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**A REVIEW STUDY OF RAINFALL PREDICTION USING NEURO-FUZZY  
INFERENCE SYSTEM**

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**ABSTRACT**

Rainfall Prediction is a very challenging task. In India which is an agricultural country, the success or failure of the crops and water scarcity in any year is always viewed with greatest concern. A small fluctuation in the seasonal rainfall can have devastating impacts on agriculture sector. Accurate rainfall prediction is a necessity in agriculture field. Various algorithms have been proposed but rainfall prediction is still not accurate. It is difficult to name a particular algorithm is suitable for prediction. Sometimes when certain algorithms are combined, they perform better and are more effective. In this paper our main motive is to study Data mining, Neural Network, fuzzy logic and ANFIS.

**KEYWORDS:** Neural network, Fuzzy logic, ANFIS.

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**INTRODUCTION**

Data Mining is a method of excavation and extraction of the great, unknown and unjust information from large sets of information then analyzing it to extract the hidden relevant pattern to create crucial selections in time. In short, data processing automates the detection of relevant patterns in information repositories. Data mining tools predict future trends and behaviors, allowing businesses to make proactive, knowledge-driven decisions. The automated, prospective analyses offered by data mining move beyond the analyses of past events provided by retrospective tools typical of decision support systems. Data mining tools can answer business questions that traditionally were too time consuming to resolve. The most commonly used techniques in data mining are:

- Artificial neural networks: Non-linear predictive models that learn through training and resemble biological neural networks in structure.
- Decision trees: Tree-shaped structures that represent sets of decisions. These decisions generate rules for the classification of a dataset. Specific decision tree methods include Classification and Regression Trees (CART) and Chi Square Automatic Interaction Detection (CHAID).
- Genetic algorithms: Optimization technique that use process such as genetic combination, mutation, and natural selection in a design based on the concepts of evolution.
- Nearest neighbor method: A technique that classifies each record in a dataset based on a combination of the classes of the k record(s) most similar to it in a historical dataset (where  $k \geq 1$ ). Sometimes called the k-nearest neighbor technique.
- Rule induction: The extraction of useful if-then rules from data based on statistical significance.

Many of these technologies have been in use for more than a decade in specialized analysis tools that work with relatively small volumes of data. These capabilities are now evolving to integrate directly with industry-standard data warehouse and OLAP platforms. The appendix to this white paper provides a glossary of data mining terms.

**The Data Mining Process**

Figure shows the phases, and the iterative nature, of a data mining project. The process flow shows that a data mining project does not stop when a particular solution is deployed. The results of data mining trigger new business questions, which in turn can be used to develop more focused models.

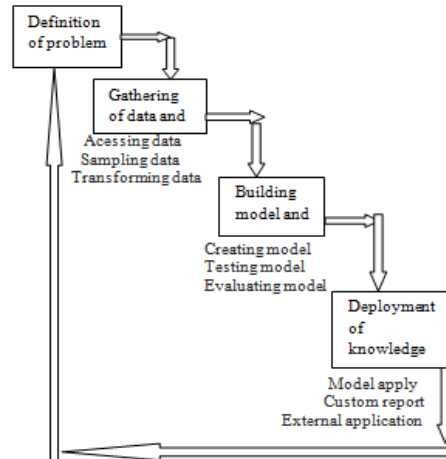


Figure 1 The Data Mining Process

**RAINFALL PREDICTION**

Sometimes the unknown event of concern is forthcoming, however prophetic analytics will be helpful to any sort of strange whether in previous or coming time. Rain prediction acts as a blessing because it provides info regarding the prevalence of rain and by that information we are able to predict regarding the seasonal product. Foreknowledge regarding the downfall is that the most combined field. As downfall could be a random development whose forthcoming proceedings gamble on some forerunner from different specifications like the ocean level temperature (SLT) the surface pressure (SP) and different atmospherically dimensions. The climate conditions like the heat, moisture; breeze etc. there's most giddiness within the season, weather and also the climate.

**BASIC REVIEW OF FOLLOWED TECHNIQUE**

**NEURAL NETWORK**

Neural networks are typically organized in layers. Layers are made up of a number of interconnected 'nodes' which contain an 'activation function'. Patterns are presented to the network via the 'input layer', which communicates to one or more 'hidden layers' where the actual processing is done via a system of weighted 'connections'. The hidden layers then link to an 'output layer' where the answer is output. Most ANNs contain some form of 'learning rule' which modifies the weights of the connections according to the input patterns that it is presented with.

Soft computing deals with approximate models wherever associate in nursing approximation answer or results achieved. Soft computing has 3 basic parts, namely, symbolic logic, Artificial Neural Network (ANN) and Genetic algorithmic rule. Neural network is often utilized by researchers within the field of downfall prediction.

