

THE USE OF ARTIFICIAL NEURAL NETWORK FOR CATEGORIZATION AND INDICATION OF WEATHER FORECASTING DATASET WITH DYNAMIC LIBRARY

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Abstract— Collection of data related to weather parameter such as temperature, precipitation, pressure, wind speed and direction, dew point and rainfall. This process of collection of data is called as weather prediction. For safety of life and property it is essential to indicate the changes. Categorization and indication of weather predicts the state and changes in weather for future time. Weather forecasting can be done by analyzing data and collecting it for present state of atmosphere. To map input and output relations neural network technique is used. Collected data is used for prediction by training neural network which will provide future prediction of data. This can be done by using BPP (back propagation algorithm). The variation in one parameter will reflect the changes in other parameters will be discussed in this paper. The biggest advantage of the back propagation neural network is that it will give large class of function and it is efficient for numerical differentiation.

Keywords— weather prediction, Categorization, Weather forecasting, neural network, future prediction, back propagation algorithm, numerical differentiation.

INTRODUCTION

Weather is condition of air on earth at a different place and time. It is the application of science and technology which helps to predict the state of the atmosphere in future time for a particular location. It is important due to its effectiveness. It is done by collecting quantitative data of the atmosphere. The changing nature of the atmosphere will have arises the need of computational power required to solve the formal equations describing the atmospheric conditions in the systems. Two methods are used for weather forecasting

1. The empirical approach and
2. The dynamical approach.

The first approach is based on the occurrence of analogs and is often referred by meteorologists as analog forecasting. This approach is very useful to predict weather if recorded data's are plentiful.

The second approach is based on equations and forward simulations of the atmosphere and is often referred to the computer model. The dynamic approach is only used to model large-scale weather phenomena and may not forecast short-term weather efficiently. Most of the weather systems use a combination of both empirical and dynamical techniques. Artificial Neural Network (ANN) provides a methodology for solving many types of nonlinear problems that are difficult to be solved by traditional methods.

Future weather can be predicted by ANN technique. This technique trains the data with past experience and future data can be predicted.

RELATED WORK

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. [1]

This paper gives 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.

Temperature Prediction System Using Back propagation Neural Network: An Approach proposed by Parag. P. Kadu, Prof. K. P. Wagh, Dr. P. N. Chatur. [2]

In this model, it explains back propagation neural network which is used for temperature forecasting. The technical milestones, that have been achieved by the researchers in this field has been reviewed and presented in this paper.

An Artificial Neural Network Model for Rainfall Forecasting in Bangkok, Thailand was developed by N. Q. Hung, M. S. Babel, S. Weesakul, and N. K. Tripathi. [3]

This model was predicted the rainfall and management of flood like situation before 6 hours. This was used in Bangkok for rainfall prediction and managing the passing of flood water. This model predicts rainfall only but can't predict the temperature, humidity.

TOOLS AND TECHNIQUES

Back Propagation Method – Back propagation was created by generalizing widrow Hoff learning rule to multiple layer network and nonlinear differentiable transfer function. Input vectors and corresponding target vectors are used to train a network until it can approximate a function, associate input vectors with specific output vectors. Back propagation algorithm consists of two paths; forward path and backward path. Forward path contain a feed forward network, initializing weight, simulation and training the network. Feed forward network often have one or more hidden layers of sigmoid neurons followed by output layer. The back propagation is a multilayer supervised learning and error is propagated back through earlier layer of network.

