CLOUD BURST FORECAST USING EXPERT SYSTEMS

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Abstract - *Rainfall prediction is the one of the necessary strategies to predict the climatic prerequisites in any country. This paper proposes a rainfall prediction mannequin the usage of Multiple Linear Regression (MLR) for Indian dataset. The enter statistics is having a couple of meteorological parameters and to predict the rainfall in extra precise. The Mean Square Error (MSE), accuracy, correlation are the parameters used to validate the proposed model. From the results, the proposed computing device mastering mannequin gives higher outcomes than the different algorithms in the literature.*

Key Words: Multiple Linear Regression, rainfall, prediction, machine learning, accuracy

1.INTRODUCTION

Rainfall prediction is vital in Indian civilization, and it performs predominant position in human lifestyles to a high-quality extent. It is disturbing accountability of meteorological branch to predict the frequency of rainfall with uncertainty. It is intricate to predict the rainfall precisely with altering climatic conditions. It is difficult to forecast the rainfall for each summertime and wet seasons. Researchers in all over the world have developed several fashions to predict the rain fall typically the use of random numbers and they are comparable to the local weather data.

The proposed mannequin is developed the usage of more than one linear regression. The proposed technique makes use of Indian meteorological date to predict the rain fall. Usually, desktop mastering algorithms are labeled into two principal categories: (i) unsupervised studying (ii) supervised learning. All the clustering algorithms come beneath supervised computer learning. Figure 1 represents the special classification of desktop getting to know algorithms. Figure two describes the rainfall prediction lookup primarily based on neural community for Indian scenario. Even even though many fashions have developed, however it is quintessential for doing lookup the usage of laptop studying algorithms to get correct prediction. The error free prediction gives higher planning in the agriculture and different industries.

2.LITERATURE REVIEW

P. Goswami and Srividya [1] have mixed RNN and TDNN elements and conclusion of their work used to be that composite fashions offers higher accuracy than the single model. C. Venkatesan et al. [2] used Multilayer Feed Forward Neural Networks (MLFNN) for predicting Indian summer season monsoon rainfall. Error Back Propagation (EBP) algorithm is educated and utilized to predict the rainfall. Three community fashions with two, three and ten enter parameters have analyzed. They additionally in contrast the output end result with the statistical models. A.Sahai et al. [3] used error again propagation algorithm for Summer Monsoon Rainfall prediction of India on month-to-month and seasonal time series. They used facts of preceding 5 years of month-to-month and seasonal suggest rainfall values for rainfall prediction. N. Philip and K.Josheph [5] used ABF neural community for every year rainfall forecasting Kerala region. Their work suggests that ABFNN performs higher than the Fourier analysis. V. Somvanshi et al. [7] predictied rainfall of Hyderabad, INDIA place the usage of ANN model. They additionally in contrast ANN with ARIMA technique. They used previous 4 months rainfall facts as inputs to neural community model. S. Chattopadhyay and M. Chattopadhyay [9] have used two parameters minimal temperature and most temperature for rainfall forecasting. S. Chattopadhyaya and G. Chattopadhyaya [10] used Conjugate Gradient Decent (CGD) and Levenberg–Marquardt (LM) getting to know algorithm for training. Performances of each algorithms had been equal in prediction task. C. Wu et al. [12] expected the rainfall of India and China. They utilized Modular Artificial Neural Network (MANN). MANN's overall performance was once in contrast with LR, K-NN and ANN. K. Htike and O. Khalifa [13] used yearly, biannually, quarterly and month-to-month rainfall statistics for rainfall prediction. They trained 4 one of a kind Focused Time Delay Neural Networks (FTDNN) for rainfall forecasting. Highest prediction accuracy was once supplied by means of the FTDNN mannequin when every year rainfall records is taken for training. S. Kannan and S. Ghosh [14] contributed in the direction of growing K- imply clustering method mixed with choice tree algorithm, CART, is used for rainfall states technology from massive scale atmospheric variables in a river basin. Rainfall country on day by day foundation is derived from the historic every day multi-site rainfall facts the usage of K-mean clustering. M. Kannan et al. [15]

