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Prediction of Rainfall Using Fuzzy Dataset

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Abstract:- Rainfall prediction is one of the demanding operational responsibility carried out by meteorological services worldwide. Planning is referred to as the roadmap to success as failing to plan implies planning for failure. Information about future happenings instrumental to efficient and effective planning. Effects of natural disaster such as flooding, drought can only be prevented with effective planning. The different techniques that can be applied are as- decision tree, clustering, K-mean, fuzzy logic. In this paper, we have used the fuzzy logic technique to predict the rainfall, given the temperature of that particular geographical location.

Keywords:- Planning, Forecasting, Rainfall, Fuzzy Logic, Data mining.

I. INTRODUCTION

The back bone of Indian economy is agriculture. Most of agriculture depends upon the rain still irrigation facility is not good in India. A good rainfall result in the occurrence of a dry period for a long time or heavy rain both affect the crop yield as well as the economy of country, so due to that early prediction of rainfall is very crucial. A wide range of rainfall forecast methods are employed in weather prediction at regional and national levels. There are two methods for predicting rainfall. Empirical approach and the Dynamical approach.

The empirical approach is based on analysis of historical data of the rainfall and its relationship to a variety of atmospheric and oceanic variables over different parts of the world. The most widely used empirical approaches, which are used for climate prediction, are regression, artificial neural network, fuzzy logic and group method of data handling.

On the other hand in dynamical approach, predictions are generated by physical models based on systems of equations that predict the evolution of the global climate system in response to initial atmospheric conditions.

In this paper, rainfall prediction model is implemented with the use of empirical statistical technique, datasets of the climate data such as rainfall in mm of various areas in India, temperature. The model forecasts monthly rainfall amount. The experimental results prove that there is a close agreement between the predicted and actual rainfall amount.

A. TYPES OF FORECASTING

The weather forecast is separated into four types: short-range, medium-range and long-range weather forecasting. Now throwing in which the details about the present weather and forecast up to a couple of hours ahead are given.

Short range forecast (1 to 3 days) – In which the weather in each progressive 24 hr. intervals might be predicted up to 3 days. This gauge range is principally concerned with the weather frameworks saw in the most recent weather graphs, in spite of the fact that era of new frameworks is additionally considered.

Medium range forecast (4 to 10 days) – Average weather conditions and the weather on every day might be recommended with logically lesser details and exactness than that for short range forecasts.

Long range/Extended Range estimates (over 10 days to a season) - There is no rigid definition for Long Range Forecasting which may run from a month to month to a regular estimate. Weather is comprised of different parameters including air temperature, atmospheric pressure, humidity, precipitation, solar based radiation and wind. Each of these elements can be measured to characterize typical weather examples and to decide the quality of neighborhood atmospheric conditions. Based upon above parameters just predict the extreme weather events like serious rainfall, heat waves, fog and dry seasons.

B. DATA MINING TECHNIQUE

Data Mining is the extraction of conceal pattern from data warehouses. It is an intense innovation with an incredible breadth to investigate and predict crucial data from the databases. Meteorological data are voluminous, dynamic, unpredictable and high dimensional. There are a few methods utilized as a part of data mining as characterization, Association, Regression, Cluster Analysis, Outlier Analysis etc. Among these Classification system is here generally utilized. Classification is a supervised learning strategy used to forecast aggregate participation for data occurrences. On the off chance that we may wish to utilize characterization to predict whether the weather on a specific day will be "sunny", "rainy "or "shady". Prediction models continues-value function, it predicts obscure or missing qualities.

C. DATA MINING TOOLS

The Data Mining includes tremendous number of tools utilized for the mining systems. These devices involve distinctive procedures as Classification, Prediction, Preprocessing, Clustering, Association and Visualization. A portion of the tools utilized are as follows,

Weka, is a GUI and goes about as one of the data mining tools. This incorporates the applications as Explorer, Experimenter, Knowledge Flow and Simple CLI. These have the strategies as Classify, Preprocess, Associate, Visualize etc.

