A Survey on Artificial Neural Network Algorithms for Forecasting

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Abstract: **An Artificial Neural Network (ANN) is often used to predict the behavior of nonlinear systems. ANN has been successfully employed by most of the researchers during this field prediction for the last twenty-five years. This paper provides a comparison between the forecasting algorithms, Single Layer Perceptron, Multi Layer Perceptron, and Back propagation.**

Keywords: **Artificial Neural Network, Single Layer Perceptron, Multi Layer Perceptron, Back propagation**

I. INTRODUCTION

Prediction of future events is the most important and challenging task in the modern world. Prediction is done by many algorithms wildly used algorithm is logistic regression. The Artificial Neural Network algorithms provide a new and wildly used alternative to logistic regression that wildly used for prediction. Neural Networks are strictly more general then logistic regression on the original inputs. Regression is the method of dealing with only linear dependencies. But, the artificial neural network deals with linear and non-linear dependencies that should perform better than regression.

The Artificial Neural Network has various models, the basic and most common model consists of three Layers namely Input layer, Hidden layer, and Output layer. Each layer has neurons that replay the input from the previous layer and give the output for the subsequent layer. These three layers are fully interconnected with each other through that it can pass the data. It performs prediction using many algorithms. Each algorithm works with own method and has advantages and limitations. The algorithms used the ANN techniques and those techniques also separately used in the problems.

The objective analysis of this paper, the different forecasting algorithms of artificial neural networks compared with each other. These three algorithms are commonly used in prediction using an artificial neural network. This paper also discusses the activation function, architecture, learning rules, and input features of three neural network prediction algorithms, namely Single Layer Perceptron, Multi Layer Perceptron, and Back propagation.

II. CONCEPT OF ARTIFICIAL NEURAL NETWORK

The Artificial Neural Network is based on the collection of interconnected units known as 'Artificial Neurons' inspired by the model of 'Biological Neuron' in the human brain, that exchange the message between each other. The Artificial Neural Network consists of three layers namely,
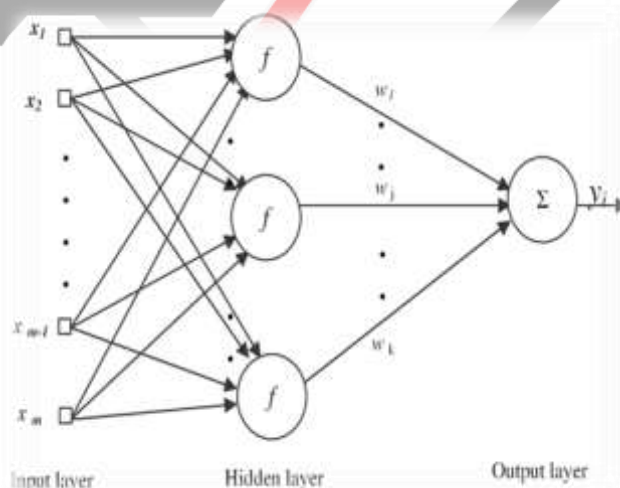

Fig 1: Basic Architecture of Artificial Neural Network

Input layer, Hidden layer, and Output layer. Each layer has neurons that replay the input from the previous layer and gives the output for a subsequent layer. Fig 1 shows the basic structure of the artificial neural network. The connections between the two neurons called 'edges'. The edges between the subsequent layers have a numeric weight that tuned the training process.

III. ARTIFICIAL NEURAL NETWORK ALGORITHMS

The Artificial Neural Network has various techniques to find out the result. This paper discusses the three major algorithms which are used for forecasting. The paper describes the algorithm with activation function, learning rate, and other factors. The algorithms are back propagation, Single Layer Perceptron, and Multi Layer Perceptron.

Back Propagation Network (BPN)

Back propagation is one of the most famous and familiar algorithms in an Artificial Neural Network. The back propagation method is iterative, recursive, and efficient for calculating the weight updates in the network. The network can perform the trained tasks. Network design time in back propagation is known as the Activation Function. The Activation Function determines the value in each node. The Activation Function has various divisions that are a linear function, sigmoid function, tanh function, etc. In the back propagation algorithm, Gradient Descent is the main technique. This looks at the minimum value of the error function in weight space, which is used to find the global and local minima of the function. The back propagation implements the gradient descent in the multi-layered neural network. In this network, the information moves both backward and forward direction.
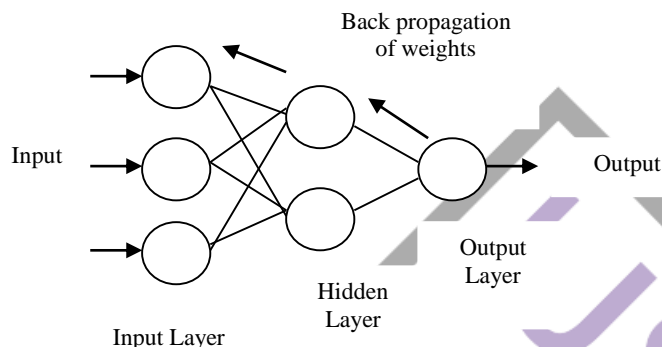

