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# A Machine Learning Model for Rain Fall Prediction Using ANN

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**Abstract:** *Most dynamic and testing task the department of meteorology faces is that of rainfall prediction or precipitation prediction. Precipitation is anticipated utilizing various models with their mix, perception, patterns of information and examples. Precipitation can be anticipated utilizing different AI procedures. In this paper, Artificial Neural Network (ANN) like Feed Forward Neural Network (FFNN) model is worked for anticipating the precipitation. Fake brain organizations (ANN) are the significant and alluring delicate registering strategy for expectation. ANN depends on self-versatile component in which the model gains from authentic information catch utilitarian connections among information and make expectations on current information. The exact expectation of precipitation is a significant rule for dealing with the water assets. The forecast exactness is estimated utilizing disarray lattice. The outcomes show that the expectation model in light of ANN demonstrates satisfactory precision.*

**Keywords:** Rain prediction, Artificial neural network (ANN), Backpropagation, Feed Forward Network, Precipitation

## I. INTRODUCTION

Farming is vital for the development of the Indian economy, and horticulture is crucial for the extension of the economy. Expectation of precipitation is urgent for the country's horticultural advancement in the area of the Indian economy. Precipitation determining is a troublesome however essential functional obligation regarding meteorological offices from one side of the planet to the other. For expectation, a huge volume of verifiable information from past information records is required. The work is troublesome since each end should be founded on a component of vulnerability. Precipitation, particularly precipitation, meaningfully affects our civilisation. Horticulture is essential to India's government assistance. Precipitation is important for farming to succeed.

It additionally assists with water assets. Precipitation data in the past assists farmers with better dealing with their harvests, prompting monetary development in the country. Expectation of precipitation is gainful to forestall flooding that saves individuals' lives and property. Change in the planning of precipitation and its sum makes estimating of precipitation an issue for meteorological researchers.

An enormous scope of rainfall expectation techniques is accessible in India. In India, there are two essential strategies for determining precipitation. Relapse, Artificial Neural Network (ANN), Decision Tree calculation, Fuzzy rationale and group cycle of information taking care of are the greater part every now and again utilized computational techniques utilized for weather conditions determining the essential objective is to follow data rules and connections while acquiring theoretical and possibly costly information. Also, it benefits water assets. The country's economy develops because of ranchers having the option to all the more likely deal with their yields thanks to verifiable precipitation information.

Precipitation anticipating is helpful for abstaining from flooding, which safeguards lives and property. Determining precipitation is hard for meteorological specialists as a result of varieties in the timing and volume of precipitation.

In India, a wide assortment of strategies for anticipating precipitation are accessible. India has two sorts of essential procedures for anticipating precipitation The most widely recognized computational methods utilized for weather conditions gauging are relapse, Artificial Neural Networks (ANN), Decision Tree Algorithm, Fuzzy Logic, and Team Data Handling. The essential goal is to follow data, while learning elusive and possibly costly information, rules, and

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connections.

Artificial neural networks are widely utilised in engineering nowadays because they can be used to represent both linear and non-linear systems without taking into account the numerous assumptions that are used in many statically based methods. The ability to examine and judge for the usage of an artificial neural network for forecasting relies on previous data, which is used for prediction. The accuracy of statistical and mathematical models is not as high as ANN's. The aforementioned paradigm is based on the idea of biological neurons. Rainfall and meteorological parameters can be analysed by ANN.

The back propagation approach is the most popular technique for training neural networks. It is overlooked that a datasheet describing the needed output from various inputs is necessary for learning and creating training sets. The two-layer model used for training is also applicable to the Feed-Forward network, which is utilised to examine many hidden neuronal properties. The Back Propagation method, Layer Recurrent Network, and Cascaded Back Propagation algorithm are the major backbone concepts essential used to create an ANN for the ultimate agenda of this project which is the prediction of rainfall or precipitation

## II. LITERATURE REVIEW

Hu (1964) [1] started the implementation of ANN in weather forecasting. He used an adaptive system called Adaline for pattern classification. This system, when trained on 200 winter sea level pressure and 24-hr pressure change patterns covering the area from 25N to 65N and 110W to 170W, was able to make “rain” “no rain” forecasts for the San Francisco Bay area on 100 independent cases that compared favorably with the official U.S. Weather Bureau forecasts for the same periods. After this research, he suggested that adaptive systems have the capability of making useful predictions or specifications of weather without complete understanding of the dynamics or complete measurement of the physical parameters involved.

