The Use of Artificial Neural Network for Categorization and Indication of Weather Forecasting Dataset with Dynamic Library

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***Abstract*—Weather forecasting is the process of recording the parameters of weather like wind direction, wind speed, humidity, rainfall, temperature etc. Back Propagation Algorithm can be applied on these parameters in order to predict the future weather. In this paper, the variation in one parameter will reflect the changes in other parameters such as humidity, temperature and rainfall. Back Propagation Algorithm (BPN) is used to predict temperature. The main advantage of the BPN neural network method is that it can fairly approximate a large class of functions and is more efficient than numerical differentiation. The simple meaning of this term is that the proposed model has potential to capture the complex relationships between many factors that contribute to certain temperature**

***IndexTerms*—Weather forecasting, back propagation algorithm, temperature prediction.**

I. INTRODUCTION

A neural network is a powerful data modeling tool that is able to capture and represent complex input /output relationships. The motivation for the development of neural network technology stemmed from the desire to implement an artificial system that could perform intelligent tasks similar to those performed by the human brain. Neural network resemble the human brain in the following two ways:

1. A neural network acquires knowledge through learning.
2. Neural network knowledge is stored within interneuron connection strengths known as synaptic weights.

A neural network model is a structure that can be adjusted to produce a mapping from a given set of data to be featured on or relationships among the data. The model is adjusted, or trained, using a collection of data from a given source as input, typically referred to as the training set. After successful training, the neural network will be capable to perform categorization, classification, estimation, prediction, simulation or indication on new data from the same or similar sources.

Weather forecasting for the future is one of the most important attributes to forecast because agriculture sectors as well as many industries are largely dependent on the weather conditions. It is often used to predict and warn about natural disasters that are caused by abrupt change in climatic conditions. At macro level, weather forecasting is usually done using the data gathered by remote sensing satellites. Weather parameters like maximum temperature, minimum temperature, extent of rainfall, cloud conditions, wind streams and their directions, are projected using images taken by these meteorological satellites to access future trends. The satellite-based systems are inherently costlier and require complete support system. Moreover, such systems are capable of providing some information, which is usually generalized over a larger geographical area. The variables defining weather conditions like temperature (maximum or minimum), relative humidity, rainfall etc., vary continuously with time, forming time series of each parameter and can be used to develop a forecasting model either statistically or using some other means that uses this time series data.

Many meteorological departments are working on future weather prediction in order to prevent from climatic hazard. These department records the weather data represents in the form of images. The data recorded by the satellite represented in the form of images are made available to the public.

II. RELATED WORK

In past decades, several models were designed in order to perform weather forecasting, depending on image acquisition process. The model named "Knowledge Based System for Weather Information Processing and Forecasting" developed by Siddiqui Khalid J. and Nugen Steve M., has five output parameters as image acquisition, image processing and enhancement, feature extraction and selection, weather knowledge base and weather inference engine. This model was designed for physical observation from satellite imagery and meteorological information. The future prediction and categorization of data is not possible with this model [1].

Pielke R.A., developed a model named "A comprehensive meteorological modeling system RAMS," for weather prediction. Regional Atmospheric Modeling System (RAMS) was utilized in 1996 at Atlanta, in USA Summer Olympics for weather forecasts, RAMS was a cluster based meteorological system assisting the meteorologists to better predict the weather forecast across the city of Atlanta. This model was developed for prediction of rain for only upcoming 6 hours [2].

The next model developed by Sharma A., named as "A Weather Forecasting System using concept of Soft Computing: A new approach" which constructs an image which represents actual data. It relates the data to the forthcoming weather events based on

previous records and history recognized by the system. It doesn't give the prediction of different parameters such as wind, pressure, humidity and water level [3].

The model named as "An artificial neural network model for rainfall forecasting in Bangkok, Thailand" developed by N. Q. Hung, M. S. Babel, S. Weesakul, and N. K. Tripathi, were predicted the rainfall and management of flood like situation before 6 hours. This model predicts rainfall only but can't predict the temperature, humidity etc. [4].

"An Efficient Weather Forecasting System using Artificial Neural Network" designed by Dr. S. SanthoshBaboo and I.KadarShereef, gives a simplified output when worked with few parametric changes but does not predict the rainfall[5].

In the model "Classification and Prediction of Future Weather by using Back Propagation Algorithm-An Approach" proposed by Sanjay D. Sawaitul, Prof. K. P. Wagh, Dr. P. N. Chatur, there is a rough step by step description of procedure for the classification and prediction of weather forecasting. The designing phase of "Classification and Prediction of Future Weather by using Back Propagation Algorithm" technique is described [6].

III. WORKING

It requires hardware and software tool. Hardware tool includes Wind Sensor, Rain Sensor, Thermo-Hygro Sensor and PC for the collection of data.

Software tool includes MATLAB which uses three toolboxes: Neural Network toolbox, communication toolbox, instrumentation toolbox. In this thesis, back propagation algorithm and data mining techniques are used for automated data analysis and knowledge discovery is needed for prediction of data. Categorization of weather data into particular category of weather is done. Artificial neural network (ANN) toolbox of MATLAB is used for weather categorization. Using this toolbox, the weather can be predicted. Data sheet, Graph or image data is predicted using neural toolbox. After prediction of weather, temperature and other parameters are indicated onto different ports where data is sent using communication and instrumentation toolbox of MATLAB.

