



## Survey on Prediction using Back Propagation Neural Network

*Er. Gaurav Sharma*  
A.P. CSE, JMIT Radaur  
India

*Er. Rudrakshi*  
Pursuing M.Tech, JMIT Radaur  
India

**Abstract**—The main purpose of this paper is to study how artificial neural network is used for various applications like temperature forecasting, weather forecasting, crop prediction and weather forecasting. The study is based on back propagation neural network which is trained and tested based on the dataset provided. Our purpose is to study a farmer prediction system to identify crop suitable for particular soil. To achieve this Neural Network should be trained to perform correct prediction for farmers.

**Keywords**— Neural Network, Back Propagation, Training, Pattern, Processing Element, Feed-Forward, Activation Function.

### I. INTRODUCTION

A neural network consisting of processing elements (which can possess a local memory and can carry out localized information processing operations) which is parallel, distributed information processing arrangement interconnected together with unidirectional signal channels named as connections. Each processing component has a single output connection which branches ("fans out") into as many collateral connections as desired (each carrying the same signal) and processing component output signal can be of any mathematical type preferred. All of the processing that goes on surrounded by each processing component must be completely confined i.e., it must depend only upon the current values of the input signals arriving at the processing element via impinging connections and upon values stored in the processing element's local memory[7].

Artificial Neural Network (ANN) is highly suitable for the situations where the underlying processes exhibit messy features. The concept of ANN is originated from the effort to develop a mathematical model capable of recognizing complex patterns on the same line as biological neuron work. It is useful in the situations where underlying processes / relationships display disordered properties. ANN does not require any earlier knowledge of the system under consideration and are well suited to model dynamical systems on a realtime basis. It is, consequently possible to set up systems so that they would adapt to the events which are observed and it is helpful in real time analyses, e.g. different fields of predictions, weather forecasting etc[1].

Neural networks are members of a family of computational architectures inspired by biological brains (e.g., McClelland et al., 1986). These architectures are called "connectionist systems", and they are self-possessed of interconnected and interacting components called nodes or neurons (these terms are generally considered synonyms in connectionist terminology). Neural networks are characterized by a lack of explicit representation of knowledge; there are no symbols or values that directly correspond to classes of significance. Rather, knowledge is completely represented in the patterns of interactions between network components (Lugar and Stubblefield, 1993). A graphical representation of a typical feedforward neural network is given in Fig. 1. The term "feedforward" indicates that the network has links that extend in only single direction. Except during training, there are no backward links in a feedforward network; all links proceed from input nodes toward output nodes[8].

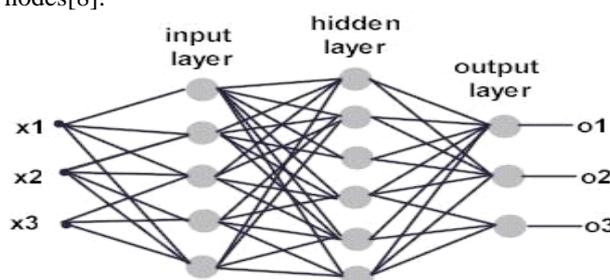


Fig. 1: Structure of feedforward neural network

#### A. Backpropagation Neural Network:

The traditional Back-propagation Neural Network (BPNN) Algorithm is generally used in solving many practical problems. The BPNN learns by calculating the errors of the output layer to find the errors in the hidden layers. Back-Propagating is highly appropriate for problems in which no relationship is found between the output and inputs. Due to its suppleness and learning capability, it has been effectively implemented in wide range of applications[9].

Backpropagation, or propagation of error, is a recurrent method of teaching artificial neural networks how to achieve a given task. It is a supervised learning technique and is an implementation of the Delta rule. It requires a teacher that knows, calculate, the desired output for any given input. It is mainly useful for feed-forward networks (networks that have no estimation) and it is an short outer shell for "backwards propagation of errors" and it requires that the activation function worn by the artificial neurons (or "nodes") is differentiable[10].

The input layer neurons is responsible for receiving input from the outside world, and then pass it to the middle layer's neurons; Middle layer is the internal information processing layer which is responsible for information transformation, the middle layer can be designed for single or multiple hidden layer structure; The last hidden layer transfer the information of each neuron to output layer, after further treatment, to complete a study of the forward propagation process, the output layer output the results to the outside world[5].

The procedure of backpropagation learning algorithm can be alienated into two phases: propagation and weight update.

Phase 1: Propagation

Each propagation involves the subsequent steps:

a. Forward propagation of a training pattern's input through the neural network in order to generate the propagation's output activations.

b. Backward propagation of the propagation's output activations through the neural network in sequence to produce the deltas of all output and hidden neurons using the training pattern target.

