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An Effective Weather Forecasting Using Neural Network

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Abstract: *Weather Forecasting is the task of determining future state of the atmosphere. Accurate weather forecasting is very important because agricultural and industrial sector largely depend on it. This Paper present Artificial Neural Networks in weather predictions. The Neural Networks package supports different types of training or learning algorithms. One such algorithm is Back Propagation Neural Network (BPN) technique. Weather is a dynamic and non-linear process so Artificial neural network (ANN) can be used for weather prediction. This research also states that ANN is the best approach than traditional and numerical methods. Back propagation is the most important algorithm to train a neural network for weather forecasting.*

Keywords: *ANN (Artificial neural network), Feed forward network, LM (Levenberg Marquardt Algorithm), BPA.*

1. INTRODUCTION

Weather condition is state of atmosphere at given time in terms of weather variables like temperature, pressure, wind direction etc. Modern weather forecasting involves a combination of computer models, observation, and knowledge of trends and patterns. Weather warnings are important to protect life and property. Forecasts based on temperature and precipitations are important to agriculture and industry sector [10]. Temperature forecasts are done by collecting quantitative data about the current state of the atmosphere. The main advantage of the BPN neural network method is that it can fairly approximate a large class of functions. This method is more efficient than numerical differentiation [6]. Weather predictions are used to warn about natural disasters that are caused by abrupt change in climatic conditions. Neural network works like the human brain because it acquire knowledge through learning and it's knowledge stored within interneuron connection known as Synaptic weight. This paper gives comparison between gradient descent and LM algorithm. Levenberg-Marquardt algorithm was faster and achieved better performance than the other algorithms in training. Levenberg-Marquardt training normally used for small and medium size networks, if the enough memory available [9]. The gradient descent algorithm is generally very slow because it requires small learning rates for stable learning. The momentum variation is usually faster than simple gradient descent, because it allows higher learning rates while maintaining stability, but it is still too slow for many practical applications. These two methods are normally used only when incremental training is desired.

2. FEEDFORWARD NETWORK

A layered feed forward neural network has layers, or subgroups of processing elements. The first step in training is to create network object. Feed-forward networks with more layers might learn complex relationships more quickly. Feed-forward network has no feedback. FFN allows signal to travel one way only. Feed-forward ANN are straight forward network that uses inputs with outputs. To create a network, you provide typical input and output values that initialize weight and bias values and determine the size of the output layer. In the training process the weights are so adjusted that mean squared error obtained between experimental and obtained result can be minimized. This network consists of multiple layers. This architecture consists of three layers, first is input layer, second is hidden layer and third is output layer. The computational units of the hidden

layer are known as the hidden neurons or hidden units

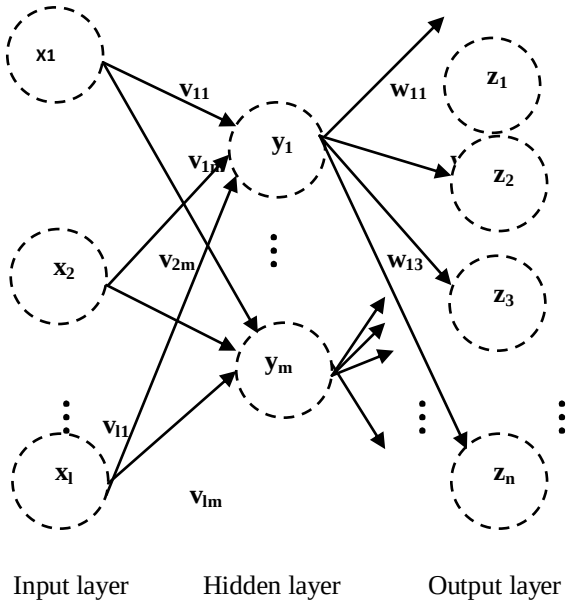

Figure1. *A Multilayer Feedforward Network*

3. BACKPROPAGATION NETWORK

A back propagation neural network uses a feed-forward topology, supervised learning and back propagation learning algorithm. It has very good application potential and has its own limitations. It is applied to a wide range of practical problems and has successfully demonstrated its power. Rumelhart, Hinton and Wilham (1986) presented a clear and concise description of the back propagation algorithm. Back propagation is a general purpose learning algorithm. It is powerful but also expensive in terms of computational requirements for training. In back-propagation algorithm, there are two phases in its learning cycle one to propagate the input patterns through the network and other to adapt the output by changing the weights in the network. It is a supervised learning method .It requires a dataset of desired output for many inputs, making up the training set. It is more useful for feed-forward networks. The back propagation is a gradient descent method. This method adjusts the weights according to the error function. The network weights are moved along the negative of the gradient of the performance function. The term back propagation refers to the manner in which the gradient is computed for nonlinear multilayer networks.