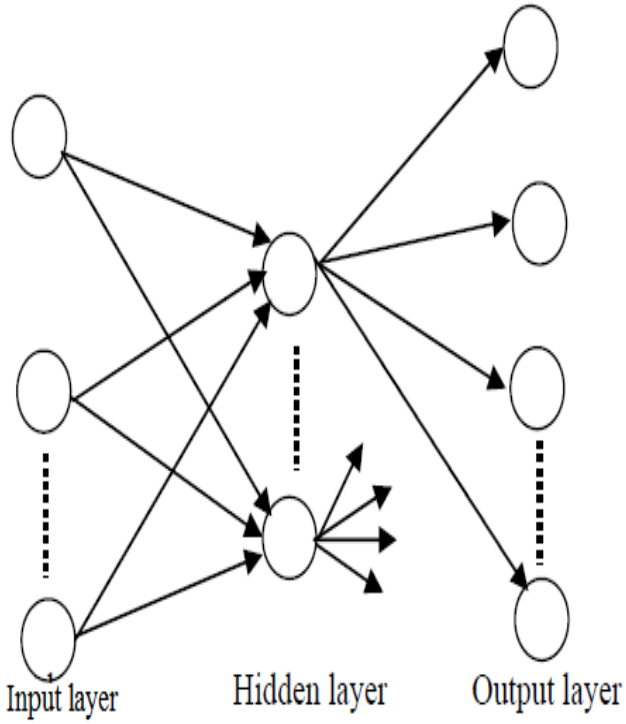
IV. STEP BY STEP DISCRIPTION

Data collection: Using different sensors different parameters are noted and data sheet is made.
Pre-processing of data: This is done for the purpose of categorization of weather.
Data transfer: Data sheets are converted to excel sheets for statistical data information purpose to be used in MATLAB.
Data mining: The required data of a particular date is taken out from excel sheet.
Categorization and prediction of weather using ANN toolbox.
Indication of weather using instrument and communication toolbox.

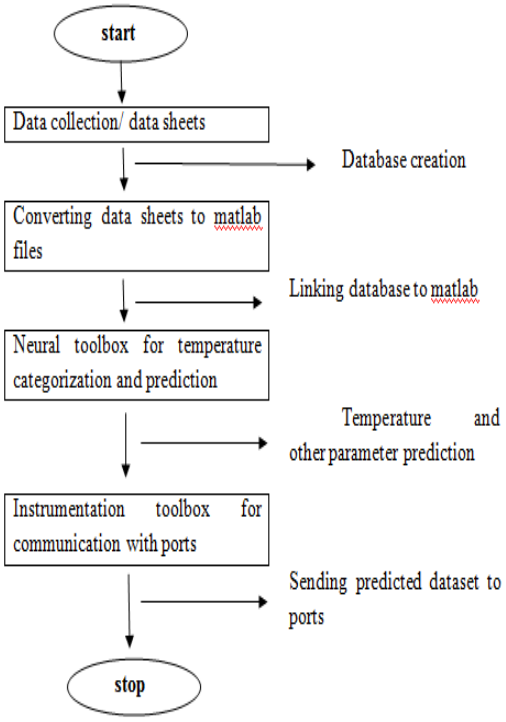
BACK PROPOGATION ALGORITHM

a. ARCHITECTURE

input layer has many input parameters such as wind, temperature, humidity, rainfall etc. and output layer consists of outputs to be predicted after processing of the input parameters. Process is done in the hidden layer. Back propagation is used to predict the data from the database.



b. DATA FLOW DIAGRAM



V. CURRENT STATUS AND FUTURE WORK

Using the proposed model,categorization and prediction of different parameters such as rainfall, temperature, water level of Narmada River, wind flow etc can be done. For any natural calamities like hurricane, this model can indicate the message to different ports for precautions.

The current model observes and stores recorded information about the weather like temperature, humidity, rainfall, water level for the current period of time or maximum for the upcoming 24 hours, and data is sent to the PC for further process. It also analyzes the future weather if there is a change in any one parameter.

In future it can be extended to note the readings for hurricane and also used to increase the range of wireless devices or sensors used for transmitting the data to different ports. It can also be extended for prediction of large areas at a time. The data may be sent to different ports in the form of image or graph or data sheets.

VI. CONCLUSION

In the proposed model, back propagation neural network is used for predicting the temperature based on the training set provided to the neural network. Through the implementation of this system, it is illustrated, how an intelligent system can be efficiently integrated with a neural network prediction model to predict the temperature. This method proves to be a simplified conjugate gradient method. When incorporated into the software tool the performance of the back propagation neural network was satisfactory as there were not substantial number of errors in categorizing. Back propagation neural network approach for temperature forecasting is capable of yielding good results and can be considered as an alternative to traditional meteorological approaches. This approach is able to determine the non-linear relationship that exists between the historical data (temperature, wind speed, humidity, etc.,) supplied to the system during the training phase and on that basis, make a prediction of what the temperature would be in future.

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