Phase 2: Weight update

For each weight-synapse track the subsequent steps:

a. Multiply its output delta and input activation to get the gradient of the weight.

b. Subtract a ratio (percentage) of the gradient from the weight.

Learning rate is defined as the ratio (percentage) that influences the speed and quality of learning;. The greater the ratio, the faster the neuron trains; the lower the ratio, the more exact the training is. The symbol of the gradient of a weight indicates where the error is growing, this is why the weight must be updated in the opposed direction. Repeat phase 1 and 2 until the performance of the network is acceptable[11].

## II. RELATED STUDY

**Parag.P.Kadu et. al. [1]** This paper utilizes artificial neural networks for temperature forecasting. The study based on dataset provided which is trained and tested. Three-layer network has been constructed in formulating the ANN-based predictive model. Air temperature predictions can provide farmers and producers with valuable information when they face decisions regarding the use of mitigating technologies such as orchard heaters or irrigation. The research presented in this developed artificial neural networks models for the prediction of air temperature. Back propagation neural network is used for temperature forecasting in this paper. The technical milestones, that have been achieved by the researchers in this field has been reviewed and presented in this paper. There are different models that are developed for weather forecasting using artificial neural network, and by use of soft computing, which are discussed in this paper. Temperature forecasting uses artificial neural networks and the back propagation algorithm are explained.

**Feihu Jin et. al. [2]** The artificial bee colony algorithm has positive distributed computation and a constructive greedy heuristic convergence and it is a novel simulated evolutionary algorithm. . BPN is a kind of feed forward neural network which is widely used in many areas, but it has some shortcomings, like low precision solutions and easy convergence to the local minimum. Artificial bee colony algorithm and back propagation neural network can be combined and adopted so that a nonlinear model can be identified and an inverted pendulum can be controlled. Simulation results shows that the extensive mapping ability of neural network and the rapid global convergence of artificial bee colony algorithm can be obtained by combining artificial bee colony algorithm and neural network.

**Haiyan Song et. al. [3]** This research aims at designing an intelligent and carry-home diagnosis expert system (ES) to help inexpert farmers detect crop nutrition disorders in time. To guarantee the reasoning veracity of the system, artificial neural networks (ANN) were predictable, and a single chip computer was applied for spot using opportunity. The creation of two subsystems and their corresponding ANN clusters take place according to the location where the nutrition disorders first took place. The symptoms of the crops were composed. The conclusion and confidences of symptoms diagnosis by field experts were used as input and output neurons of ANN. Single chip computer diagnosis was realized using MCS-51C language . Field justification shows that diagnosis errors were less than 8%. Likewise, the combination of ANN and ES can make up traditional expert system defects and improve the systems intelligence and diagnosis efficiency.

**Asli Celikyilmaz et. al. [4]** Although traditional fuzzy models have proven to have high capacity of approximating the real-world systems, they have some challenges, e.g. computational complexity, optimization problems etc. In this paper it is proposed that a new fuzzy system modeling approach based on improved fuzzy functions with continuous output variable to model systems. The new modeling approach introduces three features: a) an improved fuzzy clustering algorithm, b) a new structure identification algorithm, and c) a nonparametric inference engine. The IFC algorithm yields concurrent estimates of parameters of c-regression models, collectively with fuzzy c-partitioning of the data, to compute improved membership values with a new membership function. The structure identification of the original approach utilizes IFC, as a substitute of standard fuzzy c-means clustering algorithm, to fuzzy partition the data, and uses improved membership values as additional input variables along with the original scalar input variables for two different choices of regression methods: least squares estimation or support vector regression, to determine "fuzzy functions" for each cluster. One could be trained the system behavior more accurately compared to other fuzzy system modeling models with novel

IFC. The nonparametric inference engine is a new approach, which uses the alike -nearest neighbour method for reasoning. Experimental comparisons indicate that the proposed approach yields comparable or better accuracy than fuzzy or neuro-fuzzy models based on fuzzy rules bases.

**LI Yizhen et. al. [5]** This presents a BP Artificial neural network prediction modeling method for forecasting the trend of Shanghai index, and uses the genetic algorithm to optimize the BP network parameters, structure and weight. The forecasting results show that the optimization algorithm not only avoids BP algorithm into a local minimum point and the problems of slow convergence, but also conquer the GA Shortcomings such as the search time too long and search speed too slow caused by in a similar form of exhaustive search for optimal solution. This modeling method has high application value in the stock market of such a complicated nonlinear stochastic system modeling.