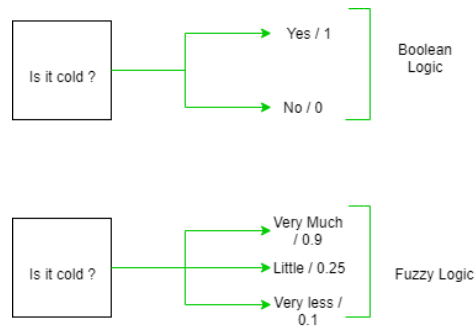
RapidMiner, is an open source instrument with programming stage that actualizes the incorporated environment including mining and analytics. This not only processes the method such as segmentation, regression, classification, but also validates the process for prediction automatically.

OrangeCanvas, is one of the sorts of data mining tools that is utilized for unsupervised data. It incorporates the common classification, regression and the distinctive sorts of regression. This likewise assesses distinctive plots, matrices and the forecasts.

II. FUZZY LOGIC TECHNIQUE

The things which are not clear are term as fuzzy. In the real world many times we encounter a situation when we can't determine whether the state is true or false, a valuable flexibility for reasoning are provided by fuzzy logic. In this way, we can consider the inaccuracies and uncertainties of any situation.

In boolean system truth value, 1 represents truth value and 0 represents false value. But there is no logic for absolute truth and absolute false value in the fuzzy system. But in fuzzy logic, there is intermediate value too present which is partially true and partially false.



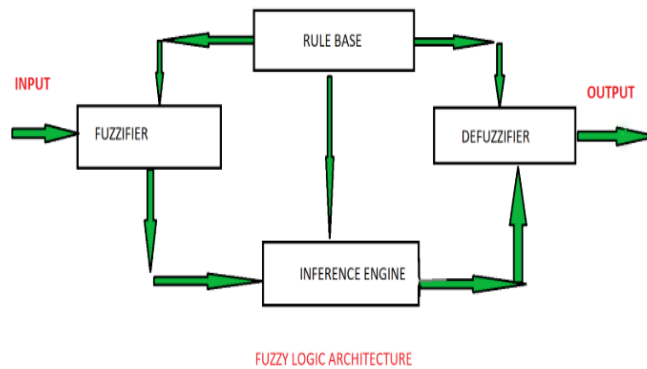
Its Architecture contains four parts:-

Rule Base: It contains all the rules and the IF-THEN conditions provided by the experts to govern the decision making system, on the basis of linguistic information. Several effective methods for the design and tuning of fuzzy controllers are recently developed in fuzzy theory. The number of fuzzy rules are reduced due to this developments.

Fuzzification: It is used to convert inputs i.e. crisp numbers into fuzzy sets. The exact inputs measured by sensors and passed into the control system for processing, such as temperature, pressure, rpm's, etc are basically the crisp inputs.

Inference Engine: The current fuzzy input with respect to each rule and decides which rules are to be fired according to the input field determines the matching degree. Next, to form the control actions the fired rules are combined.

Defuzzification: The fuzzy sets obtained by inference engine are converted into a crisp value. Several methods are available in defuzzification and the most suitable is used to reduce the error with a specific expert.



ALGORITHM OF FUZZY LOGIC:-

1. Define the linguistic variables and terms (initialization)
2. Construct the membership functions (initialization)
3. Construct the rule base (initialization)
4. Using the membership functions the crisp input data is converted into fuzzy values (fuzzification)
5. According to rule base rules are evaluated (inference)
6. Combine the results of each rule (inference)
7. Then convert output data to non-fuzzy values (defuzzification)

III. LITERATURE SURVEY

K. Abhishek [2] et al. training and testing data sets and finding the number of hidden neurons in these layers for the best performance are the applications implemented by this survey. Using artificial neural network models in the research it predict the average rainfall over Udupi district of Karnataka has been analyzed. Three layered network has been constructed in formulating artificial neural network based predictive models. The number of hidden neurons are different in the model under study.

Alaa Sheta [8] et al. proposed novel models for weather forecasting using two techniques; artificial neural networks and fuzzy logic. These models have been established on two different regions, Amman airport and Taipei \ China. In the development of these models, feed forward neural network is architecture of used neural network and it was trained using back propagation algorithm. We evaluate the efficiency of weather forecasting models using two measures; Variance Accounted For (VAF), and Mean Absolute Error (MAE). Experimental results showed that the proposed models can forecast with more accurate result.

