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A Review On Machine Learning Methods, Its Applications And Algorithm

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Abstract

Machine learning is a science that was discovered and developed in the 1950s as a subfield of artificial intelligence. The first steps in machine learning date back to the 1950s, but there have been no significant advances in this science since then. These studies were restarted and further developed in the 1990s, and continue to this day. Future improvements are expected in this field. As a result, it has become increasingly difficult to analyze and process the rapidly growing amount of data. In order to find the best model for a new dataset, machine learning relies on a growing amount of data. Due to this, machine learning research will continue in tandem with the growth of data.. In this research, we examine the history of machine learning, the methods used in machine learning, its application fields, and the research conducted in this area. The purpose of this study is to provide researchers with information on machine learning, which has become increasingly popular in recent years.

Keyword- Machine Learning, Machine Learning Algorithms

I . Introduction

For this paper, a good starting point would be to introduce the fundamental concept of Machine Learning. If the machine's measurable performance on these tasks improves as it gains more experience performing these tasks, then it has learned from its experience. In other words, the machine uses data to make decisions and forecasts. Using medical investigation reports from a patient, a computer program me can learn to detect / predict cancer. By analyzing medical investigation reports from a larger population, it will gain more experience and become more efficient.

As validated by an experienced oncologist, its performance will be measured in terms of the number of correct cancer predictions and detections it makes. Pattern recognition, natural language processing, data mining, traffic prediction, online transportation networks (e.g. estimating surge prices in peak hours by Uber app) are just a few of the fields where machine learning is used. BoTs (chat bots for online customer support) are used to refine search engine results such as Google's, as well as for spam filtering, crime prediction using video surveillance, and other services (face recognition in face book). Those updates can also result in noisy gradients, which can cause the error rate to fluctuate instead of decreasing slowly, as is the case with machine learning. SGD can be used to evaluate three types of problems, namely classification, regression, and clustering,. Machine learning algorithms can be applied using "supervised learning" or "unsupervised learning" techniques, or they can be used in conjunction with semi-supervised learning and reinforcement teaching techniques, depending on the types of training data available. We will review some of the most popular machine learning algorithms in the following sections.

II MACHINE LEARNING APPLICATIONS

Machine learning applications fall into a variety of categories and subcategories.

- Computer vision, prediction, semantic analysis, natural language processing, and information

retrieval are among the different application domains. In the computer vision domain, sub-domains include object recognition, object detection, and object processing.

- Prediction: It is divided into three sections: classification, analysis, and recommendation Text classification, document classification, and image classification are all possible. Medical diagnosis and network prediction Detecting intrusions and predicting service degradation successful implementation of an attack based on Machine learning is the process of learning by rote.
- In semantic analysis, syntactic structures in paragraphs, sentences, and words are related to writing as a whole through the use of natural language processing and information retrieval techniques. Programming computers to process natural language data is called natural language processing (NLP). In information retrieval, information is found in a document, in documents, in metadata that describe the data, and in databases of sounds and images. It is a science. Machine learning techniques have been explored in the past in these three areas.

III MACHINE LEARNING METHODS

The four parts of machine learning are as follows:

Supervised learning: A method in which the current input data is used to determine the final result set is called a data-driven method. classification and regression are its two categories. In this case, the data are divided into categories based on their specific characteristics. As a result of the data's available features, regression is used to predict or conclude the other features.

Unsupervised learning: Supervised and unsupervised learning differ in that output data is not provided in the latter. Relations and connections between data are used to facilitate learning. There is also no training data in unsupervised learning. Clustering and association are also unsupervised learning methods.

Clustering: Finding similar groups of data when the data's inherent groupings are unknown.

Association: Finding the relationships and connections between data in a single data set is known as association.

Semi-supervised Learning: Labeled and unlabelled data are insufficient when learning is supervised or unsupervised. They are deduced based on very inadequate unlabeled data. Semi-supervised learning is the term used to describe this method of instruction. The labelled data set is the difference between semi-supervised and supervised learning. There are more labelled data to be predicted in supervised learning, as compared to unlabeled data. While labelled data are less abundant in semi-supervised learning, predictions are more abundant

Reinforced learning: In this type of learning, the agents are rewarded for their efforts. It's the agent's job to find the quickest and most efficient route to the goal, despite the fact there are start and finish points. When the agent follows the correct procedures, he or she is rewarded. A wrong turn, on the other hand, has negative consequences. On the way to the goal, we learn.

IV MACHINE LEARNING ALGORITHMS

i. **Gradient Descent Algorithm:** Gradient Descent is an iterative method that aims to minimize a cost function through a series of iterations. The partial derivative of a slope or gradient function should be calculable. A learning rate (step size) plus derivative is used to reduce coefficients at each iteration so that local minima can be reached after several iterations. There is no further reduction in cost function after the iterations are stopped when the cost function converges to its minimum value The Stochastic Gradient Descent (SGD), Batch Gradient Descent(BGD). And Mini Batch Gradient Descent(MBGD) are the three types of method.

- In BGD, error is computed for each example in the training dataset, but the model will not be updated until all training examples have been evaluated and the model has been updated accordingly.The computational efficiency of the BGD algorithm is its primary advantage. It produces a stable error gradient and converges at a steady rate. As a result of this stable error gradient, the algorithm may result in a state of convergence that is less than optimal in some cases .En outré, the algorithm must have access to and be able to store the entire training data set in its memory.
- In SGD For each training example in a dataset, SGD calculates the error, and the parameters are updated for every training example. For a given problem, SGD may be faster than BGD. Due to the frequent updates, SGD provides an accurate rate of improvement. The frequent updates, on the other hand, are computationally more expensive than the BGD approach. It's also possible that the frequency of these updates will result in noisy gradients, causing the error rate to fluctuate instead of decreasing slowly.
- In order to arrive at the MBGD approach, the concepts of SGD and BGD are combined. According to this method, the training dataset is divided into

small batches, and each batch is updated. SGD and BGD are therefore balanced. A neural network can be trained using this algorithm, which is why deep learning is the primary application of this algorithm. As part of the Back propagation algorithm, the gradient of the loss function is computed in order to adjust the weight of the neurons.