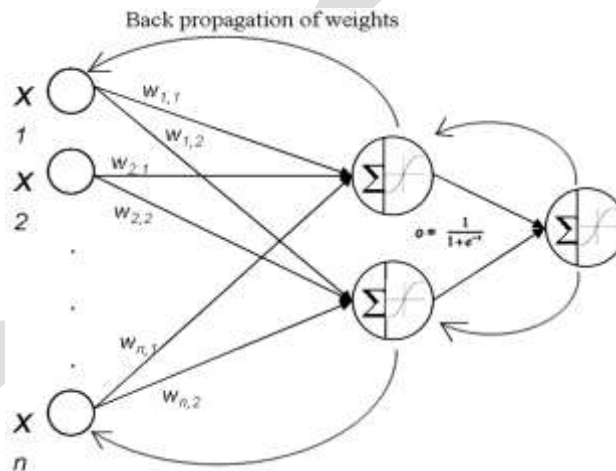


Fig : Back Propagation Algorithm

Data Mining – Today's manufacturing, engineering, business and computing process in public and private organization are generating massive amount of data. This explosive growth of data has outpaced the ability to interpret and digest the data. Therefore, data mining tool for automated data analysis and knowledge discovery are needed. There are many software tools implementing data mining and knowledge discovery techniques that are designed to work efficiently over large amount of data and carry out simple analysis to uncover relationships in data. The users may then perform further investigation and data analysis to confirm or better understand the relationship. Extraction of required data from resulting data has been done by quantitative analysis in order to prevent interface of one parameter with another.

Artificial Neural Network – 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:

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

DESIGN AND IMPLEMENTATION

Phases in Back Propagation Technique – There are two basic phases of Back propagation learning algorithm i.e. propagation phase and weight update phase along wise.

Phase 1: Propagation – Each Propagation involves the following steps

1. The input of the training pattern of Forward propagation is provided by the NN in order to get the output activations of the propagation.

2. The target of the training pattern of Back propagation of the output activations propagation through the neural network is to generate important deltas belonging to all the output and hidden neurons in the systems.

Phase 2: Weight update – For each weight-synapse

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

2. Bring the weight in the direction of the gradient by adding a ratio of it from the weight.

The speed and quality of learning has a major impact by that ratio. This is called the rate of learning. The sign of the gradient of a weight shows the increasing error area in the system. Thus the weight must necessarily be updated in the direction opposite of the system. Neural networks have a remarkable ability to derive and extract meaning rules and trend from complicated, noisy and imprecise data.

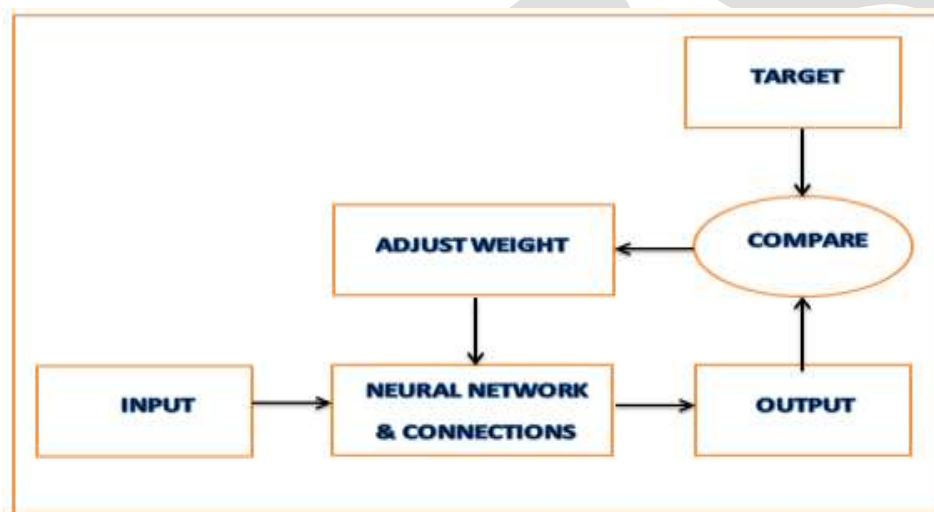


Fig : Neural Network Block Diagram

Operations to be Performed –

- **Data Collection**
- **Pre-processing**
- **Data Transfer**
- **Data Mining**
- **Prediction of Future Weather Using ANN by Back Propagation Algorithm**
- **Classification**

Architecture for the Design of Project

The input layer sends some data to the hidden layer and the hidden layer sends the processed data to the output layer. The input may be the collection of data i.e. temperature, humidity, rain and wind recorded by the different sensors and stored in the form of Excel sheet. This technique is also known as Multilayer Perceptron.