The prediction of weather using back-propagation neural network collect data such as temperature, pressure, humidity, wind, direction. Weather forecasting is done by collecting past and current data of the atmosphere then by using this data train the neural network.

There are generally four steps in the training process:

1. Assemble the training data.
2. Create the network object.
3. Train the network.
4. Simulate the network response to new inputs.

The common steps of solving a problem with back propagation are:

[1].The first step define feed-forward network using back-propagation. This defines set of input vectors and set of output vectors (target vectors).

[2].The next step is to create a network and train it until it has learned the relationship between the example inputs and targets. Two layer feed forward is most common network used in it. The newff is used to create a two-layer network with neurons in the hidden layer.

[3].The next step is to train the network using the data.

Click the Performance plot button in the training window to see a plot. The plot shows the mean squared error of the network starting at a large value and decreasing to a smaller value. In other words, it shows that the network is learning. Training on the training vectors continues as long the training reduces the network's error on the validation vectors. After the network memorizes the training, training is stopped. This technique automatically avoids the problem of over fitting.

[4].The next step after training the network, use sim to apply the network to the original vectors.

Larger numbers of neurons in the hidden layer give the network more flexibility because the network has more parameters it can optimize. If you make the hidden layer too large, you might cause the problem to be under- characterized.

4. RELATED STUDY

In this research, the weather parameters (max. temperature,min. temperature, relative humidity average wind speed) of

Rice Research Station (Kaul) are used.

Imran Maqsood et al.(2004) stated the ensemble model better than multi-layered perceptron network (MLPN), Elman recurrent neural network (ERNN), radial basis function network

(RBFN), Hopfield model (HFM) predictive models and regression techniques. This model can be used to perform multi-class classification problems without increasing the calculation complexity [1].

Paras, Sanjay Mathur, Avinash Kumar, and Mahesh Chandra et al.(2009) It eliminate the need of the satellite based systems for weather forecasting which are costlier and require complete support system. This model used ANN with time series features [2].

Otok, and suhartono et al.(2009)stated comparative study between ASTAR and ARIMA methods for rainfall forecasting .They have concluded that the best model is ASTAR model both in sample and out-sample data[3].

The neural network can applied for most of the prediction aspects, radial basis function neural network have used more efficiently for financial time-series forecasting by Nekoukar et al. , 2010[4].

Er. Jasmeen Gill*, Er. Baljeet Singh ** and Er. Shaminder Singh et al.(2010) stated that the combination of BP algorithm and genetic algorithm was best as compared to gradient based algorithm and stochastic optimizing algorithm[5].

Ch. Jyosthna Devi #1, B. Syam Prasad Reddy#2, K. Vagdhan Kumar#3, B. Musala Reddy#4, N.Raja Nayak# et al.(2012) studied about Artificial neural network using Back Propagation Neural Network (BPN) technique . This method was more efficient than numerical differentiation [7].

Gyanesh Shrivastava,Sanjeev Karmakar,Manoj Kumar Kowar,Pulak Guhathakurta et al.(2012) stated that BPN, RBFN was best and efficient model to forecast monsoon rainfall as well as other weather parameter prediction phenomenon over the smaller geographical region .This model was study comprehensive review of literature (1923-2012). BPN and RBFN were given appropriate solutions for prediction of long-range weather forecasting [8].

Arti R. Naik*, Prof. S.K.Pathan et al. (2012) stated that Levenberg Marquardt Back Propagation was fastest among many BP algorithms. In this process the weights are adjusted such that the mean squared error obtained between the experimental and obtained result can be minimized [9].

This paper propose a new technique of weather forecasting by using Feed-forward ANN .In this paper data is trained by LM algorithm. This is the fastest method among other weather forecasting methods. As there are many BP algorithm but among them Levenberg BP has better learning rate.

5. RESULT AND CONCLUSION

This paper propose a new technique of weather forecasting by using Feed-forward ANN. The data is taken from Rice Research center (Kaul) Haryana. In this paper data is trained by LM algorithm. This is the fastest method among other weather forecasting methods. As there are many BP algorithm but among them Levenberg BP has better learning rate. Fig 1 shows performance plot, Fig 2 shows testing state and Fig 3 shows Regression plot.