As a result, if the learning rate for gradient descent is too high, it will skip the true local minimum in order to optimize for time. If the gradient descent is too slow, it may never converge because it is trying so hard to find a local minimum that is exact. What minimum is reached and how quickly it is reached depends on the learner's rate of acquisition of knowledge. Changing the learning rate as the error rate decreases is a good practice.

ii Linear Regression Algorithm : Regression is a supervised learning approach. Continuous variables can be modelled using it, and predictions can be made.

Examples of applications of the linear regression algorithm include: the prediction of real estate prices, the forecasting of sales, the prediction of student exam scores, and the forecasting of stock market price movements. It is supervised learning in Regression, as we have labeled datasets and the output variable value is determined by the input variable values. This form of regression is the simplest and is possible when the variables in the dataset have a linear relationship.

Regularization makes it easy to avoid over fitting when using linear regression, which has the advantage of being simple to understand. To update linear models with new data, we can also use the SGD method. It is a good fit to use linear regression if it is known that the relationship between the covariates and the response variable is linear Statistical modeling is replaced by data analysis and preprocessing. It's a good way to learn about the data analysis process by experimenting with linear regression. Due to its oversimplification of real world problems, however, it is not recommended for most practical applications.

Linear regression has the disadvantage of not being well-suited to non-linear relationships.Complex patterns are difficult to manage. Adding the right polynomials to the model is also difficult. Many real-world problems are overly simplified by linear regression. Most of the time, the covariates and response variables do not have a linear relationship with each other A high train RSS will be obtained by fitting a regression line with OLS. If you are dealing with a real-world problem, you may find that there is no relationship between the mean of dependent and independent variables as predicted by linear regression.

Iii **Logistic Regression**: It is used to solve problems involving classification through the use of logistic regression. It gives the binomial outcome in the same way that it gives the probability of an event occurring.Based on the values of input variables, an event will occur or not (in terms of 0 and 1). A tumor's malignancy or benignity can be predicted with Logistic Regression, for example. Multinomial outcomes of Logistic Regression are also possible, such as the prediction of cuisine preference (Chinese, Italian, Mexican). Product ratings from 1 to 5 are examples of ordinal outcomes. Logistical, indeed.

Simple implementation, computational efficiency, training efficiency, and regularisation ease are all advantages of Logistic Regression. It is not necessary to scale input features in order to use them. Industry-scale problems are typically solved with this algorithm. As the output of Logistic Regression is a probability score, it is necessary to specify customised performance metrics in order to obtain a cutoff value that can be used to classify the target. Small noise in the data and multi-collinearity do not affect logistic regression. Inability to solve non-linear problems because the decision surface is linear, prone to overfitting, and ineffective without all independent variables identified. This technique is used in a variety of fields, such as medicine to predict the likelihood of developing a disease or the likelihood of a patient dying from a traumatic injury, and in engineering to predict the probability of failure for a given process, system or product.

Iv **K nearest neighbour Algorithm**:. In the KNN algorithm, data points are stored in a database.The algorithm tries to classify.As a classification problem, it is given a sample of data.No data distribution is assumed by KNN, and so no underlying data distribution is assumed by KNN.Non-parametric is the name given to this type of analysis. KNN algorithm has several advantages.Among them are A simple technique that can be easily implementedimplemented. Construction of the model is relatively inexpensive. It is a very serious issue.Multi-modal classification scheme that is flexible and well-suited classes. Records are labelled with a variety of classifications. At most, the Bayesian error rate is double that of the Bayesian error rate. In some cases, it's the most effective method. For protein function prediction using expression profiles, KNN outperformed SVM. The following are KNN's disadvantages: The cost of classifying unknown records is high. It requires the computation of the distance between the k-nearest neighbours. It becomes computationally intensive as training sets get larger.Degradation of accuracy will result from noisy / irrelevant features.

V **K Means Clustering Algorithm**: Clustering problems are often solved using the K Means Clustering Algorithm. In other words, it's a kind of unsupervised learning. As a result, it has the following benefits: When variables are large, this method is more computationally efficient than hierarchical clustering, because it requires fewer computations.In contrast to hierarchical clustering, the globular cluster and small k

clusters produce more compact clusters. Algorithms like this one are attractive because they are easy to implement and to interpret the results. In other words, the algorithm is computationally efficient because its complexity is O(K*n*d). In addition, K-Means Clustering Algorithm has the following drawbacks: it is difficult to predict K value. When clusters are globular, performance suffers. The performance is also impacted by the fact that different initial partitions result in different final clusters. When input data clusters are different in size and density, performance suffers.Even if the input data have different cluster sizes, the uniform effect can produce clusters that are relatively uniform in size.

VI Conclusion

Classification, regression and clustering problems are discussed in this paper. Each algorithm's pros and cons were discussed, along with (wherever possible) comparisons of different algorithms in terms of performance, learning rate etc. Also discussed are practical applications for these algorithms. Supervised learning, unsupervised learning, and semi-supervised learning have all been discussed as machine learning techniques. A number of machine learning techniques have been discussed, including supervised learning, unsupervised learning, and semi supervised learning As a result, readers should be able to make an informed decision about which machine learning algorithms to use in a given problem-solving context.

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