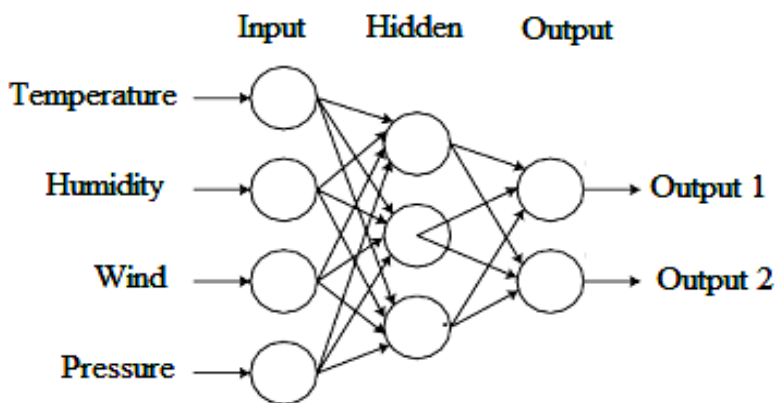
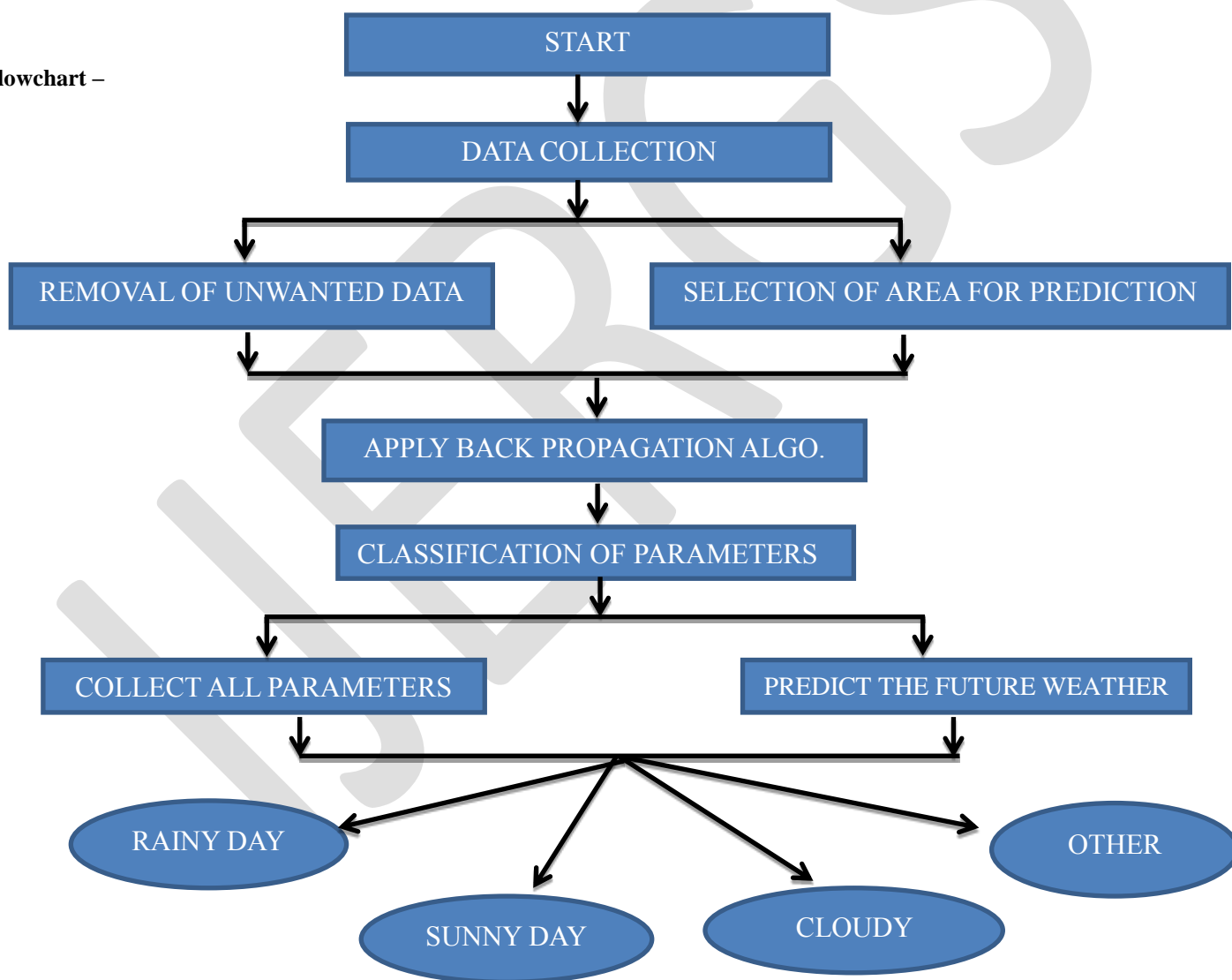