Fig 1: Basic Process of Back propagation

In back propagation, the simple neural network has two input nodes, one output nodes, and no hidden nodes. The neural network has three layers one input layer, one or more hidden layers and one output layer. The number of hidden layers is based on the problem. Fig1 shows the basic operations of back propagation. The amount of weight updated during the training is called Learning Rate. The range of learning rate is between 0.0 and 1.0, which controls the models adapted to the problem. If the learning rate is too small it causes the process to get stuck and it is too large it causes the model converges quickly to meet solution.

Single Layer Perceptron (SLP)

The simple form of a neural network is called Single Layer Perceptron, which consists of one input layer and one output layer. The input nodes are fed directly to the output nodes via a series of weights. Each node calculates the input and some of the product of weight, if the value is above a threshold the neuron takes activated value otherwise it takes deactivated value. The network consists of one of these units are called Perceptron. In Single Layer Perceptron also known as Feed-Forward Network, in that network the information always moves in the forward direction only does not move backward. The threshold value is lies between the activated and deactivated functions the Perceptron can be created. Fig 2 illustrates the basic operation of the SLP. It shows only two layers that are input layer and output layer and also has activation function.
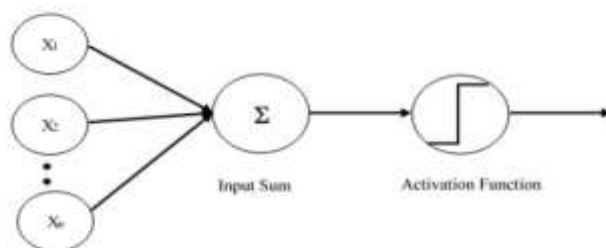

Fig 2: Single layer Perceptron

Multi Layer Perceptron (MLP)

Feed Forward Artificial Neural Network is called Multi Layer Perceptron. The MLP consists of three layers there are one input layer, one or more hidden layers, and one output layer. Each layer has nodes that have an activation function, which maps weighted input to the output of each node. In linear algebra, the number of layers can be reduced to a two-layer model which is known as an input-output model. The most commonly used activation function in MLP is a sigmoid function. The learning rate is occurring in the Perceptron by changing connection weights. Each data is processed based on the number of errors after that connection is changed.
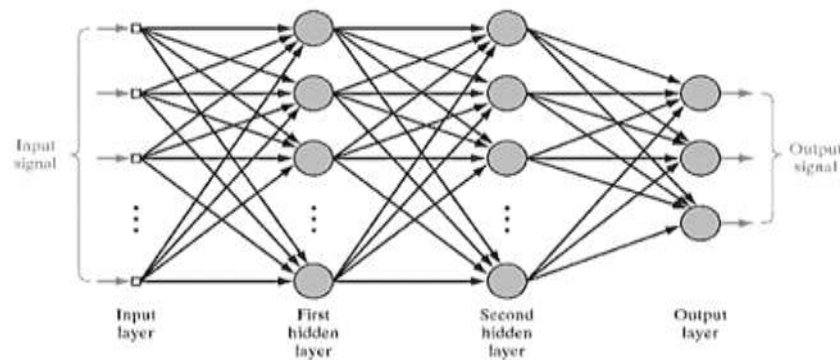
Fig 3: Multi Layer Perceptron

Multi Layer Perceptron is mainly used in supervised learning problems, they train the input and output nodes and calculate the dependencies between these inputs and output. To minimize the error rate, weight, bias, and parameter values are adjusted. The MLP uses both forward pass and backward pass to reduce the error rate and find the related solution. In a forward pass, the feed-forward network technique will be used, in that the value will be passed in the input layer to the hidden layer and then go to the output layer. In a backward pass, the back propagation technique is used, in that the value will be passed in the output layer to the hidden layer. Fig 3 illustrates the basic structure of the MLP. The Multi-Layer Perceptron is a popular machine learning solution to extremely complex problems like fitness approximation.

IV. CONCLUSION

Forecasting is an important technique in data mining to predict future values. There are so many algorithms used for forecasting. Artificial Neural Network is one of the most famous and familiar techniques for forecasting, which has many algorithms for forecasting. This paper discusses three main techniques Single Layer Perceptron, Multi-Layer Perceptron, and Back Propagation. The paper also describes the basic features, parameters, learning rate and activation function of these three techniques. Moreover, the Multi Layer Perceptron is the wildly used and best technique for forecasting, which used all kinds of forecasting problems and given the best solution.

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