection, spam filtering, etc.There are two types of Supervised Learning.

A. Regression

Regression algorithms are used if there is a relationship between the input variable and the output variable. It is used for the prediction of continuous variables, such as Weather forecasting, Market Trends, etc.

B. Classification

Classification algorithms are used when the output variable is categorical, which means there are two classes such as Yes-No, Male-Female, True-false, etc.
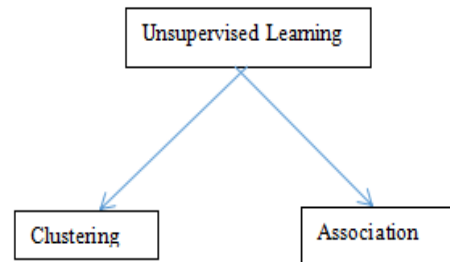
III. UNSUPERVISED LEARNING

Supervised machine learning in which models are trained using labeled data under the supervision of training data. But there may be many cases in which we do not have labeled data and need to find the hidden patterns from the given dataset. So, to solve such types of cases in machine learning, we need unsupervised learning techniques.

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

Unsupervised learning is a machine learning technique in which models are not supervised using training data set. Instead, models itself find the hidden patterns and insights from the given data. It can be compared to learning which takes place in the human brain while learning new things.

Unsupervised learning cannot be directly applied to a regression or classification problem because unlike supervised learning, we have the input data but no corresponding output data. The goal of unsupervised learning is to find the underlying structure of data set, group that data according to similarities, and represent that data set in a compressed format.

There are two types of Unsupervised Learning.

A. Clustering

Clustering is a method of grouping the objects into clusters such that objects with most similarities remains into a group and has less or no similarities with the objects of another group. Cluster analysis finds the commonalities between the data objects and categorizes them as per the presence and absence of those commonalities.

B. Association

Association rule is an unsupervised learning method which is used for finding the relationships between variables in the large database. It determines the set of items that occurs together in the data set. Association rule makes marketing strategy more effective. Such as people who buy X item (suppose a bread) are also tend to purchase Y (Butter/Jam) item. A typical example of Association rule is Market Basket Analysis.

IV. REINFORCEMENT LEARNING

Reinforcement learning is a feedback-based learning method, in which a learning agent gets a reward for each right action and gets a penalty for each wrong action. The agent learns automatically with these feedbacks and improves its performance. In reinforcement learning, the agent interacts with the environment and explores it. The goal of an agent is to get the most reward points, and hence, it improves its performance. The robotic dog, which automatically learns the movement of his arms, is an example of Reinforcement learning.

V. SEMI-SUPERVISED LEARNING

Semi-supervised learning: This approach to machine learning involves a mix of the two preceding types. Data scientists may feed an algorithm mostly labeled training data, but the model is free to explore the data on its own and develop its own understanding of the data set.

VI. IMPORTANCE OF MACHINE LEARNING

Machine learning is important because it gives enterprises a view of trends in customer behavior and business operational patterns, as well as supports the development of new products. Many of today's leading companies, such as Facebook, Google

and Uber, make machine learning a central part of their operations. Machine learning has become a significant competitive differentiator for many companies.

VII. NEED FOR MACHINE LEARNING

The need for machine learning is increasing day by day. The reason behind the need for machine learning is that it is capable of doing tasks that are too complex for a person to implement directly. As a human, we have some limitations as we cannot access the huge amount of data manually, so for this, we need some computer systems and here comes the machine learning to make things easy for us.

We can train machine learning algorithms by providing them the huge amount of data and let them explore the data, construct the models, and predict the required output automatically. The performance of the machine learning algorithm depends on the amount of data, and it can be determined by the cost function. With the help of machine learning, we can save both time and money.

The importance of machine learning can be easily understood by its uses cases, Currently, machine learning is used in self-driving cars, cyber fraud detection, face recognition, and friend suggestion by Facebook, etc. Various top companies such as Netflix and Amazon have build machine learning models that are using a vast amount of data to analyze the user interest and recommend product accordingly.

VIII. ADVANTAGES AND DISADVANTAGES

Machine learning has seen use cases ranging from predicting customer behavior to forming the operating system for self-driving cars.

When it comes to advantages, machine learning can help enterprises understand their customers at a deeper level. By collecting customer data and correlating it with behaviors over time, machine learning algorithms can learn associations and help teams tailor product development and marketing initiatives to customer demand.

Some companies use machine learning as a primary driver in their business models. Uber, for example, uses algorithms to match drivers with riders. Google uses machine learning to surface the ride advertisements in searches.

But machine learning comes with disadvantages. First and foremost, it can be expensive. Machine learning projects are typically driven by data scientists.There is also the problem of machine learning bias. Algorithms trained on data sets that

exclude certain populations or contain errors can lead to inaccurate models of the world that, at best, fail and, at worst, are discriminatory.

IX. CONCLUSION

Machine Learning is a technique of training machines to perform the activities a human brain can do, albeit bit faster and better than an average human-being.

This machines can be trained to perform human activities in several areas and can aid humans in living better lives.Machine should be able do all the things what we can do & machine learning will play a big role in achieving this things.

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