**Lavina , Pankaj Dev Chadha et. al. [6]** The aim is to develop a farmer prediction system to identify crop suitable for particular soil. To achieve this Neural Network should be trained to perform correct prediction for farmers. After the network has been properly trained which can be used to identify the crop suitable for particular type of soil. The Artificial neural networks are relatively crude electronic networks of "neurons" based on the neural structure of the brain and process the records one at a time. It "learn" by comparing their prediction of the record with the known actual record. Errors from the initial prediction of the first record is fed back into the network, and which is used to modify the networks algorithm the second instance approximately and so on for many iterations.

### III. COMPARISON

In this it can be seen in Table I that BP algorithm achieves better accuracy when compared with the RLS because both the training and the testing RMSE are smaller for the BP algorithm [12].

TABLE I  
 Comparision of BP & RLS

Methods	Training RMSE	Testing RMSE
RLS	0.0717	0.0121
BP	0.0321	$3.2561 \times 10^{-5}$
Sugeno Fuzzy Inference	NAN	-

In this hidden layer determines function to use function 'Tansig', the output layer determines function to use function 'purelin', and training function uses function 'traingdm' in Table II. Our programming realizes the structures, training and prediction of BP neural network [13].

TABLE II  
 Structures, Training and Prediction of BP

Year	Actual value	Predictive value	Prediction error
1998	96.9	103.2	6.5%
2002	98.6	106.6	8.1%

### IV. CONCLUSION

It is concluded that the BP algorithm achieved better accuracy when compared with the RLS algorithm. A back propagation neural network with gradient descent method minimizes the error rate and it is a promising approach for temperature forecasting. Results that are achieved by using NN are encouraging, especially in some fields like pattern recognition. NN is getting more and more attention in last two decades. BP algorithm is most popular algorithm used in NN. It is one of the main reasons why NN are becoming so popular.

### REFERENCES

- [1] Parag.P.Kadu, Prof.Kishor P.Wagh, Dr.Prashant N. Chatur "Temperature Prediction System Using Back propagation Neural Network An Approach" International Journal of Computer Science & Communication Networks, Vol 2(1), 61-64.
- [2] Feihu Jin, Guang Shu "Back Propagation Neural Network Based on Artificial Bee Colony Algorithm" 2013 IEEE.
- [3] Haiyan Song , Yong He "Crop Nutrition Diagnosis Expert System Based on Artificial Neural Networks" 2005 IEEE.
- [4] Asli Celikyilmaz, Member, IEEE, and I. Burhan Turksen, Fellow, IEEE "Enhanced Fuzzy System Models With Improved Fuzzy Clustering Algorithm" IEEE TRANSACTIONS ON FUZZY SYSTEMS, VOL. 16, NO. 3, JUNE 2008.
- [5] LI Yizhen , Zeng Wenhua, Lin ling, Wu jun, Lu Gang "The forecasting of Shanghai Index trend Based on Genetic Algorithm and Back Propagation Artificial Neural Network Algorithm" ICCSE 2011.
- [6] Er. Lavina , Er. Pankaj Dev Chadha "Survey on Crop Prediction Using Back Propagation Neural" IJARCSSE 2013.
- [7] Robert Hecht-Nielsen "Theory of the Backpropagation Neural Network" Book Neural networks for perception (Vol. 2) Pages 65-93.

- [8] David Leverington “A Basic Introduction to Feedforward BackPropagation Neural Network” [http://www.webpages.ttu.edu/dleverin/neural\\_network/neuralnetworks.html](http://www.webpages.ttu.edu/dleverin/neural_network/neuralnetworks.html).
- [9] Shital Solanki,H.B.Jethva “A review on back propagation algorithms for Feedforward Networks” GRA Volume : 2 | Issue : 1 Volume : 2 | Issue : 1 | Jan 2013.
- [10] Enireddy.Vamsidhar, K.V.S.R.P.Varma, P.Sankara Rao ,Ravikanth satapati “Prediction of Rainfall Using Backpropagation Neural Network Model ” IJCSE Vol. 02, No. 04, 2010.
- [11] <http://en.wikipedia.org/wiki/Backpropagation>.
- [12] José de Jesús Rubio, Member, IEEE, Plamen Angelov, Senior Member, IEEE, and Jaime Pacheco “ Uniformly Stable Backpropagation Algorithm to Train a Feedforward Neural Network” IEEE 2010.
- [13] Wei Minghua, Zhou Qiaolin, Yang Zhijian, Zheng Jingui “Prediction Model of Agricultural Product’s Price Based on the Improved BP Neural Network” IEEE 2012.