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MACHINE LEARNING BASED RAINFALL PREDICTION

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ABSTRACT

When trying to foretell a country's weather, rainfall is a crucial metric to use. A multiple variate regression rainfall prediction model for the Indian dataset was suggested in this research. Monthly data was collected from 1901 to 2015. In order to validate the suggested model, we look at the input data, which includes certain meteorological factors, and see if it can more accurately estimate the quantity of precipitation. The results show that compared to other methods in the literature, the suggested machine learning model produces superior outcomes. Uncertainty in precipitation frequency predictions is the responsibility of the Finnish Meteorological Institute. It is challenging to accurately anticipate precipitation in response to changing climate conditions. It is challenging to predict summer and rainy season rainfall. Precipitation on a daily basis boosts agricultural output, ensures a steady supply of food and water, and promotes public health. Data mining and machine learning methods applied to environmental datasets from many nations have been the subject of numerous studies aimed at precipitation forecasting. Agriculture, the backbone of the country's economy, is hit hard by the inequitable distribution of precipitation across the nation. To lessen the impact of drought and soil degradation, the nation should organize and implement strategies for the rational use of rainfall. Using machine learning approaches, this research aims to forecast the daily rainfall intensity and determine the critical atmospheric variables that generate rain.

Keywords: Multiple Linear Regression, Auto-encoder, LSTM, Precipitation Accuracy.

I.INTRODUCTION

Heavy and irregular rainfall can have significant and unpredictable impacts, such as the destruction of crops and farms and damage to property. To reduce risks to life and property and improve agricultural farm management, an improved forecasting model is needed for early warning. More efficient use of water resources is one of the many benefits that this forecast brings to farmers. The complex process of precipitation forecasting necessitates exact results. Numerous technological gadgets can foretell the arrival of rain by analyzing variables such as temperature, humidity, and pressure. We have resorted to machine learning techniques in pursuit of dependable results when these more traditional methods proved fruitless. Predicting the future weather is as easy as reviewing rainfall statistics from prior seasons. We may use methods like regression and classification to determine the accuracy and the difference between the actual and predicted values, among others, depending on the requirements. The significance of selecting the appropriate algorithm and customizing the model to fulfill specific requirements is emphasized by the fact that different techniques provide varying degrees of accuracy.The purpose of using regression analysis is to get the average value of the dependent variable based on the known or

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fixed values of the independent variables. The approach takes into account the fact that the dependent variable is reliant on other factors. Here is an example that demonstrates how an individual's compensation is influenced by their experience: wage is the dependent variable, whereas work experience is the independent one. Simple linear regression can help us understand the relationship between one dependent variable and one independent variable. At first glance, the standard regression equation seems as follows: The equation $y = \beta0 + \beta1x + \varepsilon$ makes use of parameters $\beta0$ and $\beta1$, as well as a probabilistic error factor ε. Quantitative support and error correction are two other potential applications.

II.LITERATURE SURVEY

The study conducted by Chattopadhyay et al. [1] presents the results of a visual cluster analysis of rainfall data from India using a growing hierarchical self-organizing map (GHSOM). Their use of Support Vector Machine (SVM) also shown that clustering improves the precision of rainfall forecasts for the Indian summer monsoon. Statistical analysis and visual representations have both been used to show the findings.

To conduct their research, Kumar et al. [2] used a configuration of a multi-layered artificial neural network that learned using back-propagation. Using artificial neural network models, the research examined the feasibility of predicting the average rainfall across the Udupi district of Karnataka.

To automate the process of feature extraction from observational time series data and to take advantage of correlations between these characteristics for short-term rainfall prediction, Qiu et al. [3] presented a multi-task convolutional neural network model.

Among the deep learning models tested by Aswin et al. [4] for rainfall prediction, ConvNet emerged as the clear winner because to its reduced root-mean-squared error (RMSE) value.

In their study of rain forecasting models using MATLAB neural networks, Gan et al. [5] found that neural network models outperformed regression models.

