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Emerging Trends and Applications of Machine Learning: A Survey

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Abstract

Machine learning is one of the most growing field and current technology trend in Artificial Intelligence which enables learning algorithms to learn continuously based on training and emerging information.With the learning approach, the machine develops the capability to analyze the useful information from large amount of data and recognize the hidden pattern even withinsufficient information. Spam emails, marketing, intrusion detection,healthcare, web page ranking, recommendation systems, object recognition are some of the applications where the learning algorithms are used on daily basis. This paper presents a review on the Machine learning emerging trends, the work of various authors in this field and the applications.

Keywords; *Artificial Intelligence; Machine Leaning techniques; Deep learning; Application.*

I. INTRODUCTION

Machine learning is one of the most developing technical fields based on the study of algorithms, statistical and logical models to give computers the capability to learn without being programmed explicitly [1]. It is an application of Artificial intelligence that mainly focuses on developing the computer systems so that they learn automatically from the training data, examples and past experiences to improve the performance. Thus, this technology empowers the computer machine to accomplish the certain task intelligently without the intervention of human beings.

With the growth of large volumes of data everywhere, the main problem lies in analyzing the data to extract the useful information from it. Machine Learning helps to discover the hidden patterns through historical learning and trends in data where feature extraction is the most important task of machine learning [2]. The field of Machine learning is very vast and its applications are increasing rapidly. From extracting the useful information, making decisions from a large amount of data generated by the sensors, radars, big data. These applications have recently elevated interest in this area. Healthcare, smart city projects, self-driven automobiles, pattern recognition, IoT application, Intrusion detection etc. all require adaptive learning [3]. Data featuring and analysis has a major role in interpreting the data for producing valid analytics. Here, Machine learning plays an important role which is used to design some models and algorithms to extract the useful information, carry out the complex task and make predictions on the results. Machine learning algorithms are classified as supervised, unsupervised, semi- supervised learning. These learning algorithms are utilized in many applications which we use on daily basis. From using a web search engine like Google to Facebook, it utilizes these algorithms

to rank the web pages, to recognize images. It has also encountered the challenges of big data especially the unstructured data[4]. Thus, it helps the

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data scientists, engineers, analysts for decision making and producing valid results which could increase productivity.

As this field is growing, it proves to be useful in large areas. In the field of biology, medicine, physics, social sciences and many more, it has proved to be useful. In healthcare, Machine learning is developing systems that can assist the doctors to give an efficient diagnosis. In transport systems, it is assisting in developing the self-driven automobiles to make the existing transport system more efficient. In data science, it is helping to extract the useful data from the vast data available. There is a number of Machine learning algorithms which are categorized into main classifications such as Regression, Classification, Clustering which contains a number of algorithms to give efficient results based on the input pattern. The main steps followed by Machine learning is feature engineering, choosing the appropriate algorithm, training the model and then classify/predict the result [5].

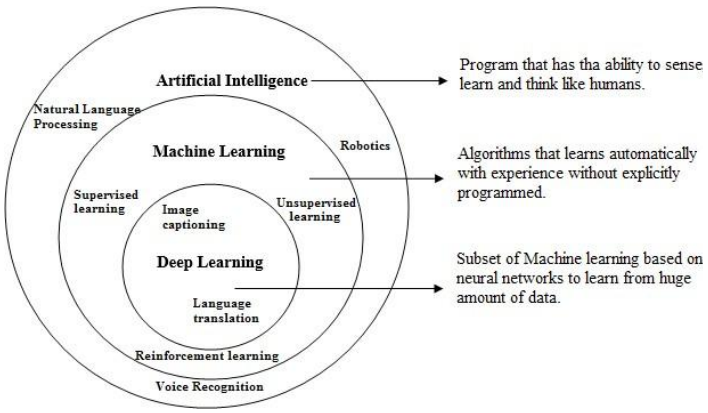

Fig 1.

Thus, Machine Learning has become a significant area of research around the world owing to its immense applications. Machine Learning algorithms have been comprehensively functional in a variety of domains.

