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Accurate Prediction of Rainfall by Analyzing Time Series Data Using Artificial Neural Network Models

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ABSTRACT

Time Series data is massive in volume, extremely dimensional and continuous change. Statistic knowledge analysis for foretelling is one among the foremost vital aspects of the sensible usage. Accurate rain forecasting and its prediction with the assistance of your time series data analysis can help in evaluating drought and flooding things ahead. During this paper, Artificial Neural Network (ANN) technique has been wont to develop one-month and two-month ahead forecasting models for rain prediction exploitation monthly rain knowledge of Northern Republic of India. In these model, Feed Forward Neural Network (FFNN) exploitation Back Propagation algorithmic program and Levenberg-Marquardt coaching operate has been used. The performance of each the models has been assessed supported multivariate analysis, Mean square. Error (MSE) and Magnitude of Relative Error (MRE). Proposed ANN model showed optimistic results for each the models for foretelling and located one month ahead foretelling model perform higher than 2 months ahead foretelling model. In this paper we are going to analyze the research on time series data analysis and the rainfall prediction.

Keywords :— *Data Mining, Time series data analysis, Rainfall forecasting, Artificial Neural Network, Feed Forward Neural Network, Multilayer artificial neural network, back propagation algorithm.*

I. INTRODUCTION

Rainfall is recognizing jointly of the most necessary component of the hydrological method. correct rain prognostication can facilitate in evaluating drought and flooding things before. Therefore, it's vital to own an ideal model for rain prognostication. The country like Republic of India, wherever most of the farmers rely upon monsoon for his or her crop, it's needed to be having advance data of actual rain. many nations of Republic of India additionally suffered from the flood whereas some state is facing the matter of drought. In any of those 2 things, it should need associate degree correct and economical rain prediction model. this type of rain prognostication model can facilitate in higher handling worst things generated thanks to flood or draught. Advance prediction of rain by this model additionally provides adequate time to makes adequate arrangements for saving lives, transportation, procural and provide of food and medicines.

Data mining may be a set of techniques accustomed extract unknown items of data from the massive information repository. There square measure numerous data processing techniques offered to extract valuable and helpful data from spatial, temporal, sequencing and statistic knowledge. Time Series knowledge may be a part of temporal knowledge. statistic knowledge generated from scientific knowledge, monetary applications, weather knowledge, GPS, detector Networks etc. massive in volume, extremely dimensional and continuous change is that the nature of your time series knowledge [1]. Use of your time series knowledge [2] in prediction, pattern identification, anomaly detection, motif discovery, clustering, classification, segmentation fetches the eye of information mining researchers.

In statistic knowledge analysis the patterns that existed in past can seem in future additionally. now series knowledge analysis permits a model for a posh system wherever the goal is to predict the system's behavior while not knowing the practicality of the system [3].There are a unit numerous applied math techniques, data processing approaches, artificial neural network and soft computing techniques together with particle swarm improvement utilized by the man of science to resolve statistic information analysis downside [4, 5].

Artificial Neural Networks (ANN) is associate extensively established technique for modeling complicated nonlinear and dynamic systems. ANN is useful in developing associate acceptable model once physical method relationship isn't clear or wherever the character of the event has chaotic properties. Though neural network needed previous data regarding the system however it reduces the model's reliance on this previous data. This removes the requirement for a definite specification of the precise useful type of the link that the model seeks to represent. During this paper, an endeavor has been created to develop a 1-month and 2-month rain statement model for rain prediction in North Bharat by using ANN.

II OBJECTIVE:

The prime objective of this study is to investigate downfall pattern in North Asian nation victimization applicable statistic ways for the amount 1871 to 2012 (141 years) on the premise of information recorded at Indian meteorological Department, Pune. The precise objectives are:

1. To develop a statistic model for one-month and two-month ahead downfall foretelling a pair of. to spot the simplest network structure for each the models. 3. Compare the performance of one-month and two-month ahead foretelling models.

Weather and climate over the world aren't constant with time, they modify on completely different statistic starting from the earth science to the diurnal through annual, seasonal and intra-seasonal timescales. Downfall varies with latitude, elevation, topography, seasons, distance from the ocean, and Coastal sea-surface temperature. Trends in downfall extremes have huge implications. Flood or draught events cause vital harm to agriculture, setting, infrastructure, social life and on gross domestic product. Therefore, a reliable downfall prediction and assessing behavior at the station, regional and national levels is extremely vital. The results of this analysis paper can hopefully be used:

1. For prediction the pattern of downfall within the study space.

2. To supply info that might be useful for call manufacturers in formulating policies to mitigate the issues of fresh water resources management, wearing away, flooding, and drought.

3. To supply info for the first warning system within the study space.

4. As a basis for any study in Northern Asian country.

III ANN MODEL

Artificial Neural Network (ANN) Model is developed using MATLAB. During this model Feed Forward Neural Network (FFNN) using Back Propagation algorithmic rule and Levenberg- Marquardt coaching operate has been used. Trials area unit initial conducted by arbitrarily choosing the quantity of process components at the top of the coaching, on the premise of a mean sq. error, accuracy are going to be foretold. As per the performance of model and resultant predictions, the choice of the process components rigorously narrowed down. This ANN model generates a really correct prediction for the vary of 50 to 40 neurons. This ANN model consists of 1 hidden layer and a variable variety of process components or neurons. The foremost optimum model obtained by using trial and error approach.

IV. BACK-PROPAGATION ALGORITHM

This algorithm is a supervised learning algorithm for training Multilayer perceptions which is used for rainfall prediction in Artificial Neural Networks. The Back propagation algorithmic rule looks for the minimum price of the error perform in weight area employing a technique referred to as the delta rule or gradient descent. The weights that minimize the error perform is then thought of to be an answer to the training drawback.

Below figure shows the back propagation

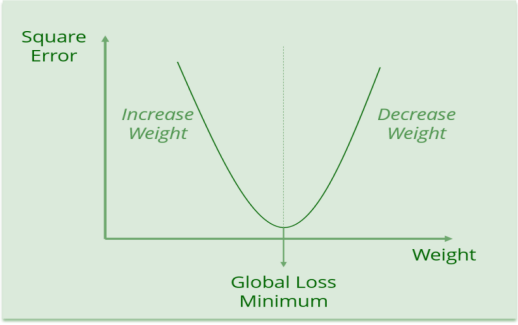

Figure 1: Back-propagation algorithm

V. CONCLUSION

In this study, 141 years rain records were analyzed, victimization information from Indian meteorological Department, Pune from numerous weather stations within the North India. Artificial Neural Network (ANN) technique has been wont to develop one-month and two- month ahead statement models for rain prediction victimization monthly rain information. In these models, Feed Forward Neural Network (FFNN) victimization Back Propagation formula and Levenberg-Marquardt coaching perform has been used. The performance of each the models are assessed supported multivariate analysis, Mean sq. Error (MSE) and Magnitude of Relative Error (MRE). Based on the general results of the analysis, the subsequent conclusions might be drawn:

1. Two models M1 and money supply, for one month and two months ahead prediction of rain, having totally different input variables were trained and tested victimization ANN technique.

2. In each the cases for M1 and money supply models, 3-25-1 and 3-50-1 network structure model was found to be the simplest statement model.

3. ANN has performed higher for M1 model than money supply model, showing that ANN technique has been ready to perform higher for one month than 2 months ahead.

4. The regression values for the M1 model have shown higher results than the money supply model.

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