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Future Weather Forecasting Using Soft Computing Techniques

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Abstract

Prediction of weather is determination of future weather condition based on different weather parameters. The different weather parameters were recorded day to day wise. In "Future Weather Forecasting using Soft Computing Technique" the neural network is trained using different combination of weather parameters, the parameter used are humidity, temperature, pressure, wind speed, dew point and visibility. After training the neural network all predicted values of humidity, temperature, pressure, wind speed, dew point and visibility are applied the fuzzy inference system, in fuzzy inference system rules were created. Now applying all predicted parameters to fuzzy system the prediction about the future weather is done.

Keywords: Artificial neural network; fuzzy inference system

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1. Introduction

As the weather changes rapidly, which effects the number of people specially farmers. The prediction of correct weather condition especially prediction of correct rainfall become very important. There are number of approaches for prediction the weather condition

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1.1 Climatology: The Climatology Method is another simple way of producing a forecast. This method involves averaging weather statistics accumulated over many years to make the forecast.

1.2 Analog Method: The Analog Method is a slightly more complicated method of producing a forecast. It involves examining today's forecast scenario and remembering a day in the past when the weather scenario looked very similar (an analog). The forecaster would predict that the weather in this forecast will behave the same as it did in the past.

1.3 Numerical Weather Prediction: Numerical Weather Prediction (NWP) uses the power of computers to make a forecast. Complex computer programs, also known as forecast models, run on supercomputers and provide predictions on many atmospheric variables such as temperature, pressure, wind, and rainfall. A forecaster examines how the features predicted by the computer will interact to produce the day's weather. The NWP method is flawed in that the equations used by the models to simulate the atmosphere are not precise.

This leads to some error in the predictions.[8] In This paper a approach is provided that the Neural network with fuzzy inference system can be applied on the weather forecasting dataset to train the neural network and effect of the parameters on each others.

2. Related Work

In the Past decades, there are numbers of model designed, in order to perform the weather forecasting, depending on image acquisition process. The model named "Knowledge Based System for weather Information processing and Forecasting has five components as Image Acquisition, Image processing, Enhancement, Feature Extraction and selection. Weather Knowledge Base and Weather Inference Engine (WINE) this model provides the information about the physical observation from satellite imagery and meteorological information[1]. One example of the same system is RAMS[2] which was used in the Atlanta, USA Summer Olympics for weather forecasts, RAMS was a cluster based meteorological system assisting the metrologists to better predict the weather forecast across the city of Atlanta .The number of dynamic methods are being attempted at various weather centers using longer integrations of medium-range models[3]. One of the important technique used in these days is Artificial neural network because of its ability to model both linear and non linear systems without the need to make assumptions as are implicit in most traditional statistical approaches.

ANN has been aggressive model over the simple linear regression model[4]. It is hard to get predictive information from the retrieved image in the content based image retrieval system [5]. In the past human forecaster was responsible for generating the entire weather forecast based upon available observations[6].In recent years, automatic indexing and retrieval based on image content has become more desirable for devlopeling large volume image retrieval applications [7].

Temperature warnings are very important as it lays a vital role in human life. Temperature forecasting is the kind of science and technology to approximate the temperature for a future time and for a given place. Temperature forecasts are performed by means of gathering quantitative data regarding the in progress state of the atmosphere. The author in this paper utilized a neural network-based technique which determines the future temperature. The Neural Networks package consists of various kinds of training or learning techniques.