In 1991 Cook and Wolfe [2] presented a neural network to predict average air temperatures. They used back-propagation learning algorithm for this purpose and got satisfactory result.

An Artificial Neural Network model has developed by McCann (1992) [3] to give 3-7 hr forecast of significant thunderstorms on the basis of surface based lifted index and surface moisture convergence. The two neural networks produced by them were combined operationally at National Severe Storms Forecast Centre, Kansas City, Missouri to produce a single hourly product and was found to enhance the pattern recognition skill.

An important research work in applying ANN for rainfall forecasting was undertaken by French et al. (1992) [4], which employed a neural network to forecast two-dimensional rainfall, 1 h in advance. Their ANN model used present rainfall data, generated by a mathematical rainfall simulation model, as an input data. That work was, however, limited in a number of aspects. For example, there was a trade-off between the interaction and the training time, which could not be easily balanced. The number of hidden layers and hidden nodes seemed insufficient, in comparison with the number of input and output nodes, to reserve the higher order relationship needed for adequately abstracting the process. Still, it has been considered as the first contribution to ANN’s application and established a new trend in understanding and evaluating the roles of ANN in investigating complex geophysical processes.

Chen and Takagi (1993) [5] have proposed a feature based neural network approach for rainfall prediction in the area of the open sea near Shikoku, Japan. A four-layer neural network was used to automatically learn the internal relationship between geostationary meteorological satellite GMS data and rainfall intensity distribution. They have used Back propagation learning algorithm for training and infrared and visible imagery of GMS image as the input data to the network.

In 1994 Zhang and Scofield [6] presented an artificial neural network (ANN) technique for heavy convective rainfall estimation and cloud merger recognition from satellite data. They have developed an Artificial Neural network expert system for Satellite-derived Estimation of Rainfall (ANSER) in the NOAA/NESDIS Satellite Applications Laboratory and found that using artificial neural network group techniques, the following can be achieved: automatic recognition of cloud mergers, computation of rainfall amounts that will be ten times faster, and average errors of the rainfall estimates for the total precipitation event that will be reduced to less-than 10 per cent.

Michaelides et al [7] (1995) compared the performance of ANN with multiple linear regressions in estimating missing rainfall data over Cyprus. They have proposed a technique that can be put forward in order to generate a sufficiently long

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time series of rainfall records for those locations for which the existing time series is either discontinued (forward extension) or where the archives have a relatively recent start (backward extension). The method uses artificial neural networks for the estimation of daily rainfall at particular observation sites in Cyprus (termed target stations) using as input daily rainfall observations from the neighboring sites that had a sufficiently long and complete archive of data (termed control stations). In this way, the technique can be used to fill in missing data from the rainfall observation network but also for checking suspected data by using the records from surrounding stations. This technique of using neural networks is contrasted to the traditional multiple linear regression method. Here, the target station was considered as the dependent variable and the control stations as the independent variables.

Kalogirou et al. (1997) [8] implemented ANN to reconstruct the rainfall over the time series in Cyprus. They used feed forward multilayer neural networks for the estimation of precipitation in selected rainfall collecting stations in Cyprus.

## III. METHODOLOGY

### 3.1 Artificial Neural Network

It is comprised of specially organized network with computing elements that they can learn and acquire the knowledge from the dataset. An artificial neural network is associated with nodes. After building the ANN they are trained with different datasets. Firstly, have to train the NN by a dataset which is having both input and output. The input is given to the NN. The weights which are giving to neural networks are random numbers which are untrained.

The value of weights which are giving to the NN must have values in the middle of -1 and +1. Weight training is used to decrease the error function in neural networks. By doing all This it gives the output. If the output is incorrect then adjusts the weights on the NN. By doing so on up to the resemblance output is given by the neural network. Then stop adding the weights and consider the weights and check it for another dataset. The weights consider in the next data in the data goes wrong then the process repeats.