III.PROPOSED METHODOLOGY

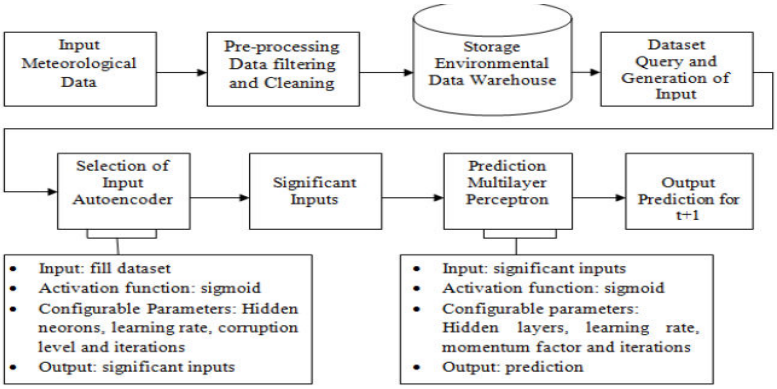

Figure 1: Proposed Methodology

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The weather bureau provides the input data used by the proposed rainfall forecast algorithm, which includes weather conditions such as temperature, humidity, wind speed, and historical rainfall quantities. After that, we filter and sanitize the data to get rid of any mistakes or missing numbers. For convenience, the cleaned data is kept in an environmental data warehouse. After that, we feed our models data by means of queries. With the aid of autoencoders, which compress data and identify key inputs according to customizable parameters like hidden neurons, learning rate, and corruption level, important characteristics may be selected. Multilayer perceptron (MLR) is used to forecast rainfall based on these important inputs. Making predictions for the following step (t+1) and offering an output prediction based on the learned model, the MLP utilizes activation functions like sigmoid, customizable parameters for hidden layer learning rate, momentum factor, and iterations.

IV.RESULT ANALYSIS

In order to have a better understanding of the rain in different places, we have compiled and analyzed rainfall data from 1901 to 2015. The monthly, yearly, and three-month consecutive rainfall histograms are displayed below. During the months of July, August, and September, the Y-axis shows an increase in the volume of rain.

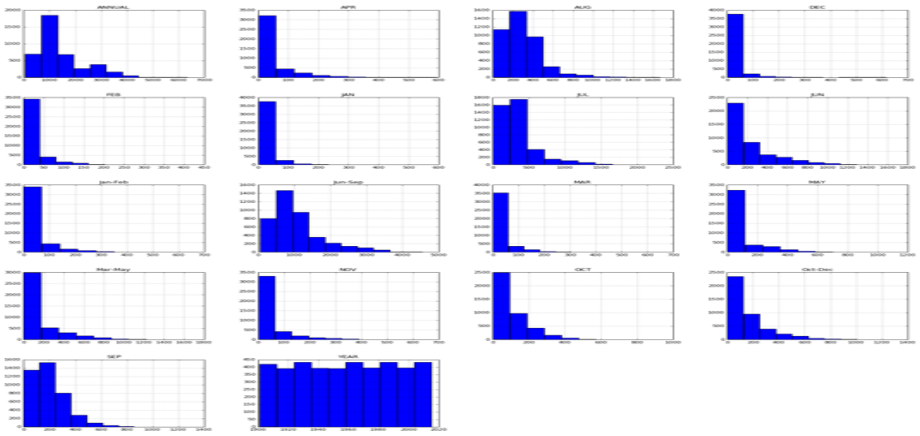

Figure 2: Monthly, yearly, and three-month running rainfall histograms

Below is a line graph that shows the rainfall amount over time. This data points to the fact that precipitation levels were much higher in the 1950s.

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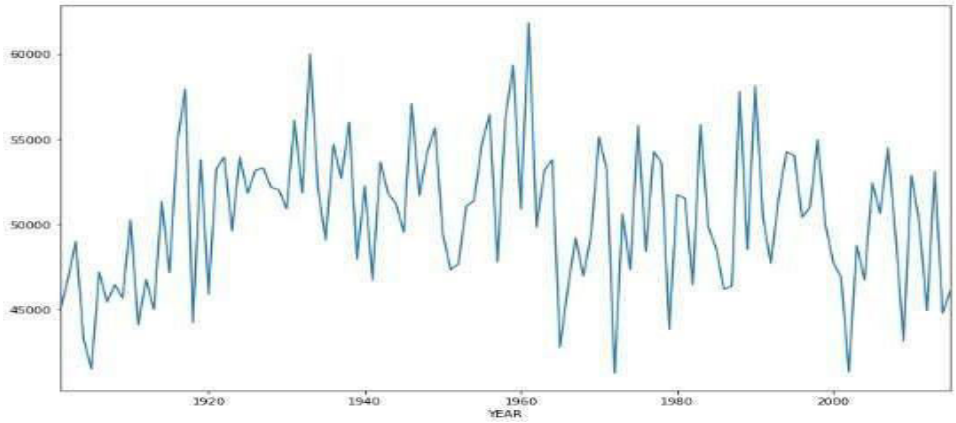

Figure 3: Line graph for distribution of rain from the year 1901-2015

You can see the monthly rainfall totals for different subdivisions in the bar graph down below. The months of March, April, and May saw exceptionally high rainfall volumes in Eastern India.