expected quick time period rainfall. Empirical approach approach is used for prediction task. Data of three precise months for 5 years is analyzed for precise region. Clustering is used for grouping the elements. G. Geetha and R. Selvaraj [16] used ANN mannequin for predicting month-to-month rainfall of Chennai region. M. Sharma and J. Singh [17] regarded parameters such as rainfall, most and minimal temperature, and relative humidity. They expected weekly rainfall over Pantnagar region. ANN got greater prediction accuracy than more than one linear regression model. J. Abbot and J. Marohasy [18] used Time Delay Recurrent Neural Network (TDRNN) for month-to-month rainfall prediction over Australia region. A. Kumar et al. [19] anticipated common rainfall over Udipi district of Karnataka. They used ANN fashions for prediction venture of rainfall. They concluded that Back Propagation Algorithm (BPA) used to be higher than the layer recurrent and cascaded lower back propagation. Soo-Yeon Ji et al. [21] expected the hourly rainfall. CART and C4.5 are used for prediction, which might also supply hidden vital patterns with their reasons. There had been 18 variable used from climate station. 10 fold pass validation technique is carried out for validation purpose. CART carried out higher than C4.5. S. Nanda et al. [24] estimated rainfall the usage of a complicated statistical mannequin ARIMA and three ANNs fashions which are MLP, LPE (Legendre Polynomial Equation) and FLANN (Functional-Link Artificial Neural Network). In Comparision, FLANN offers higher prediction accuracy in contrast to the ARIMA model. A. Naik and S. Pathan [25] used the ANN mannequin for rainfall prediction. They modified again propagation algorithm which used to be greater sturdy than the easy lower back propagation algorithm. Pinky Saikia Dutta and Hitesh Tahbilder [28] envisioned month-to-month Rainfall of Assam via usual statistical approach -Multiple Linear Regression. Parameters chosen for the mannequin are min-max temperature, suggest sea degree pressure, wind pace and rainfall. Acceptable accuracy is given with the aid of prediction mannequin based totally on a couple of linear regression. Table affords categorization of distinctive tactics of rainfall prediction. The categorization is primarily based on following features: authors, region, dataset time period, techniques, accuracy measure and rainfall predicting variables.

3. MLR BASED RAIN FALL PREDICTION

The proposed approach is primarily based on the a couple of linear regression. The information for the prediction is accrued from the publically reachable sources and the 70 proportion of the statistics is for coaching and the 30 share of the records is for testing. Figure two describes the block design of the proposed methodology. Multiple regression is used to estimate the values with the assist of descriptive variables and is a statistical method. It is having a linear relationship between the descriptive variable and the output

values. The following is the equation for more than one linear regression:

$$yi = \beta 0 + \beta 1\, xi1 + \beta 2 xi2 + ... + \beta p\, xip + \varepsilon$$

The variety of observations is indicated by means of n. The structured variable is yi and the descriptive variable is xi. ù0 and ùp are the steady y intercept and slop of descriptive variable respectively. Model error is indicated by. In the proposed mannequin more than one meteorological parameters are fundamental to predict the rain fall, it is higher to use the a couple of linear regression as a substitute of easy linear regression.

Table 1. Comparison of Rainfall Prediction Methods

S. No.	Methods	Performance Parameters	Tools Used
1.	a)Feed Forward with Back –Propagation b)Layer Reccurent c) Cascaded feed Forward back Propagation	Mean Square Error (MSE)	Matlab: Nntool, Nftool
2.	Deep Convolutional Neural Network	MSE, Correlation, Critical Success Index (CSI)	Not Mentioned
3.	LSTM and ConvNet	Mean Absolute Percentage Error (MAPE) and Root Mean Square Error (RMSE)	Not Mentioned
4.	BP network	Accuracy	Matlab: Neural Network Platform
5.	Genetic Programming	RMSE	Not Mentioned
6.	Artificial Neural Network	Accuracy	Meteorological Parameters
7.	Linear Regression	RMSE, MAE	Pandas and scikit Learn
8.	Hybrid Neural Network	Accuracy, Precision, Recall	Not Mentioned