Fig : Architecture of Design

Flowchart –



In the above data flow diagram, the data is collected with the help of different sensors and the recorded data is sent to the PC and this data is stored in the form of data sheets and are represented in the form of graphs and charts. The unwanted data are removed and the data for the particular area is sent to the statistical software for the further process. This selection of data is done by the Data Miner software. In Artificial Neural Network the Back propagation Algorithm is implemented and the variations in parameters are observed.

According to these variations the logic in Back propagation will be developed and the change in other parameters with respect to one parameter will be predicted. The back propagation algorithm consists of two paths; forward path and backward path.

Project GUI –



Fig : Project GUI

This project GUI is having five buttons as Weather, Image, Graph, Clear and Close. Weather button will show the dialog box showing the weather of that particular date. Image button will show the result in pictorial form. Graph button will show the output in the form of graph. Clear button will clear all the text box recordings of weather forecasting parameters shown in project GUI. Close button will exit from the application. The Pop up window displaying the output will vary with respect to the combination of weather parameters retrieved in the project GUI from the database on that particular date.

RESULTS AND DISCUSSIONS

When the parameters are loaded on GUI, user has to click on weather button to see the weather condition of that day. The entries in project GUI is loaded by accessing the data from database. GUI acts as a frontend for "The Use of Artificial Neural Network for Categorization and Indication of Weather Forecasting Dataset with Dynamic Library" software designed in MATLAB.

In the below graph, rainfall is plotted with respect to time. In the same manner, graph for temperature, humidity, dew point and other weather parameters can also be plotted. The result is shown and calculated by back propagation algorithm.