### 3.2 Feed Forward Network

In the generic feed forward network characterized by the lack of feedback. The information moves in only one direction that is forward, this type of network can be connected in cascade to create multilayer network. The layer consists of neurons and makes independent computation on data that it receives and passes to another layer. Weights are the connection between the two layers, neurons make computation based upon weighted sum of inputs. The first layer of feed forward network is the input layer and the last layer is the output, other layer between the two layers are called as hidden layers. A function called the threshold is used for calculating the output of the neuron in the output layer.

### 3.3 Backpropagation Algorithm

This learning algorithm is applied to multilayer feed-forward networks consisting of processing elements with continuous differentiable activation functions. The typical back-propagation network contains an input layer, an output layer, and at least one hidden layer. The number of neurons at each layer and the number of hidden layers determine the network's ability on producing accurate outputs for a particular data set. The backpropagation a very simple yet efficient algorithm, it consists of N processing elements with functions of input and output

## IV. IMPLEMENTATION

Implementation procedure for rainfall prediction undertakes different steps

1. Different data is collected from various sources as per the requirement.
2. A pre-processing procedure is required to filter the data and get proper dataset.
3. An appropriate ANN algorithm is built according to the requirement specifying.
4. Data testing is done using the ANN built so far.
5. Errors that raised up during testing can be scrutinized using the Back propagation algorithm.
6. Using the dataset an output is predicted, accuracy is checked by means of analysis.

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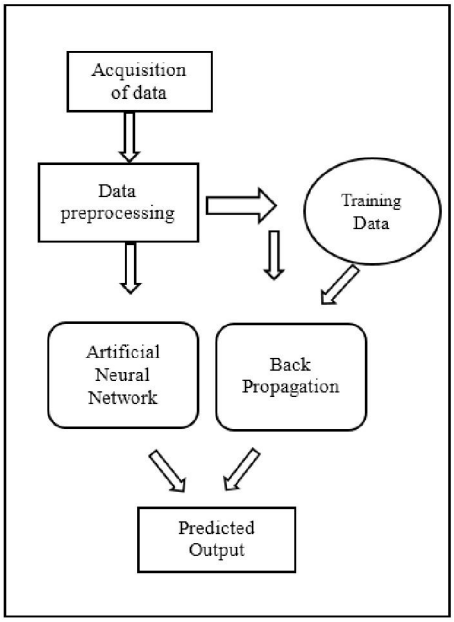


Figure 1

## V. CONCLUSION

This paper has shown Rainfall is most significant natural phenomenon that is not only important for the human beings, but also to the living beings. Due to the changing climatic conditions, rainfall cycles are also changing and temperature of the earth is rising. The changing temperature is also affecting agriculture, industry and sometimes may cause flooding and land slide. Therefore, it is essential for the human beings to keep a check upon this natural phenomenon in order to survive. Thus, predicting the rainfall is important.

1. A system to forecast rainfall is essential using artificial intelligence of neural network that is popular with modern technology. The main aim is to at build a predicting system using neural networks that could predict rainfall accurately and efficiently with minimum error. The study incorporated different areas and used their rainfall data with different neural networks like ANN, through training the network with these inputs and outputs.
2. A Feed Forward Neural Network algorithm is used for building the model and predicting the rain- fall. The accuracy obtained by using the model was 93.55%. The result showed that the FFNN model can be used as a predictive algorithm for rainfall prediction. In future work, the performance of the prediction model could be improved by comparing different classification algorithms and testing the model with large amount of data.

How neural networking using tensor flow and other modules in python suitably can be used to build a neural network bot that takes input from the user in the form of text such as messaging and interaction with the bot, speech and video or picture. The main agenda of this bot was to take the inputs from the people especially from the younger peers such as students or the young working class prone to different traumatic situations and those who do not want to share or cant share their feelings with ease, this bot serves as a virtual companion and helps by taking the various inputs, analysing the mood and provides the necessary feedback.

This bot can be further enhanced by integrating the social media accounts of the user taking their consent and dynamically analyse the mood of the person at regular intervals and provide futuristic suggestions based on the mood of the person to cheer up the user such as movie, music, book, restaurant or even provide suggestions to talk to necessary people in utmost necessity. In future in this growing social media having been showing the signs of least interaction among people and this needs to be taken care. Hence this bot can be upgraded to bring out the human nature and basic human traits such as being social, interacting etc. Not just restricting it to an application this can be integrated and made cross platform application.

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