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The Discipline of Machine Learning in Artificial Intelligence: A Review

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ABSTRACT

Machine learning is one of the most exciting recent technologies in Artificial Intelligence. Learning algorithms in many applications that's we make use of daily. Every time a search engine like Google is used to search the internet, one of the reasons that works so well is because a learning algorithm. Every time social media is used it recognizes friends' photos, that's also machine learning. Spam filters in email saves the user from having to wade through tons of spam email, that's also a learning algorithm.

***Keywords*:** Learning, ML, Reinforcement learning, Classification.

INTRODUCTION

The development of today's AI applications started with using the age-old traditional statistical techniques. You must have used straight-line interpolation in schools to predict a future value. There are several other such statistical techniques which are successfully applied in developing so-called AI programs. Some of the examples of statistical techniques that are used for developing AI applications are:

- Classification
- Clustering
- Regression
- Probability
- Decision Trees

These are some primary techniques that are enough to get started on AI without scaring of the vastness that AI demands. However, today the data is abundant. To analyze the kind of huge data that we possess statistical techniques are of not much help as they have some limitations of their own. More advanced methods such as deep learning are hence developed to solve many complex problems

Artificial intelligence in is the simulation of human intelligence processes by machines, especially computer systems. An Artificial Intelligence (AI) program is called Intelligent Agent. Intelligent agent gets to interact with the environment. The agent can identify the state of an environment through its sensors and then it can affect the state through its actuators.

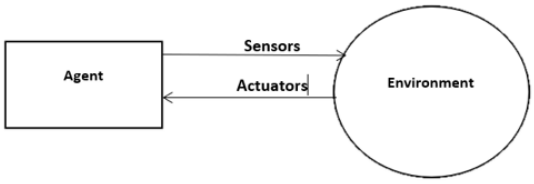

Figure 1: Artificial Intelligence Perception cycle

The important aspect of AI is the control policy of the agent which implies how the inputs obtained from the sensors are translated to the actuators, in other words how the sensors are

mapped to the actuators, this is made possible by a function within the agent.

The ultimate goal of AI is to develop human like intelligence in machines. However, such a dream can be accomplished through learning algorithms which try to mimic how the human brain learns.

However, AI programs do the more interesting things such as web search or photo tagging or email anti-spam. So, machine learning was developed as a new capability for computers and today it touches many segments of industry and basic science. There is autonomous robotics, computational biology. Around 90% of the data in the world was generated in the last two years itself and the inclusion of machine learning library known as Mahout into Hadoop ecosystem has enabled to encounter the challenges of Big Data, especially unstructured data.

MACHINE LEARNING

Machine learning, which is a field that had grown out of the field of artificial intelligence, is of utmost importance as it enables the machines to gain human like intelligence without explicit programming.

Machine learning (ML) is a field of inquiry devoted to understanding and building methods that 'learn', that is, methods that leverage data to improve performance on some set of tasks. It is seen as a part of artificial intelligence. Machine learning algorithms build a model based on sample data, known as training data, in order to make predictions or decisions without being explicitly programmed to do so. Machine learning algorithms are used in a wide variety of applications, such as in medicine, email filtering, speech recognition, and computer vision, where it is difficult or unfeasible to develop conventional algorithms to perform the needed tasks.

In the area of machine learning research the emphasis is given more on choosing or developing an algorithm and conducting experiments on the basis of the algorithm. Such highly biased view reduces the impact or real world applications. In all fields of engineering, there are larger and larger data sets that are being understood using learning algorithms.

MACHINE LEARNING ALGORITHMS TYPES

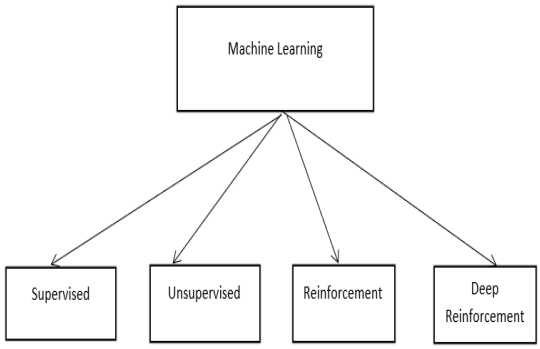

Figure 2: Machine Learning Types

Supervised Learning

Supervised learning is analogous to training a child to walk. You will hold the child's hand, show him how to take his foot forward, walk yourself for a demonstration and so on, until the child learns to walk on his own.

This learning process is based on the comparison of computed output and expected output, that is learning refers to computing the error and adjusting the error for achieving the expected output. For example, a data set of houses of particular size with actual prices is given, then the supervised algorithm is to produce more of these right answers such as for new house what would be the price.

Supervised learning is the machine learning task of inferring a function from labeled training data. The training data consist of a set of training examples. A supervised learning algorithm analyzes the training data and produces an inferred function, which can be used for mapping new examples.

Unsupervised Learning

Unsupervised learning is termed as learned by its own by discovering and adopting, based on the input pattern. In this

learning the data are divided into different clusters and hence the learning is called a clustering algorithm.

In unsupervised learning, we do not specify a target variable to the machine, rather we ask machine "What can you tell me about X?". More specifically, we may ask questions such as given a huge data set X, "What are the five best groups we can make out of X?" or "What features occur together most frequently in X?". To arrive at the answers to such questions, you can understand that the number of data points that the machine would require to deduce a strategy would be very large.