Ayham Omary [5] et al. builds dataset about Jordanian weather and precipitation related information. By using local and web resources this information is gathered. To parse all weather related information from different websites that store such information is term as tool. Based on historical data, data mining techniques and AI algorithms are used

for future precipitation forecasting. To predict future forecasting and possible climate change data mining and statistical methods are used.

Ashwani [4] et al. analyses the use of data mining techniques in forecasting weather. Using Artificial Neural Network and Decision tree Algorithms and meteorological data is collected in specific time. Standard performance metrics, and the algorithm which gave the best results used to generate classification rules for the mean weather variables are compared in this algorithm. Data mining techniques can be used for weather forecasting in various cases.

Rajini Kanth [3] et al. applied K-means cluster algorithm for grouping similar data sets together and also applied J48 classification technique along with linear regression analysis.

Nikhil Sethi,[1] et al. proposes MLR technique for Forecasting of weather. Rainfall plays an important role in agriculture and it plays an important role in the economy of India. Rainfall prediction has been the one of the most challenging issue around the world in last year. Widely used techniques for prediction are Regression analysis, clustering, and Artificial Neural Network (ANN). Multiple linear regression (MLR) technique is used for the early prediction of rainfall in this paper.

Dhawal Hirani [7] et al. this paper reports a detailed survey on rainfall predictions using different rainfall prediction methods extensively used over last 20 years. From the survey it has been found that most of the researchers used artificial neural network for rainfall prediction and got significant results. The forecasting techniques such that uses MLP, BPN, RBFN, SOM and SVM are suitable to predict rainfall than other forecasting techniques such as statistical and numerical methods by this survey. However some limitations is clearly noticed in all the methods of rainfall prediction discussed in this survey paper The extensive references in support of the different developments of methods provided in this research should be of great help to researchers to accurately predict rainfall in the future and to select the method that would solve their problem they will be facing in their proposed prediction model.

G.Vamsi Krishna [6] et al. the category of cloud is predictable and the rainfall is anticipated by using the proposed methodology based on Gaussian Mixture model together with K- means Clustering. The performance is tested in the presence of the clustering algorithm and also discarding the clustering algorithm. In order to test the performance, performance metrics such as Peak Signal to Noise Ratio and Mean squared error are considered. The class of cloud is established using the Cloud Mask Algorithm together with the histogram equalization. The nature of cloud can be identified by using the K- Means Clustering technique. The category of rainfall cloud is predicted by analyzing the color and density of the cloud images.

TABLE 1. VARIOUS ALGORITHMS AND THEIR LIMITATIONS

Ref. No.	Algorithms	Attributes	Time Period	Advantages	Limitations
[1]	Artificial neural network and decision tree techniques.	Max temperature, min temperature, sunshine, Rainfall,	Months and years.	From given enough data ANN's can detect the relationships between weather parameter and use these to predict future weather conditions.	They used only small limited areas for weather forecasting.
[2]	Decision tree algorithm	Max temperature, rainfall, evaporation and wind speed	13 years	Important deviations which show changes in climatic patterns identified.	It cannot predict the weather short term efficiently.
[3]	Data mining technique k means cluster algorithm	High temperature, cold climate, Rainfall	112 years	The predictions can be done using the linear regression line equations that are found in an effective manner	Need to extend to any huge data sets with various attributes /parameters for effective analysis and accurate prediction.

[4]	Multiple linear regression technique	Rainfall, vapor pressure, average temperature cloud cover	30 years	predict rain in the future year by knowing climate factors which is very useful for farmers for their agriculture purpose.	This is the only prediction regarding rain but not accurate because of climate factors.
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IV. CONCLUSION

Rainfall has an great impact on agriculture, economy not only in India but across the whole world. In this paper we have proposed a method for rainfall prediction after analysis of rainfall dataset which is derived by some fuzzy logic. So that we can predict rain in the future year by knowing climate factors which is very useful for farmers for their agriculture purpose. Due to climatic factors only prediction regarding rain but not accurate result is analysed. As we know that climate factors changes due to different reasons and here we have used some factors so other remaining factors can influenced the rain.

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