II. LITERATURE REVIEW

The author[6] has proposed the use of machine learning strategies for cancer diagnosis using nuclei samples from breast masses. They have utilized and trained certain algorithms such as Support Vector Machines, Artificial Neural Networks, General Linear Model regression on the data to estimate the diagnostic outcome. They compared their prediction from the trained algorithms with the decisions of real world and achieved high accuracy, effectiveness. The author [7] has proposed a problem of monitoring system in ICU i.e., intensive care unit. As the present monitoring system in ICU has numerous issues to distinguish genuine conditions of patients which producehigh false alarms that is affecting the working conditions. Additionally, these alerts can risk the patient life by deceiving the staff members. Thus, the author has proposed an approach to avoid these false alerts to improve the current health monitoring system by combining the incremental versions of Support vector machine i.e. LASVM and ISVM with k-prototype methods of clustering. The proposed approaches are implemented on a large volume of data and has produced best results contrasted with other frameworks and models. Revathi S et al.

[8] centers around machine learning methods for intrusion detection. The author presents NSL- KDD dataset and analysis the intrusion using machine learning algorithms. The author also discusses that using this dataset the system has improved accuracy in finding the anomaly to tackle the attacks. Tahira et al.[9] discussed Student evaluation in e-learning using Machine learning algorithms. The author emphasizes on predicting a fair assessment of students using Naïve Bayes, Decision trees and Random forest algorithm of Machine learning. This will benefit the instructor and student for the fair evaluation and can further act as guidance for students. Author has described a detailed study on these evaluation techniques and the author has conducted performance testing for measuring the validity and accuracy of results. Qianlong Wang, et al. [10] has discussed about the earthquake prediction problem, which is considered as most important area of concern in seismology. Various

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studies have already been done to solve this problem but with no satisfactory results as it is quite hard to predict its nature. The author has described and utilize a long short term memory network (LSTM) technique to learn the spatio temporal relation of earthquakes in various localities and this technique helps in making earlier and better prediction.

III. MACHINE LEARNING TECHNIQUES

Machine Learning can be categorized into the following different types of learning as shown in the Fig 1.2

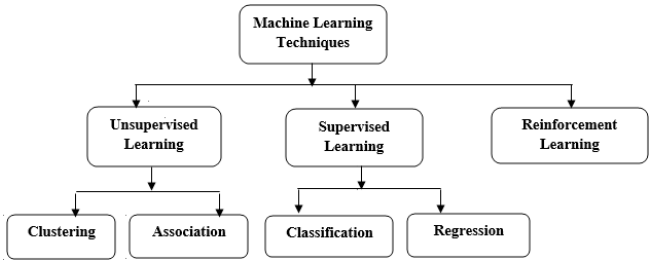

Fig 2. Taxonomy of Machine Learning Algorithms

A. Supervised Learning

In Supervised learning, labelled data is provided to the machine for training i.e. a correct answer is associated with the data and then the machine is trained. Initially, the machine is trained and through this process the machine develops the learning capability [11]. Later on, when the machine is provided with new set of data, the supervised learning algorithm analyses and produces a correct result for the new set of data.It can be used in various applications such as Spam detection, image and object recognition etc.

Supervised learning algorithms are further listed into two categories:

1. Classification- In Classification, the output variable is a discrete value or a category. For example, gender of a person can be male or female.

2. Regression- In Regression, the output variable is a continuous or real value. For example, salary of a person. It utilizes Linear regression model for prediction.

B. Un-supervised Learning

In Un-supervised learning, the machines are trained without instructions or known results i.e. the training of machine is done using the data and information which is not labeled or classified. The machines themselves recognize and categorize the hidden information based on the patterns, similarities from the given input information [12].