Reinforcement Learning

Reinforcement learning is based on output with how an agent ought to take actions in an environment so as to maximize some notion of long-term reward. A reward is given for correct output and a penalty for wrong output. Reinforcement learning differs from the supervised learning problem in that correct input/output pairs are never presented, nor sub-optimal actions explicitly corrected.

Consider training a pet dog, we train our pet to bring a ball to us. We throw the ball at a certain distance and ask the dog to fetch it back to us. Every time the dog does this right, we reward the dog. Slowly, the dog learns that doing the job rightly gives him a reward and then the dog starts doing the job right way every time in future. Exactly, this concept is applied in "Reinforcement" type of learning.

Deep Reinforcement Learning

The deep learning is a model based on Artificial Neural Networks (ANN), more specifically Convolutional Neural Networks (CNN)s. There are several architectures used in deep learning such as deep neural networks, deep belief networks, recurrent neural networks, and convolutional neural networks. These networks have been successfully applied in solving the problems.

The Deep Reinforcement Learning (DRL) combines the techniques of both deep and reinforcement learning. The reinforcement learning algorithms like Q combined with deep learning to create a powerful DRL model learning are now. The technique has been with a great success in the fields of robotics, video games, finance and healthcare.

APPLICATIONS OF MACHINE LEARNING

Email

With the bulk amount of messages pouring daily it proves highly inconvenient for users to segregate the messages manually. Therefore, machine learning proves to be most beneficial by categorizing the mail automatically into various user-defined inbox tabs such as primary, social, promotions, update etc.

The incoming messages are analyzed and the important sentences are extracted from the email thread and are composed into a summary. This summary is generated based on special characteristics of email.

The spam filter saves the user from having to wade through tons of spam email, that's also a learning algorithm. The spam filter can also be learned by watching which emails you do or do not flag as spam.

Face Recognition

Human face is not unique, rigid object and numerous factors cause the appearance of the face to vary. There are numerous application areas where face recognition can be exploited such as security measure at an ATM, areas of surveillance, closed circuit cameras etc.

Speech Recognition

All speech recognition software utilizes machine learning.

Intrusion detection

Intrusion detection is the process of monitoring the events that are occurring in the systems or networks and analyzing them for signs of possible incidents, which are violations or threats to

computer security policies, acceptable use policies, or standard security practices.

Anomaly detection or recognizing anomalies

Detection of unusual sequences of credit card transactions, detection of unusual patterns of sensor reading in a nuclear power plant or unusual sound in car engine for such purpose dynamic machine learning method is used where instead of looking at individual operation, a sequence of operations is analyzed.

Signature based detection

This technique of detection looks for evidence which indicates misuse. In a network, predetermined attack patterns forms a signature and these signatures are used to determine further network attacks. Machine learning enables examination of the network traffic with predefined signatures and each time database is updated.

Medical records

With the advent of automation, electronic medical records have become prevalent, so if medical records are turned into medical knowledge, then disease could be understood in a better way

Market segmentation

Many companies have huge databases of customer information. So, Unsupervised Machine learning algorithms can look at this customer data set and automatically discover market segments and automatically group customers into different market segments so that the company can automatically and more efficiently sell or market the different market segments together.

Social network

Unsupervised Machine learning algorithms can automatically identify the friends within a user circle in Facebook or Google, or it can identify the maximum number of mails sent to a particular person and categorize into collective groups. It also identifies which are groups of people that all know each other.

Mobile Learning

Information can be easily accessed as and when desired due to the mobile or portable devices. So machine learning caters the learning process of different users by providing information which is customized to the preferences of the user.

Traffic forecasting

With the ever increasing number of vehicles plying on the roads traffic management seems to a huge problem these days. Machines can be trained and used to solve this problem.

Computer games

The gaming industry has grown tremendously in the recent years. AI driven agents are used widely to create interactive gaming experience for the players. These agents can take a variety of roles such as player's opponents, teammates or other non-player characters. Apart from interacting with the human players, a game needs to satisfy a host of other requirements like the audio and visual effects.

Financial market prediction

In today's world the financial market is one of the most unstable and unpredictable. One has to be on his feet constantly in order to survive and be successful in this market. In such an environment where market crashes and sustained periods of loss, are common phenomenon and techniques of machine learning have emerged as the leading performance measures used in the industry.

CONCLUSION

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

In Machine learning the artificial agents learns from training data or by interacting with the environment and influences it to facilitate the best possible result. So Machine Learning is definitely a subfield of Artificial Intelligence.

In Machine learning, supervised and unsupervised learning are of the two major types. And AI agents are general problem solvers and can be applied in various fields.

So, AI is not about perfectly replicating human, it's about figuring out the principles that allow agents to act intelligently and improving upon us. The bottom line is that intelligence is no longer exclusive to only humans.

Human beings always strive to create comfortable life. They are always dependent on the machines. Machines are used to get the work done more efficiently, easily and fast. Earlier machines were used to reduce manual labor. Now, with the help of machine learning human beings want to create machines which are not only strong but also intelligent.

In this paper, discusses the four categories of machine learning i.e. supervised learning, unsupervised learning, and reinforcement learning and deep reinforcement learning and also presents the numerous applications. The main purpose of machine learning is to develop algorithms that assist in the creation of intelligent machines thus reducing the jobs of the programmers. Although a lot of advancements have been made in this field still then there exists glaring limitations in the data set from which machine learns. It can be rectified by constantly keeping the data sets up-to-date as learning is a continuous process. In spite of all these shortcomings machine learning has solved varying problems of global impact. Machine learning has proven to be vastly useful in a variety of fields. The applications of machine learning are therefore never ending and it still remains an active field of research with immense development options and a promising future.

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