MACHINE LEARNING MODELS WITH TYPES OF ALGORITHMS

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Abstract: Machine learning is a kind of data analysis technique which provides a flexible way of learning information about the data, so that necessary action can be predicted accurately. Machine learning techniques will provide the way of analyzing and predicting the valuable information from the available data, so the further actions can be carried out accurately. There are several kinds of machine learning approaches which are available that are based on their behavior and working procedure. Machine learning is a branch of artificial intelligence which aims at solving real life engineering problems. It provides the opportunity to learn without being explicitly programmed and it is based on the concept of learning from data. It is so much ubiquitously used dozen a times a day that we may not even know it. The advantage of machine learning (ML) methods that are used for mathematical models, heuristic learning, knowledge acquisitions and decision trees for decision making. Thus, it provides controllability, observability and stability.

Index Terms **- Machine learning, Artificial intelligence, Models and types of algorithms.**

I. INTRODUCTION

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 from fig.1.
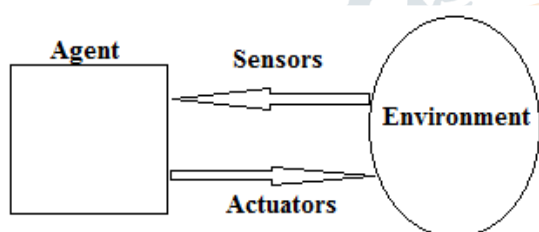

Figure 1: Perception cycle of AI

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. 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. 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. 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 this paper the various applications under the appropriate category of machine learning has been highlighted. This paper makes an effort to bring all the major areas of applications under one umbrella and present a more general and realistic view of the real world applications. Apart from this two application suggestions have been presented forward. The field of machine learning is so vast and ever growing that it proves to be useful in automating every fact of life.

II. MACHINE LEARNING

One of the types of Artificial Intelligence (AI) is Machine learning and the ability is given to the systems to study without being unequivocally planned [1]. The computer programs development is concentrated by the machine learning method and it can alter while it is reveled to the fresh data. Both the data mining and the machine learning process are similar one. The patterns are searched in these both of the system. On the other hand, the data are extracted for an alternative for the individual's knowledge in data mining applications. The machine learning method is used to identify the patterns in data and process of the program

respectively [2]. And also the machine learning method is used to classify as supervised or unsupervised. The previous data is applied to the new data in the supervised algorithms. The inferences from datasets are depicting in the unsupervised algorithms.

The machine learning methodology is developed compared to the previous machine learning methodology because of the novel computing technologies [3]. From the pattern recognition this method is developed and the concept of the systems is studied without any planning to execute the particular performance; scientists are mostly concentrated on the artificial intelligence and it is required to watch suppose the systems could studied from the data. In the machine learning method the iterative phase is the significant for the reason that the designs are reveled to the fresh data, and this is capable to independently suitable. From the preceding computations learn to generate reliable, repeatable choices and outcomes.

Machine learning method is mainly used to the face-book news feed to the entire members feed. Suppose the member recurrently stops scrolling with respect to read or "like" a specified friend's posts. The News Feed will begin to demonstrate the activity of the friends before in the feed. Thus the process, the software is specifically using the statistical analysis and predictive analytics to find out the patterns in the users data and the patterns are used to occupy the news feed.

III. TYPES OF MACHINE LEARNING

3.1 SUPERVISED LEARNING

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.

List of Common Algorithms
- Linear Regression
- Logistic Regression
- Decision Trees

3.2 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. One example where clustering is used is in Google News (URL news.google.com). Google News groups new stories on the web and puts them into collective news stories.