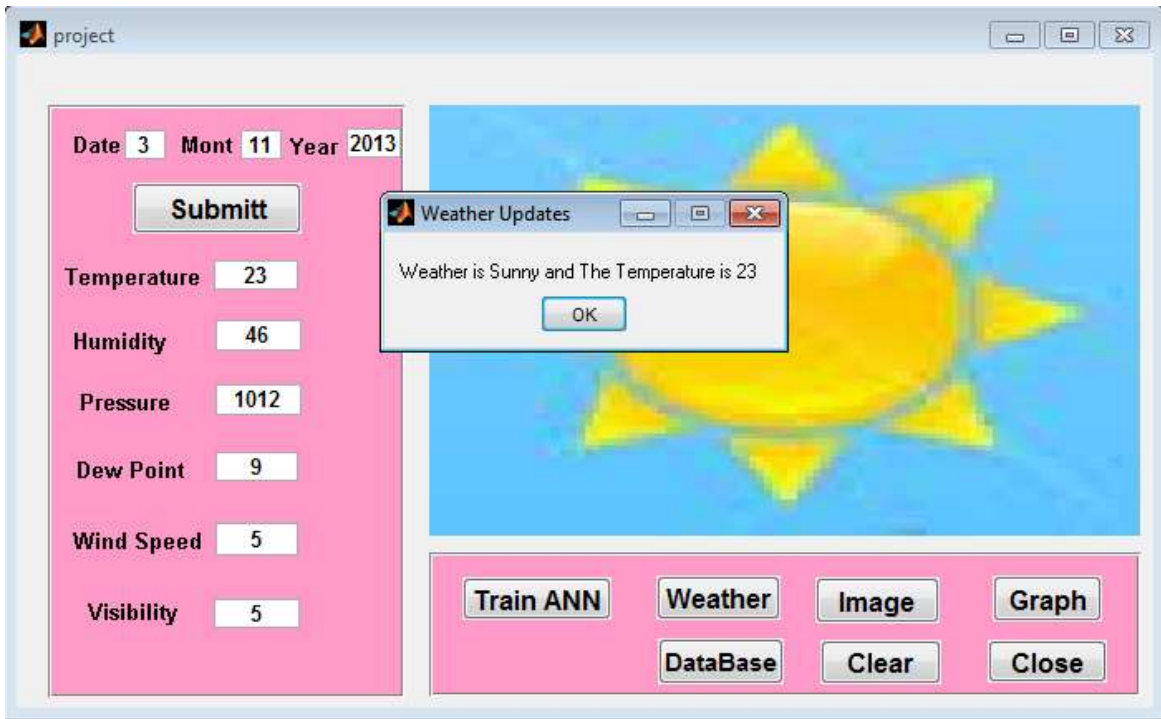


Fig : Weather Form

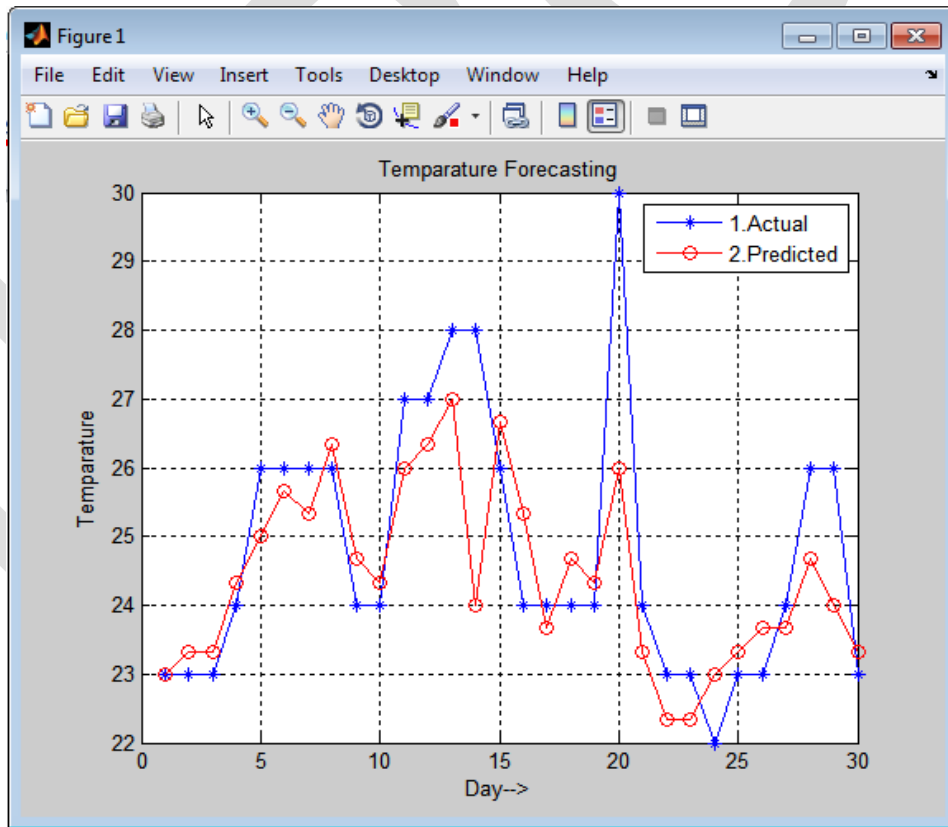


Fig : Graph

CONCLUSION

The main objective is to detect the variation in weather after some period of time or the effect on other parameters of weather with respect to any one parameter. The main aim of the project is to provide the information of future weather after some period of time by changing some parameters, or probability of what will be the effect on other parameters if there is change in one of them. To prevent from adverse effect of climatic change or to provide information about weather and its variation, this project and back propagation algorithm is used.

It also concludes that the Back propagation Algorithm can also be applied on the weather forecasting data. The results suggest that this Neural Network could be an important tool for weather forecasting. Neural Networks are capable of modeling a weather forecast system. Statistical indicators chosen are capable of extracting the trends, which can be considered as features for developing the models. Statistical indicators except coefficients of skewness and kurtosis are found suitable to extract the hidden patterns present in whether data. The Neural Network signal processing approach for weather forecasting is capable of yielding good results and can be considered as an alternative to traditional meteorological approaches.

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