

# Machine Learning

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**Abstract**—Machine learning (ML) is the scientific study of algorithms and statistical models that computer systems use to perform a specific task without being explicitly programmed. Learning algorithms in many applications that's we make use of daily. Every time a web search engine like Google is used to search the internet, one of the reasons that work so well is because a learning algorithm that has learned how to rank web pages. These algorithms are used for various purposes like data mining, image processing, predictive analytics, etc. to name a few. The main advantage of using machine learning is that, once an algorithm learns what to do with data, it can do its work automatically. In this paper, a brief review and future prospect of the vast applications of machine learning algorithm have been made

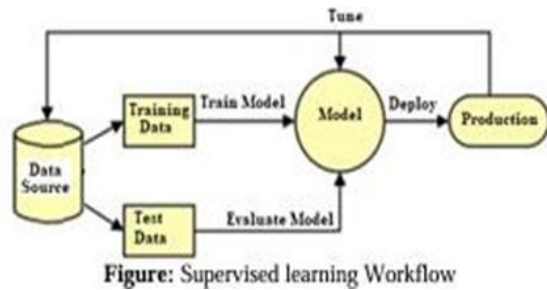
**Index Terms**—Algorithm, Machine Learning, Pseudo Code, Supervised learning, Unsupervised learning, Reinforcement learning

## I. INTRODUCTION

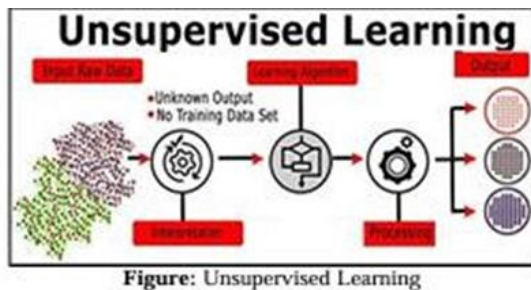
Since their evolution, humans have been using many types of tools to accomplish various tasks in a simpler way. The creativity of the human brain led to the invention of different machines. These machines made the human life easy by enabling people to meet various life needs, including travelling, industries, and computing. And Machine learning is the one among them. According to Arthur Samuel Machine learning is defined as the field of study that gives computers the ability to learn without being explicitly programmed. Arthur Samuel was famous for his checkers playing program. Machine learning (ML) is used to teach machines how to handle the data more

efficiently. Sometimes after viewing the data, we cannot interpret the extract information from the data. In that case, we apply machine learning. With the abundance of datasets available, the demand for machine learning is in rise. Many industries apply machine learning to extract relevant data. The purpose of machine learning is to learn from the data. Many studies have been done on how to make machines learn by themselves without being explicitly programmed. Many mathematicians and programmers apply several approaches to find the solution of this problem which are having huge data sets.

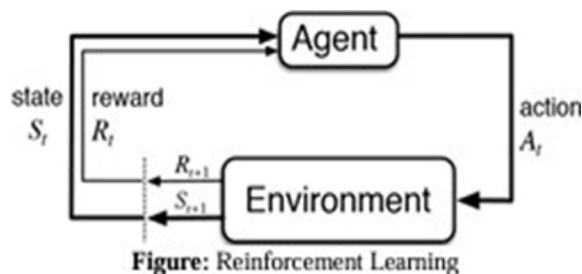
**Supervised Learning:** Supervised learning is the machine learning task of learning a function that maps an input to an output based on example input-output pairs. It infers a function from labelled training data consisting of a set of training examples. The supervised machine learning algorithms are those algorithms which needs external assistance. The input dataset is divided into train and test dataset. The train dataset has output variable which needs to be predicted or classified. All algorithms learn some kind of patterns from the training dataset and apply them to the test dataset for prediction or classification. The workflow of supervised machine learning algorithms is given in fig below. Most famous supervised machine learning algorithms have been discussed here



**Unsupervised Learning:** These are called unsupervised learning because unlike supervised learning above there is no correct answers and there is no teacher. Algorithms are left to their own devices to discover and present the interesting structure in the data. The unsupervised learning algorithms learn few features from the data. When new data is introduced, it uses the previously learned features to recognize the class of the data. It is mainly used for clustering and feature reduction.

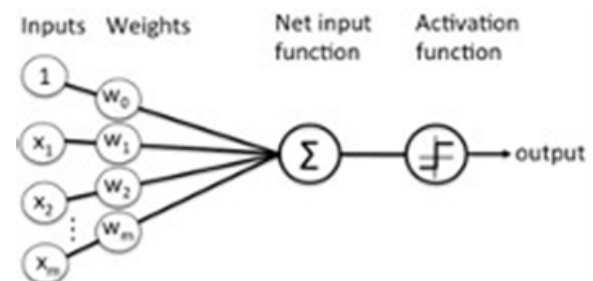


**Reinforcement Learning:** Reinforcement learning is an area of machine learning concerned with how software agents ought to take actions in an environment in order to maximize some notion of cumulative reward. Reinforcement learning is one of three basic machine learning paradigms, alongside supervised learning and unsupervised learning.