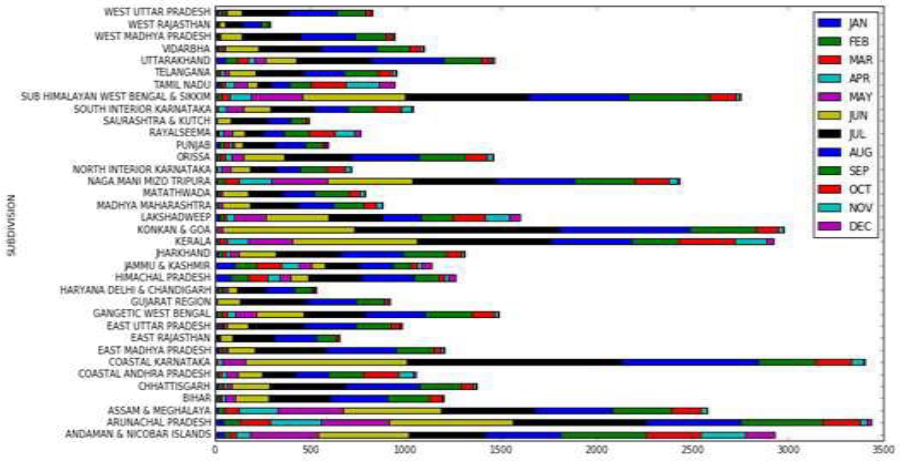

Figure 4: Bar graph for the amount of rain in all subdivisions

Methods for pre-processing were implemented following data analysis. Then a scatter plot was made using three different regression models: MLR, SVR, and Lasso.

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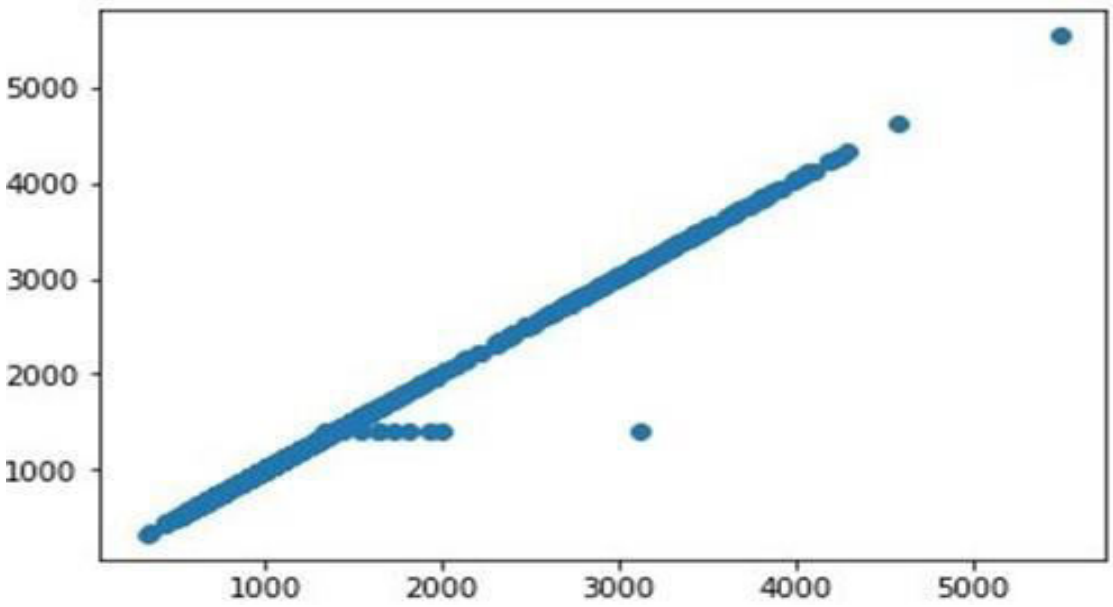

Figure 5: Scatter plot between prediction and training set

V.CONCLUSION

Predicting when it will rain is very important for farmers. The quantity of precipitation determines the rate of growth of agricultural goods. Therefore, in order to aid farmers in agriculture, it is essential to forecast the season's rainfall. The suggested approach improves upon previous methods in terms of accuracy, MSE, and correlation when predicting rainfall for the Indian dataset using multiple linear regression. Precipitation forecasting is crucial for managing water resources, protecting human health and the environment. The capacity to learn from previous experiences and nonlinear correlations in rainfall data make Artificial Neural Networks the best choice for rainfall prediction.

VI.REFERENCES

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