List of Common Algorithms
- k-means clustering,
- Association Rules

3.3 SEMI-SUPERVISED LEARNING

In the previous two types, either there are no labels for all the observation in the dataset or labels are present for all the observations. Semi-supervised learning falls in between these two. In many practical situations, the cost to label is quite high, since it requires skilled human experts to do that. So, in the absence of labels in the majority of the observations but present in few, semi-supervised algorithms are the best candidates for the model building. These methods exploit the idea that even though the group memberships of the unlabeled data are unknown, this data carries important information about the group parameters. [4]

3.4 REINFORCEMENT LEARNING

Reinforcement Learning is a type of *Machine Learning*, and thereby also a branch of *Artificial Intelligence*. It allows machines and software agents to automatically determine the ideal behavior within a specific context, in order to maximize its performance. Simple reward feedback is required for the agent to learn its behavior; this is known as the reinforcement signal. Reinforcement learning is a type of learning which makes decisions based on which actions to take such that the outcome is more positive. The learner has no knowledge which actions to take until it's been given a situation. The action which is taken by the learner may affect situations and their actions in the future. Reinforcement learning solely depends on two criteria: trial and error search and delayed outcome [7]. The general model [8] for reinforcement learning is depicted in Fig.
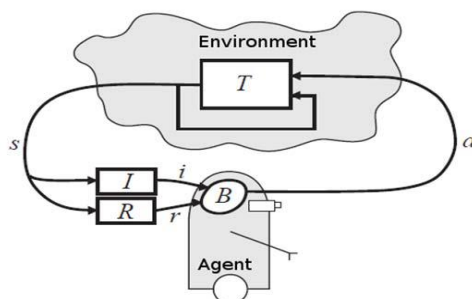
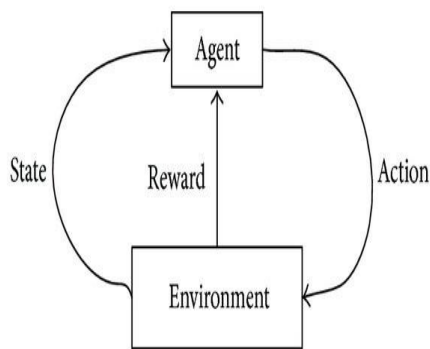Fig. The Reinforcement Learning Model

Fig: Reinforcement signal

In order to produce intelligent programs (also called agents), reinforcement learning goes through the following steps:
- Input state is observed by using a agent.
- Decision making function is used to make the agent perform into an action.
- After the action is performed, the agent receives reward or reinforcement from the environment.
- The state-action pair information about the reward is stored

3.1 SUPERVISED LEARNING

3.1.1 LINEAR REGRESSION
Linear regression is a simple algorithm, and that makes it a great place to start thinking about algorithms in general. Here it is:
$\hat{y} = a * x + b$
Read aloud, we'd say "y-hat equals a times x plus b."
- y-hat is the output, or guess made by the algorithm, the dependent variable.
- a is the coefficient. It's also the slope of the line that expresses the relationship between x and y-hat.
- x is the input, the given or independent variable.
- b is the intercept, where the line crosses the y axis.

Linear regression expresses a linear relationship between the input x and the output y; that is, for every change in x, y-hat will change by the same amount no matter how far along the line you are. The x is transformed by the same a and b at every point.
Linear regression with only one input variable is called Simple Linear Regression. With more than one input variable, it is called Multiple Linear Regression. An example of Simple Linear Regression would be attempting to predict a house price based on the square footage of the house and nothing more.

House price estimate = a * square footage + b

Multiple Linear Regression would take other variables into account, such as the distance between the house and a good public school, the age of the house, etc.
The reason why we're dealing with y-hat, an estimate about the real value of y, is because linear regression is a formula used to estimate real values, and error is inevitable. Linear regression is often used to "fit" a scatter plot of given x-y pairs.
A good fit minimizes the error between y-hat and the actual y; that is, choosing the right a and b will minimize the sum of the differences between each y and its respective y-hat.
That scatter plot of data points may look like a baguette – long in one direction and short in another – in which case linear regression may achieve a fit. (If the data points look like a meandering river, a straight line is probably not the right function to use to make predictions.)
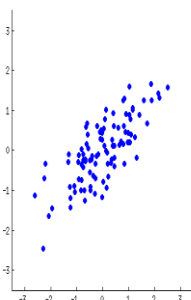
Fig. Linear Regression

