

Weather Classification and Forecasting using Back Propagation Feed-forward Neural Network

Arti R. Naik*, Prof. S.K.Pathan**

* M.E (CN) Department of Computer Tecnology,SKNCOE PUNE

** Asst Prof. Department of Computer Tecnology, SKNCOE PUNE

Abstract- This paper presents review of application of artificial neural networks in weather classification and prediction; some existing weather forecasting models have limitations and also benefits of neural network are discussed in this paper. Accurate weather prediction is important in today's world as agricultural sector is widely dependent on it. Since there is non-linearity in weather data therefore the paper focuses on potential method of weather prediction using artificial neural networks and training this network by back propagation algorithm.

Index Terms- Artificial Intelligence, ANN, Back-propagation, Weather prediction, Levenberg Marquardt algorithm

I. INTRODUCTION

Weather prediction is estimate of future weather condition. Weather condition is state of atmosphere at given time in terms of weather variables like temperature, pressure, wind direction etc. The accuracy of the prediction widely depends on knowledge of prevailing weather condition over a wide area. Weather is non-linear and dynamic process it varies day-to-day even minute-to-minute. As the climatic dataset is highly non-linear so Artificial Neural Network (ANN) can be used for weather prediction and classification.

Artificial Neural Networks has matured to a great extent over a past few years. Neural network provides methodology of solving highly non-linear problems. Inspired by brain as ANN is interconnection of highly non-linear neuron . The neuron are connected to each other via link. This network is trained using Back-propagation algorithm which follows Gradient Descent Method

This paper propose a new technique of weather classification and forecasting using Levenberg Marquardt Back Propagation Feed Forward Neural Network

II. LITERATURE SURVEY

This section explains about basics of artificial neural network, training the network using back-propagation algorithm and weather forecasting models which were used in past.

A. Artificial Neural Network

Artificial neural network is inspired by biological neuron model. In artificial neural network numbers of highly non-linear neurons are interconnected forming a network. The network

consists of three layers: input, hidden, output. These neurons are connects by links which consists of weight, weights are the connection strength which exists between the neurons in the network [2]. Basically ANN is the system that receives the input, process the data and then gives output with respect to input. More complex is the system, large is the network.

A multilayer neural network consists of input layer, one or more hidden layer and output layer. As weather is data-intensive process and the dataset is highly non-linear therefore prediction can be done accurately using artificial neural network Depending on requirements various neural network are designed among them Feed-forward neural network is widely used for weather and financial forecasting [3] .The advantages of artificial neural network is that they can be used to extract data ,detect trends, also they can predict the pattern which is not provided during training this is called generalization [4].

B. Training Artificial Neural Network

Processing of artificial neural network is done in three phase: training, validating, and testing. Firstly network is trained using input dataset. In this process the weights are adjusted such that the mean squared error obtained between the experimental and obtained result can be minimized. More the input data set used for training accurate will be the result, as it will have more data available for training [6].

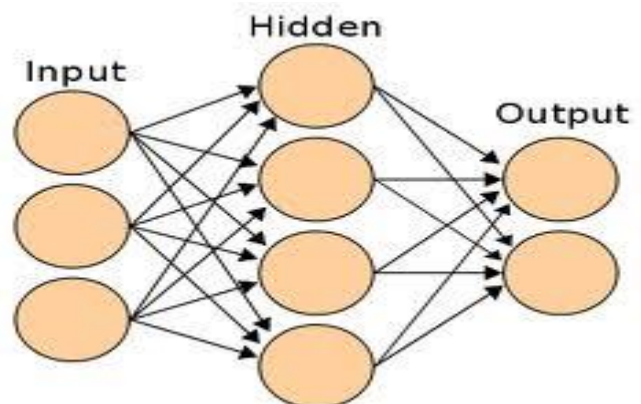


Figure 1. Feed Forward ANN

In Back propagation algorithm the error is back propagated and respectively the weights are adjusted so as to reduce the error. The iteration continues until target value with minimum error is reached [4]. At the beginning of the training process, the connections between the neurons are set to random weight

values. During the training process, the input and output data from the training data subset are fed into the network. The difference between training output and actual output values is then calculated [4]

C. Related Work

In past there were number of models designed using Numerical Weather Prediction (NWP). Aliev et al., 2008, have proposed, fuzzy recurrent neural network (FRNN) based time series forecasting method for solving forecasting problems. [1] KOŠČAK et al., 2009, have compared common meteorological forecasting method with ANN and he found the performance of ANN with high accuracy[2].Nekoukar et al., 2010, have used radial basis function neural network for financial time-series forecasting, and the result of their experiment shows the feasibility and effectiveness.[3] Geetha and Selvaraj, 2011, have predicted Rainfall in Chennai using back propagation neural network model, by their research the mean monthly rainfall is predicted using ANN model. The model can perform well both in training and independent periods [5]

III. OVERVIEW OF APPROACH & DFD

The classification and prediction of weather using back propagation neural network is basically a forecasting kit which aims to gather data that is weather parameters, like temperature, pressure, humidity, wind direction. These predictors are taken as input neuron to BPNN. Weather forecast is made by collecting the data regarding the past and current status of the atmosphere and using this data to train neural network.

The kit classifies and displays the future weather also it displays the weather information if one of the parameter is varied that is what will be the weather if value of the predictors are changed keeping one predictor value as constant.