3. Working

In this system the different weather parameters for last five years were collected day to basis. Initially data clustering is performed which will result in cluster formation, here cluster based on months were formed.
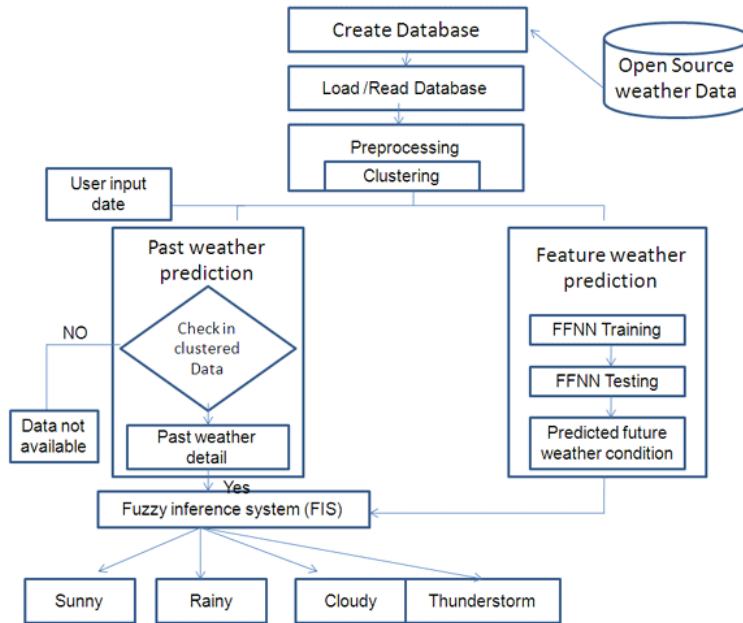

Fig.1. Flow graph

3.1. Step by step description of operation

Phase 1: Collection of Open Source Weather details
Phase 2: Create Database
Phase 3: Load/Read Database
Phase 4: Preprocessing
Phase 5: Past weather details
Phase 6: Past weather Condition
Phase 7: Future Weather Detail
      a. FFNN Training
      b. FFNN Testing
Phase 8: Fuzzy Inference system
Phase 9: Future weather condition

3.1. 1. Collection of Open Source Weather details

This is the first stage of the system where the dataset required for the system were collected from the external source here the six main parameters which are responsible for weather are considered all were collected day to day basis and the data for last five years were collected and stored in the system database.

3.1. 2. Create Database

After collecting the six parameters on daily basis the systems database is created and stored inside the system.

3.1. 3. Load/Read database

This is the first functionality provided to the user to check the different values of parameter which are already stored into the database for the previous years so from here the user can check all the values for the previous date. This function will fetch the complete data available in the database and provide to the user.

3.1. 4. Preprocessing

This is the second function in the system, in this data collected in the database are categorized in monthly clusters. As the database is the collection of data of last five years, so combined data is available in the database. In clustering same complete data is clustered into the month clusters so total twelve clusters were created.
In the cluster the different color shows the density of different parameters.

3.1. 5. Past weather details

This is next function provided into the system where the prediction of weather condition for the previous dates can be done. The system first prompt for the dialog box where data, month, year were asked from the user after asking the details first it checks the validity of date where the validity of each field is checked, if all parameters are correct then the system fetch the data available for the specified data then the all six parameters will be fetch and shown to the user. After taking date, month, year as input from user the system check the database for the available data for date specified by the user. First based on the month value it jumps to the month cluster then after checking the date and year, it fetches the complete data available in the database for the specified date.

3.1. 6. Past weather condition

In the past weather condition the values of six parameters fetch from the past weather details were provided to the fuzzy inference system. The fuzzy system will take the decision based upon the rule present on the fuzzy inference system.

3.1. 7. Future Weather Detail

The future weather detail it uses the neural network to predict the values of six parameters here the six neural were created for predicting the six values for weather parameters.
Here for future weather prediction the system will prompt for the dialog box contains date, month, and year values after getting values form user the verification will be done on data as the prediction planned from the system is for next five years (2013-2017). Here for prediction each weather parameters neural network is created train and testing, once date is taken in form the user based on the month the system will jump into the months cluster, the complete cluster for that month is loaded in the system.

If the date is belong to January month the complete cluster of January month is get loaded into the system as the system consisting of five years of data so 13*5 rows of data is available for training the neural network for temperature. After training is done for January month the system will check the date inserted by user is belong to which week as there are four week in the month it will check in which week the date belong if the date is belong to first week of January then (7days of first week of January * five January month for 5 year) that is total 7*5 rows will be available for the testing as the prediction of weather condition first week of January prominently based on the all first week of all January's we have in the data base using the above logic the prediction of the temperature value will be done.