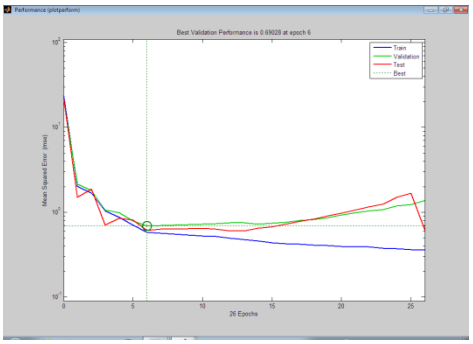

Fig 1. *Performance Plot*

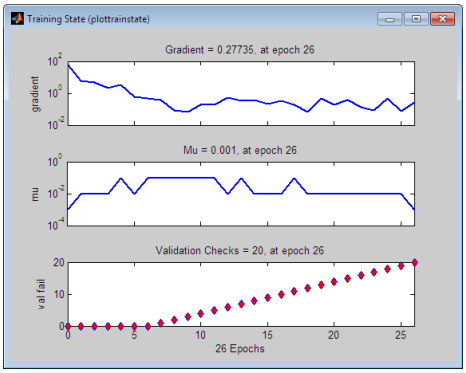

Fig 2. *Testing Data*

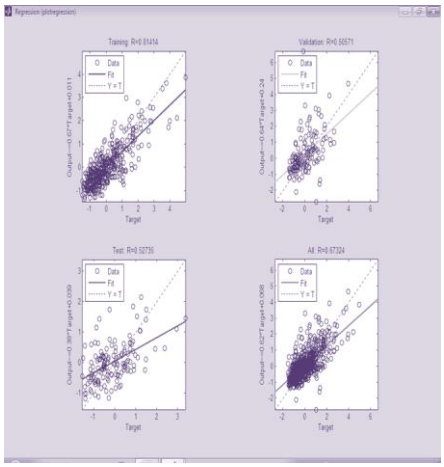

Fig 3. *Regression plot*

REFERENCES

[1] Maqsood Imran, Khan Muhammad Riaz, Abraham Ajith, 2004, Neural Comput & Applic, 13, pp. 112–122.

[2] Paras, Sanjay Mathur, Avinash Kumar, and Mahesh Chandra, 2009, A Feature Based Neural Network Model for Weather ForecastingInternational, Journal of Computational Intelligence Volume 4 Number3.

[3] Widjanarko Bambang Otok, Suhartono, 2009, "Development of Rainfall Forecasting Model in Indonesia by using ASTAR, Transfer Function, and ARIMA Methods", European Journal of Scientific Research, Vol.38 No.3, pp.386-395.

[4] Nekoukar Vahab, Taghi Mohammad, Beheshti Hamidi, 2010, "A local linear radial basis function neural network for financial time-series forecasting", Springer Science, vol. 23, pp. 352–356.

[5] Gill J. et al "Training back propagation neural networks with genetic Algorithm for weather forecasting" IEEE 8th international symposium on Intelligent systems and informatics Serbia, 2010.

[6] Dr. S. Santhosh Baboo and I.Kadar Shereef , An Efficient Weather Forecasting System using Artificial Neural Network, Vol. 1, No. 4, October 2010 ISSN: 2010-0264

[7] Ch.Jyosthna Devi #1, B.Syam Prasad Reddy#2, K.Vagdhan Kumar#3,B.Musala Reddy#4,N.Raja Nayak#5, 2012, ANN Approach for Weather Prediction using Back Propagation, International Journal of Engineering Trends and Technology-Volume3Issue1- 2012, ISSN: 2231-5381.

[8] Gyanesh Shrivastava, Sanjeev Karmakar, Manoj Kumar Kowar, Pulak Guhathakurta, 2012, "Application of artificial neural networks in weather forecasting: A comprehensive literature Review", International Journal of Computer Applications (0975 – 8887), Volume 51– No.18.

[9] Arti R. Naik*, Prof. S.K.Pathan**Weather classification and forecasting using feed forward neural network, International Journal of Scientific and Research Publications, Volume 2, Issue 12, December 2012 1 ISSN 2250-3153.

[10] Kumar Abhishek, M.P.Singh, Saswata Ghosh, Abhishek Anand, 2012, Weather forecasting model using Artificial Neural Network