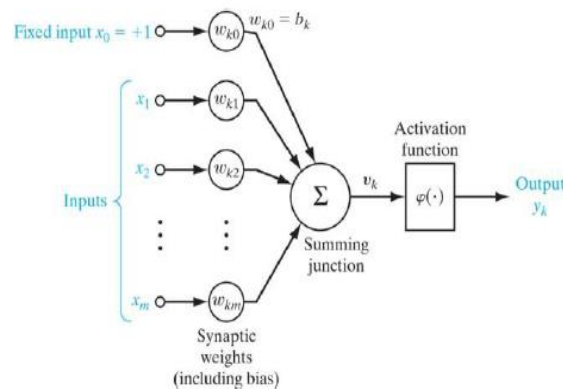


Figure2 nonlinear model of ANN

ANN predicts rain for a structure with artificial rain inputs, applied a man-made neural network system to model the rainfall-runoff method.

### FUZZY LOGIC

Our try is to forecast downfall with the assistance of symbolic logic primarily based approximate reasoning. This method uses the idea of a pure symbolic logic system wherever the fuzzy rule base consists of a set of fuzzy (IF–THEN) rules. The FIS (fuzzy reasoning engine) uses these fuzzy IF–THEN rules to work out a mapping from fuzzy sets within the input universe of discourse to fuzzy sets within the output universe of discourse supported symbolic logic values. so as to create our models we have a tendency to defines the fuzzy sets encompass 5 parameters: total cloudiness, wind direction, temperature ,relative humidity and surface pressure square measure the input variables for our model; every has 3 membership functions with single output that is rain event share. Fuzzy reasoning is that the method of mapping functions from a given input to associate output victimization symbolic logic.

Fuzzy Logic is extremely helpful in modeling inexact and complicated systems, what is more fuzzy pure mathematics may be a powerful tool and in scientific world applications of FL have apace enhanced with establishing its utility that ever system involves ambiguous associate degreed obscure input variables could increase an final result. The symbolic logic chance and its degree of result owing to the ambiguous input variables square measure thought of by some as being generated within the human mind and is commonly said as knowledgeable information. This information is that the gathering of information and ideas as a results of the expert's expertise in a very explicit system; thereby decision-making ways could also be thought of as fuzzy expressions perceived

### ANFIS (ADAPTIVE NUERO FUZZY INFRENCE SYSTEM)

An adaptive network-based fuzzy inference system (ANFIS) is a form of artificial neural network that is founded on Takagi–Surgeon fuzzy inference system, incorporating both neural networks and fuzzy logic ideologies; this one has capability to have the profits of both in a solo framework. This inference system relates to a set of fuzzy IF–THEN instructions which have learning skill to estimate nonlinear tasks and ANFIS is also called as a universal estimator. Adaptive network is a superset of all kinds of feed forward neural networks and has supervised learning ability. As its name implies, it is a network structure containing nodes and nodes are connected with directional links. Furthermore, all or part of the nodes is adaptive, means their result depends on the parameter(s) relating to these nodes. For minimizing prescribed error measure, the learning rule states how these parameters should be changed. An adaptive network is a multilayer feed forward network in which each node has some incoming signal and a set of parameters on which every node performs a particular function (node function). The formulas for the node functions may vary from one node to another node, in addition the adaptive network has some input-output function and the choice of each node function is depended on that input-output functions.

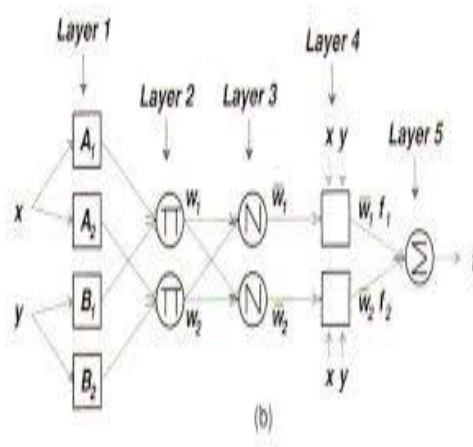


Figure 4: ANFIS Architecture

**LIERATURE REVIEW**

Sarma, Konwar, Das etc [1] showed that Artificial Neural Network (ANN) can also be combined with different methods. A neural network model for rainfall retrieval over ocean from remotely sensed microwave (MW) brightness temperature (BT) is described. They Proposed, a soft computing approach for rainfall prate estimation over ocean using online feature selection, clustering, and hybrid neural network. In this study, they applied an online feature selection (FS) algorithm to the BT dataset obtained from TMI. The nine-channel BT data are the input feature to this feature selection algorithm. It selects the most relevant channels both vertical as well as horizontal. A k-means clustering algorithm is then applied to the dataset of selected features. Separate multilayer perceptron (MLP) neural networks are trained for each of the clustered data. These trained MLPs are then combined to form a hybrid network. The results showed that hybrid network ANN-Hyb provided better instantaneous rain fall rate estimation compared to ANN alone.