A. Data Collection

The data related to the predictors is provided to the network input layer. The data can be gathered using weather software also wireless weather sensors can be used like anemometer sensor, thermo hygro sensor etc

B. Preprocessing

The noise in the data is removed in this step so as to get better Prediction result.

C. Weather Prediction using BPNN

The network is feed forward neural network. This network is to be trained using Levenberg Marquardt BPNN.

D. Classification

In neural network classification can be done easily. However it is mainly done using IF-THEN and Decision Table. After classification it should display, whether the future day selected will be sunny, rainy, partly cloudy etc.

E. Data Flow Diagram

The data is recorded using sensors and this data is given as input to the network. The data is preprocessed to remove noise

and the it is trained and validated. Further the output can be classified (means weather the weather will be sunny, rainy, cloudy etc) by means of decision table

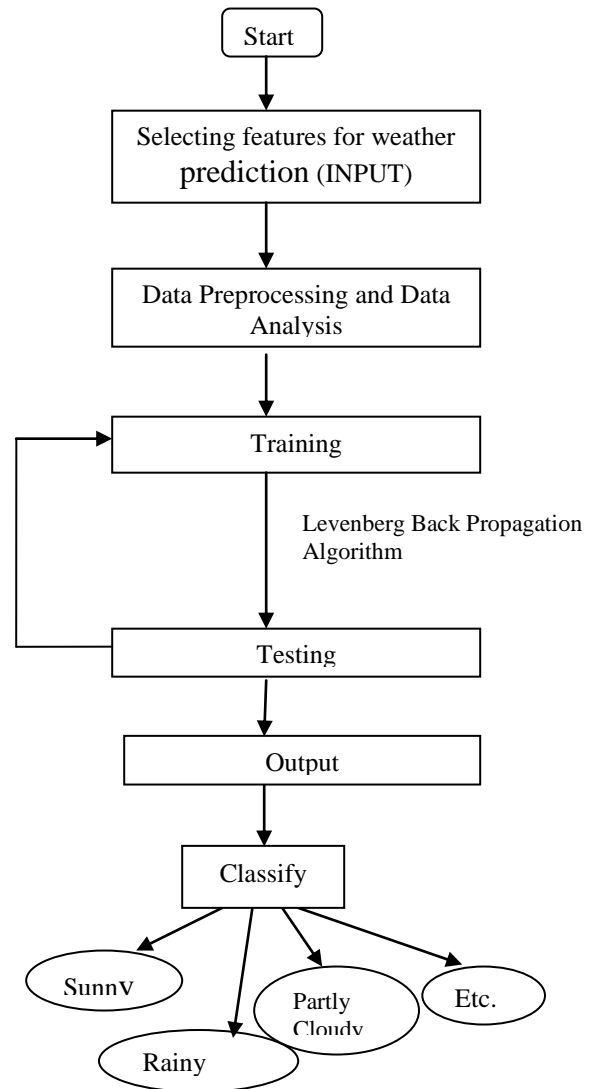


Figure 2. Flowchart weather classification

IV. CURRENT STATUS

In past forecasting was being done simply by observation. After that numerical methods were developed. Then images from satellite were used to retrieve data.

Currently the weather data of upcoming 24 hours can be recorded or the data up till next five days. In future it can be extended to note hurricane and storm surge data.

V. CONCLUSION

This paper propose a new method of weather forecasting using Feed forward ANN and this data can be trained using LM algorithm to predict the future weather as well last to classify it. As there are many BP algorithm but among them Levenberg BP

is the fastest .However in future it can be extended to forecast weather for large area or region.

REFERENCES

- [1] Alijev R. A., Fazlollahi B., Aliev R. R., Guirimov B., 2008, "Linguistic time series forecasting using fuzzy recurrent neural network", *Soft Comput*, vol. 12, pp. 183–190.
- [2] KOŠČAK Juraj, JAKŠA Rudolf., SEPEŠI Rudolf, SINCÁK Peter., 2009, "Weather forecast using Neural Networks", 9th Scientific Conference of Young Researchers
- [3] 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.
- [4] 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.
- [5] Senduru Srinivasulu, "Extracting Spatial Semantics in Association Rules For Weather Forecasting Image", *Research Scholar Department of Information Technology, Sathyabama University Chennai, India IEEE 2010*
- [5] Geetha G., Selvaraj R Samuel, 2011, "Prediction of monthly rainfall in Chennai using back propagation neural network model", *International Journal of Engineering Science and Technology*, Vol. 3 No. 1, pp. 211-213.

AUTHORS

First Author – Arti R.Naik, SKNCOE PUNE ,and sidnaik111@gmail.com.

Second Author – Prof S.K.Pathan, Asst Prof. Computer Engineering, SKNCOE PUNE

Correspondence Author –

1. Arti Naik, sidnaik111@gmail.com, 9028396212.



2. Pathan Mohd. Shafi is having more than 13 year of teaching experience and now currently wworking as a Asst. Professor in Smt. Kashibai Navale College of Engineering, Pune for 6 years. He has worked as a lecturer in MIT Engineering College, Aurangabad for 7 years and worked as visiting faculty in Government Polytechnic Jintur, for one year. He has taught the subjects like Computer Organization, Computer Graphics, Operating System, Network and Information Security, Java Programming Language.