Un-supervised learning algorithms are further listed into two categories:

1. Clustering- It is a form of unsupervised learning where we locate the hidden patterns or grouping in data.

2. Association- In Association form of unsupervised learning we associate the rule to describe the data.

C. Reinforcement Learning

In Reinforcement Learning, the machines are trained to learn by exploring through the different actions on its own and then to make a specific decision. Here, the maximum long-term performance is achieved by exploring in its environment and through feedback mechanism as no answer is given, the reinforcement agent learns itself and makes a decision to achieve the result. Reinforcement learning finds application in inventory management, Robotics, Finance, Manufacturing etc.

IV. APPLICATION AREAS OF MACHINE LEARNING

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Following are the major emerging trends where machine learning is extensively used and transforming the industries as shown in the Fig 3:

1. In Automatic recognition of handwritten postal codes, Researchers are able to utilize the potential of machines to automatically read the state/ city/ pin code. They combined optical character recognition (OCR) with a machine learning approach to correctly predict the handwritten postal address.

2. In Recommendation system, Machine learning technology is widely used. As we all are familiar with the suggested products by most of the e-commerce websites such as Amazon. These suggestions are mainly the results of the millions of online transactions through the e-commerce platform and data is analyzed based on the history of users. These recommendation systems are utilized by large companies such as Pandora, Netflix etc. for giving more personalized experience to the users [13].

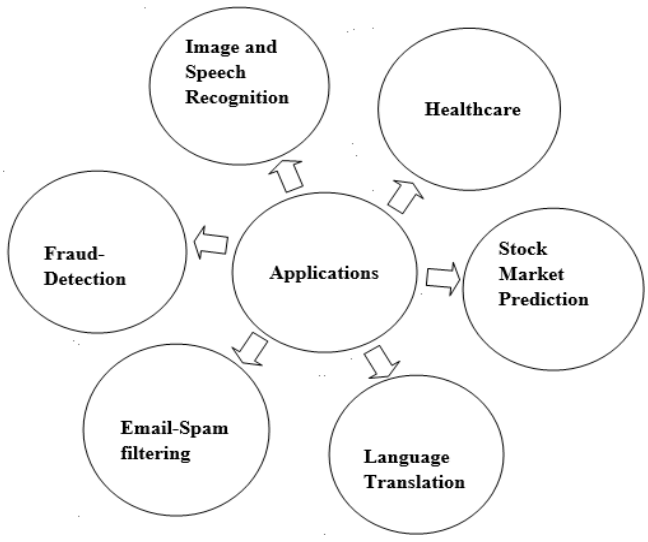

Fig 3. Applications of Machine Learning

3. Google has employed Machine learning strategies for developing the self-driving autonomous car by analyzing the speed, acceleration, turns of past drives. Here, deep learning neural networks are used which a field of Machine is learning to identify the objects and make optimal actions. It incorporates sensors for detecting the change in the environmental conditions. In the coming years, we can expect this trend to be used by other automakers to make the technology better.

4. The spam detection system also utilizes machine learning to filter the emails which it learns from its training process.

5. In Education, machine learning is utilized to develop applications that can aid in teaching-learning activities. Grade scope, Massive Open online courses are some applications that have been developed to help teachers analyze the student's performance by changing the manual system and allocating the teachers to less-routine activities [14].

6. Machine learning supports computer vision and image recognition systems to detect and analyze the visual images. In most social media applications, these systems are used to tag objects or people.

7. Translating text into different languages using machine translation which includes the statistical, neural network based techniques.

8. In Public sectors, machine learning offers efficient services to tackle the problems during catastrophes, policy-making, and finance.

Thus, Machine learning is continuously increasing to replicate the human intelligence into machines and making them more capable to tackle the complex tasks. It will keep on increasing its importance to the business activities and will contribute more to improving business efficiency and productivity.

V. CONCLUSION

In this paper we have presented an overview to machine learning, various learning techniques and applications. The recent trend depicts the growth of Machine learning in different areas. Machine learning is directing towards efficient algorithms with the capability of accurate predictions, responses. In future it will be developed to take critical challenges which can minimize the error and

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can improve the accuracy of the machines. The main motive is to create intelligent machines that can hold the capability to perform a complex task and thereby reducing the job of human. Thus, Machine learning has diverse application and it will remain an active area of research in future.

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