Another researcher F. Mekanik and M. A. Imteaz [2] found that Australian rainfall is also affected by these key modes of complex climate variables. On the other hand, few attempts have been made to establish the combined effect of these indices on rainfall in order to develop a better understanding and forecasting system. Since rainfall is a complicated atmospheric phenomenon, linear techniques might not be sufficient enough to capture its characteristics. This research attempts to find a nonlinear relationship between the Victorian rainfall and the lagged-indices affecting the region using Artificial Neural Networks (ANN). It was discovered that ANN modeling is able to provide higher correlations using the lagged indices to forecast spring rainfall in compared to linear methods. Using these indices in an ANN model increased the model correlation up to 99%, 98% and 43% for the three case study stations of Horsham, Melbourne and Orbost in Victoria, Australia respectively.

Vamsidhar, Rao, satapati etc[3] used the back propagation neural network model for predicting the rainfall based on humidity, dew point and pressure in the country INDIA. Two-Third of the data was used for training and One-third for testing. The number of training patterns is 250 training and testing patterns are 120. In the training they obtained 99.79% of accuracy and in Testing they obtained 94.28% of accuracy. These results can predict the rainfall for the future. For rainfall prediction, Artificial Neural Network was applied and the rainfall was predicted in India. According to the results back propagation neural network were acceptably accurate and can be used for predicting the rainfall. So by using this method for prediction we can find the amount of rainfall in the region by using the attributes like humidity, dew point and pressure.

**CONCLUSION**

This paper presents a survey that using artificial neural network (ANN).ANFIS approach is used for rainfall forecasting yields good results and can be considered as an alternative to traditional metrological approaches. In this paper we have studied various researcher's reviews and their techniques to forecast rainfall prediction.

**REFERENCES**

- [1] Diganta Kumar Sarma, Mahen Konwar, Jyotirmoy Das Srimanta Pal, and Sanjay Sharma, "A Soft Computing Approach for Rainfall Retrieval From the TRMM Microwave Imager", IEEE Transactions on Geosciences and Remote Sensing, Vol. 43, No. 12, December 2005, pp 2879-2885
- [2] F. Mekanik and M. A. Imteaz, "A Multivariate Artificial Neural Network Approach for Rainfall Forecasting: Case Study of Victoria", Australia, Proceedings of the World Congress on Engineering and Computer Science 2012, Vol I WCECS 2012, October 24-26, 2012, San Francisco, USA
- [3] Enireddy. Vamsidhar, K.V.S.R.P.Varma P.Sankara Rao, Ravikanth satapati, "Prediction of Rainfall Using Back propagation Neural Network Model", International Journal on Computer Science and Engineering, Volume 02, No. 04, pp 1119-1121, 2010
- [4] Asklany, Somia A., et al. "Rainfall events prediction using rule-based fuzzy inference system." Atmospheric Research 101.1 (2011): 228- 236.
- [5] John, Dinu., K. K. Sindhu., and B. B. Meshram. "Two Stage Data Mining Technique for Fast Monsoon Onset Prediction." International Journal of Advanced Research in Computer Science and Software Engineering, Volume 2, Issue 6, June 2012
- [6] K Poorani. "Data Mining Based on Principal Component Analysis for Rainfall Forecasting in India." International Journal of Advanced
- [7] Research in Computer Science and Software Engineering, Volume 3, Issue 9, September 2013 Pranjali Wankhede., Prof. Richa Sharma. "A Review on Weather Forecasting Systems Using Different

- Techniques and Web Alerts.” International Journal of Advanced Research in Computer Science and Software Engineering, Volume 4, Issue 2, February 2014
- [8] Pinky SaikiaDutta., Hitesh Tahbilder, “Prediction of Rainfall Using Data mining Technique Over Assam.” Indian Journal of Computer Science and Engineering (IJCSE) Vol. 5 No.2 Apr-May 2014.
- [9] Dr.NeerajBhargava, Dr.RituBhargava, Prakash Singh Tanwar and Ankit Sharma. “Rainfall Spatial Analysis using GIS.” International Journal of Advanced Research in Computer and Communication Engineering Vol. 2, Issue 5, May 2013
- [10] RahamathullaVempalli.“Day Wise Rainfall Prediction System Using Artificial Neural Networks.” International Journal of Advanced Research in Computer Science and Software Engineering, Volume 4, Issue 3, March 2014.
- [11] Devi, ChJyosthna, et al. "ANN approach for weather prediction using back propagation." International Journal of Engineering Trends and Technology 3.1 (2012).