3.1.2 LOGISTIC REGRESSION

Logistic regression is not really regression, not in the sense of linear regression, which predicts continuous numerical values. Logistic regression does not do that. It is actually a binomial classifier that acts like a light switch. A light switch essentially has two states, on and off. Logistic regression takes input data and classifies it as category or not category, on or off expressed as 1 or 0, based on the strength of the input's signal.

Logistic regression takes input data and *squishes* it, so that no matter what the range of the input is, it will be compressed into the space between 1 and 0. Notice, in the image below, no matter how large the input x becomes, the output y cannot exceed 1, which it asymptotically approaches, and no matter low x is, y cannot fall below 0. That's how logistic regression compresses input data into a range between 0 and 1, through this s-shaped, sigmoidal transform.
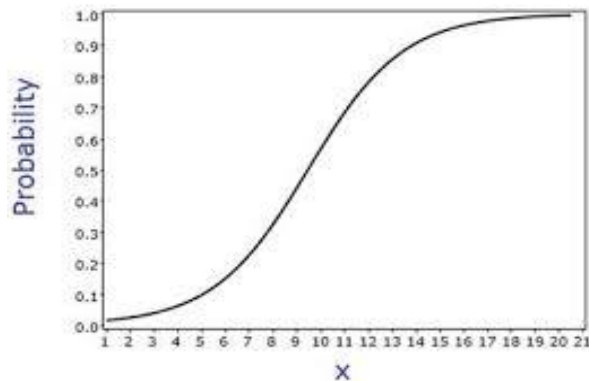

Fig: Logistic Regression

3.1.3 DECISION TREE

A decision tree is a series of nodes, a directional graph that starts at the base with a single node and extends to the many leaf nodes that represent the categories that the tree can classify. Another way to think of a decision tree is as a flow chart, where the flow starts at the root node and ends with a decision made at the leaves. It is a decision-support tool. It uses a tree-like graph to show the predictions that result from a series of feature-based splits.
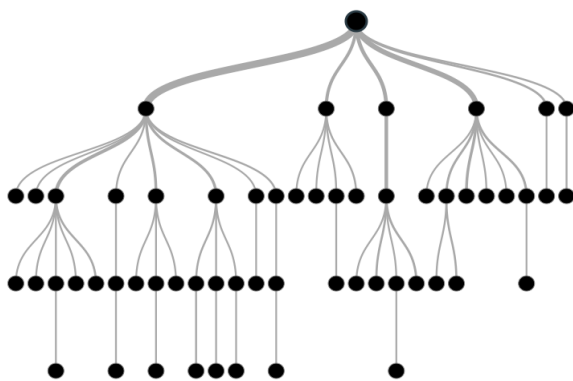

Fig: Decision Tree

Here are some useful terms for describing a decision tree:

- Root Node: A root node is at the beginning of a tree. It represents entire population being analyzed. From the root node, the population is divided according to various features, and those sub-groups are split in turn at each decision node under the root node.
- Splitting: It is a process of dividing a node into two or more sub-nodes.
- Decision Node: When a sub-node splits into further sub-nodes, it's a decision node.
- Leaf Node or Terminal Node: Nodes that do not split are called leaf or terminal nodes.
- Pruning: Removing the sub-nodes of a parent node is called pruning. A tree is grown through splitting and shrunk through pruning.

- Branch or Sub-Tree: A sub-section of decision tree is called branch or a sub-tree, just as a portion of a graph is called a sub-graph.
- Parent Node and Child Node: These are relative terms. Any node that falls under another node is a child node or sub-node, and any node which precedes those child nodes is called a parent node.