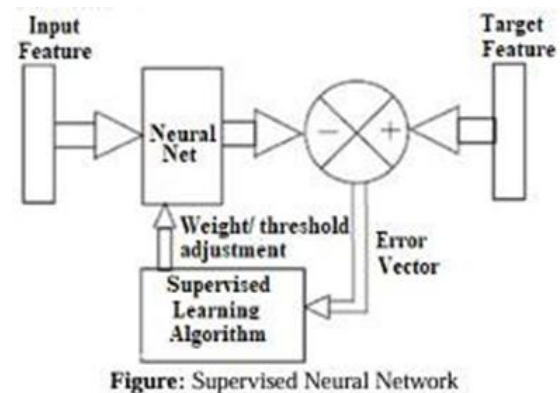
**Neural Networks:** A neural network is a series of algorithms that endeavors to recognize underlying

relationships in a set of data through a process that mimics the way the human brain operates. In this sense, neural networks refer to systems of neurons, either organic or artificial in nature. Neural networks can adapt to changing input; so the network generates the best possible result without needing to redesign the output criteria. The concept of neural networks, which has its roots in artificial intelligence, is swiftly gaining popularity in the development of trading systems.



**Supervised Neural Network:** In the supervised neural network, the output of the input is already known. The predicted output of the neural network is compared with the actual output.

Based on the error, the parameters are changed, and then fed into the neural network again. Supervised neural network is used in feed forward neural network.



**Unsupervised Neural Network:** The neural network has no prior clue about the output the input. The main job of the network is to categorize the data according to some similarities. The neural network checks the correlation between various inputs and groups them.

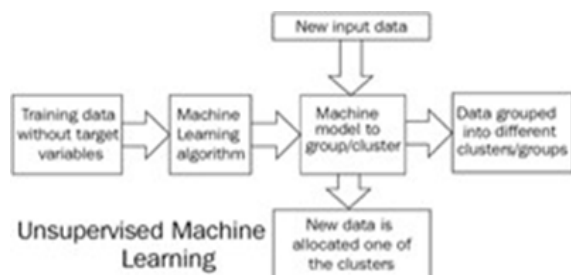


**Figure: Unsupervised Neural Network**

**Reinforced Neural Network:** Reinforcement learning refers to goal-oriented algorithms, which learn how to attain a complex objective (goal) or maximize along a particular dimension over many steps; for example, maximize the points won in a game over many moves. They can start from a blank slate, and under the right conditions they achieve superhuman performance. Like a child incentivized by spankings and candy, these algorithms are penalized when they make the wrong decisions and rewarded when they make the right ones this is reinforcement.

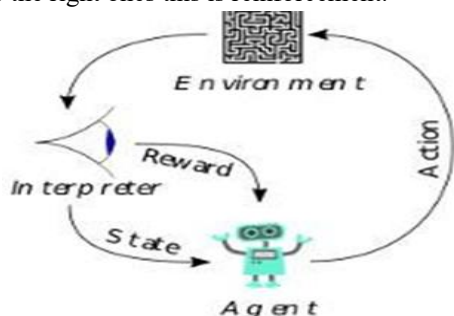


**Figure: Reinforced Neural Network**

## II. CORE METHODS AND RECENT PROGRESS

The most widely used machine-learning methods are supervised learning methods (1). Supervised learning systems, including spam classifiers of e-mail, face recognizers over images, and medical diagnosis systems for patients, all exemplify the function approximation problem discussed earlier, where the training data take the form of a collection of  $(x, y)$  pairs and the goal is to produce a prediction  $y^*$  in response to a query  $x^*$ . The inputs  $x$  maybe classical vector are they maybe more complex object such as documents, images, DNA sequences, or graphs. Similarly, many different kinds of output  $y$  have been studied. Much progress has been made by focusing on the simple binary classification problem in which  $y$  takes on one of two values (for example, “spam” or “not spam”), but there has also been abundant

research on problems such as multiclass classification (where  $y$  takes on one of  $K$  labels), multi label classification (where  $y$  is labeled simultaneously by several of the  $K$  labels), ranking problems (where  $y$  provides a partial order on some set), and general structured prediction problems (where  $y$  is a combinatorial object such as a graph, whose components may be required to satisfy some set of constraints). An example of the latter problem is part-of-speech tagging, where the goal is to simultaneously label every word in an input sentence  $x$  as being a noun, verb, or some other part of speech. Supervised learning also includes cases in which  $y$  has real valued components or a mixture of discrete and real-valued components.

## III. CONCLUSION

Machine Learning can be a Supervised or Unsupervised. If you have lesser amount of data and clearly labelled data for training, opt for Supervised Learning. Unsupervised Learning would generally give better performance and results for large data sets. If you have a huge data set easily available, go for deep learning techniques. You also have learned Reinforcement Learning and Deep Reinforcement Learning. You now know what Neural Networks are, their applications and limitations. This paper surveys various machine learning algorithms. Today each and every person is using machine learning knowingly or unknowingly. From getting a recommended product in online shopping to updating photos in social networking sites. This paper gives an introduction to most of the popular machine learning algorithms.

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