The assumptions which are made with the aid of the a couple of linear regression are: linear relationship between the each the descriptive and impartial variables, the distinctly correlated variables are impartial variables, yi is calculated randomly and the suggest and variance are zero and 1. Figure three explains the waft of MLR prediction.
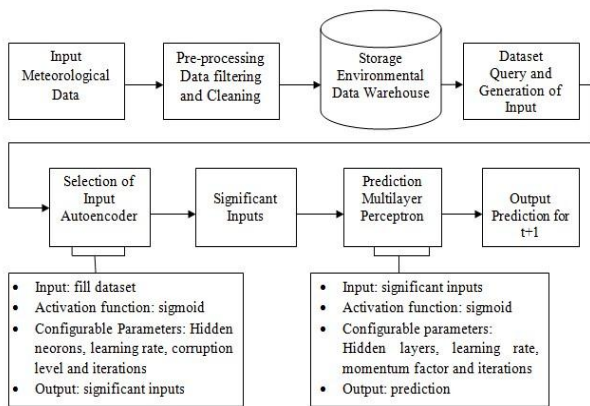
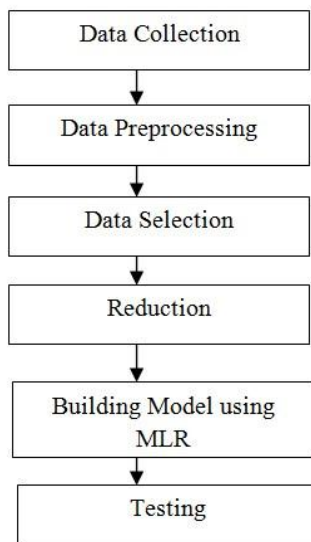**Figure 2. Block Diagram of Proposed Methodology**

Figure 3. Model Generation using MLR

4. RESULTS

This part offers with the effects in the proposed MLR based totally rain fall prediction method. The complete range of statistics in the chosen statistics set is 4116. Figure four describes the MLR prediction result. The accuracy of the MLR prediction is 0.99 and is proven in Figure 5. The evaluation of the overall performance parameters is proven in and is shown in Figure 5. The comparison of the performance parameters is shown in
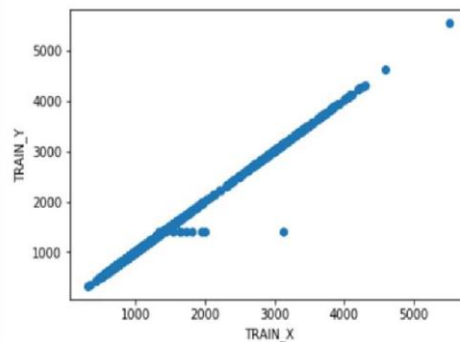

Figure 4. MLR Prediction Result

Table 2. Comparison of the Performance Parameters

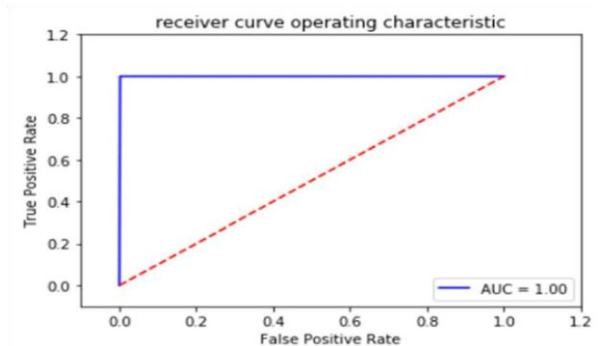| S. No.	Algorithm	MSE	RMSE	Correlation
1.	QPF	15.547	3.943	0.399
2.	LR	13.28	3.644	0.469
3.	MLR	11.894	3.449	0.473

Figure 5. MLR Accuracy after Prediction

5. CONCLUSION

Rain fall prediction performs the primary position in agriculture production. The boom of the agricultural merchandise is primarily based on the rainfall amount. So it is crucial to predict the rainfall of a season to help farmers in agriculture. The proposed approach predicts the rainfall for the Indian dataset the usage of more than one linear regression and gives multiplied effects in phrases of accuracy, MSE and correlation.

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