4. Implementation flow

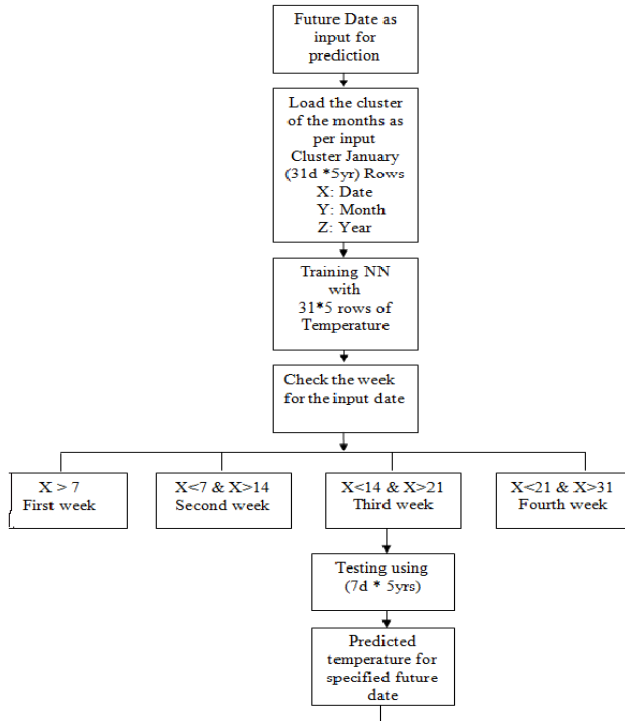The actual implementation flow are shown in figure

Fig.2. Implementation Flow of system

5. Results

The forecasts of the month June and July 2015 are noted with their predicted values and the actual weather condition of that day and following results were found
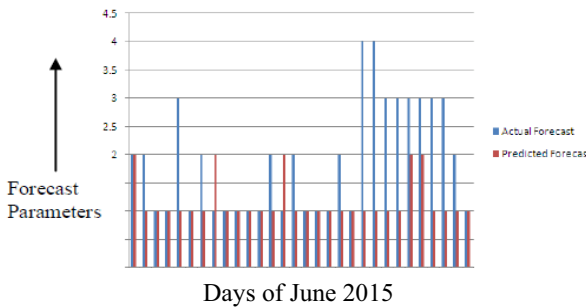

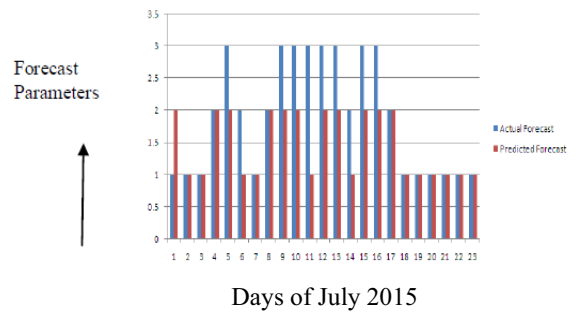Fig.3 Actual to predicted forecast for June 2015

Fig.4 Actual to predicted forecast for July 2015

Above fig. shows the comparison between the actual forecast and the predicted forecast for the period June and July 2015.
In X axis days of June / July month are plotted and in Y axis forecast condition are plotted where the values
1.Rainfall 2.Cloudy 3.Sunny

6. Conclusion

In this system, the main objective is to detect the variation in weather after some period of time or to verify how one weather parameter affect the another weather parameter. In past numbers of model were used for weather forecasting based on artificial neural network, soft computing or data mining concepts. Here the system shows the combination of neuro fuzzy can be used to enhance the accuracy. The system reliability, consistency and accuracy are increased for identification and interpretation of weather prediction. It also concludes that the Fuzzy inference system can also be applied on the weather forecasting data. From the derived results it is clear that this Neural Network could be an important tool for weather forecasting. Neural Networks are capable of modeling a weather forecast system and the use of fuzzy inference system will help system to achieve better results as compare to previous systems.

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