3.2 UNSUPERVISED LEARNING

1) K-MEANS CLUSTERING:

Clustering or grouping is a type of unsupervised learning technique that when initiates, creates groups automatically. The items which possess similar characteristics are put in the same cluster. This algorithm is called k-means because it creates k distinct clusters. The mean of the values in a particular cluster is the center of that cluster.[6]
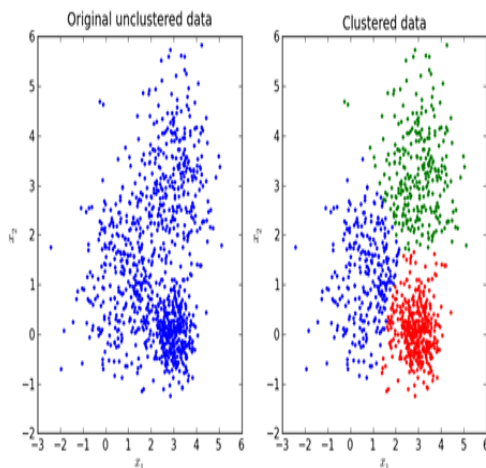

Fig. K-Means Clustering

2) PRINCIPAL COMPONENT ANALYSIS

In Principal Component Analysis or PCA, the dimension of the data is reduced to make the computations faster and easier. To understand how PCA works, let's take an example of 2D data. When the data is being plot in a graph, it will take up two axes. PCA is applied on the data; the data then will be 1D. This is explained in Fig.
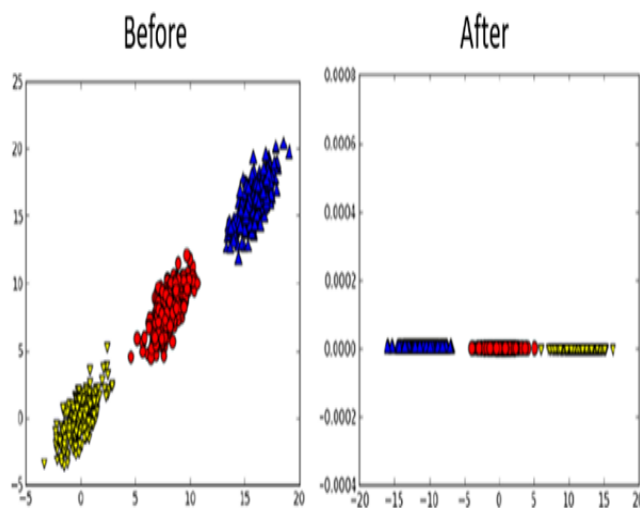

Fig. Visualization of data before and after applying PCA [`9].

IV. RECOMMENDER SYSTEMS

Recommender systems can be defined as a learning techniques by virtue of which online user can customize their sites to meet customer's tastes. For example, online user can get a rating of a product or/ and related items when he/she searching an items because of the existing recommender system. That is why it changed the way people find products, information, and even other

people. There are mainly two approaches: content based recommendation and collaborative recommendation, which help the user for obtaining and mining data, making intelligent and novel recommendations, ethics. Most e-commerce site uses this system.

V. CONCLUSION

In this analysis work, various machine learning approaches which are used for the analyzing and predicting the valuable information about health care data are briefly evaluated and discussed. The algorithms under different categories of machine learning techniques are proposed and discussed briefly. And also evaluation of those research works based on their merits and demerits are provided. From this evaluation it can be find that there are various algorithms from the categories supervised and unsupervised learning is proposed. But only fewer researches are introduced from the reinforcement learning algorithms. As the world is changing and the increased usage online application leads to dynamic growth of data which cannot be supported efficiently by the traditional supervised and unsupervised learning algorithm. From this analysis it is proved that it is required to implement the novel approaches which can support the dynamic growth of data. It will be efficient if more researches have been conducted based on reinforcement learning algorithms.

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