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# RAINFALL PREDICTION FOR AGRICULTURAL CROP PRODUCTION USING MACHINE LEARNING

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## ABSTRACT

India is an agricultural country and its economy is largely based upon crop productivity and rainfall. For analysing the crop productivity, rainfall prediction is required and necessary to all farmers. Rainfall Prediction is the application of science and technology to predict the state of the atmosphere. It is important to exactly determine the rainfall for effective use of water resources, crop productivity and pre planning of water structures. Using different data mining techniques, it can predict rainfall. Data mining techniques are used to estimate the rainfall numerically. This paper focuses some of the popular data mining algorithms for rainfall prediction. Naive Bayes, K-Nearest Neighbour algorithm, Decision Tree, Neural Network and fuzzy logic are some of the algorithms compared in this paper. From that comparison, it can analyse which method gives better accuracy for rainfall prediction

## 1. INTRODUCTION

Rainfall Prediction is one of the most challenging tasks. Though already many algorithms have been proposed but still accurate prediction of rainfall is very difficult. In an agricultural country like India, 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 has a potential benefit of preventing causalities and damages caused by natural disasters. Under certain circumstances such as flood and drought, highly accurate rainfall prediction is useful for agriculture management and disaster prevention. In this paper, various algorithms have been analysed. Data mining techniques are efficiently used in rainfall prediction.

India's welfare is agriculture. The achievement of agriculture is dependent on rainfall. It also helps with water resources. Rainfall information in the past helps farmers better manage their crops, leading to economic growth in the country. Prediction of precipitation is beneficial to prevent

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flooding that saves people's lives and property. Fluctuation in the timing of precipitation and its amount makes forecasting of rainfall a problem for meteorological scientists. Forecasting is one of the utmost challenges for researchers from a variety of fields, such as weather data mining, environmental machine learning, functional hydrology, and numerical forecasting, to create a predictive model for accurate rainfall. In these problems, a common question is how to infer the past predictions and make use of future predictions. A variety of sub-processes are typically composed of the substantial process in rainfall. It is at times not promise in to predict the precipitation correctly by on its global system. Climate forecasting stands out for all countries around the globe in all the benefits and services provided by the meteorological department. The job is very complicated because it needs specific numbers and all signals are intimated without any assurance. Accurate precipitation forecasting has been an important issue in hydrological science as early notice of stern weather can help avoid natural disaster injuries and damage if prompt and accurate forecasts are made. The theory of the modular model and the integrati2on of different models has recently gained more interest in rainfall forecasting to address this challenge. A huge range of rainfall prediction methodologies is available in India. In India, there are two primary methods of forecasting rainfall. Regression, Artificial Neural Network (ANN), Decision Tree algorithm, Fuzzy logic and team process of data handling are the majority frequently used computational methods used for weather forecasting the basic goal is to follow information rules and relationships while gaining intangible and potentially expensive knowledge. Artificial NN is a promising part of this wide field

## 2. LITERATURE SURVEY

**2.(a) Title: -Rainfall Prediction using Machine Learning Author: -Ishwarya, Santhurthi, Shanthi, Varsha Year: -2020**

**ABSTRACT: -**

In this model mainly focused on predicting the rainfall in future using different machine learning algorithms. As India’s economy significantly depends on horticulture, precipitation plays on important part. This model is very helpful for agriculture. In order to predict precipitation, an attempt is formed to a few of factual procedures and machine learning techniques to forecast and estimate meteorological parameters. For experimentation purpose daily observations were considered. We are using machine learning algorithms such as SVM , Linear regression methods for predicting the

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rainfall and also used to achieve crop yield prediction using rainfall, various machine learning algorithms such as Multiple linear regression, Decision tree, (ANN)Artificial neural networks, Support vector machine (SVM) have been used. In proposed system we are using SVM approach to analyze the datasets and also used to testing the dataset. Linear regression algorithm are used to trained the datasets for future prediction.

**2.(b) Title: -Application of Machine Learning and Deep Learning Methods for Climate Change Mitigation and Adaptation Author: - Tahmineh ladi, Shaghayegh, Jabalameli Year: -2021**

**ABSTRACT: -**

Climate change is a global issue that must be considered and addressed immediately. Many articles have been published on climate change mitigation and adaptation. However, new methods are required to explore the complexities of climate change and provide more efficient and effective adaptation and mitigation policies. With the advancement of technology, machine learning (ML) and deep learning (DL) methods have gained considerable popularity in many fields, including climate change. This paper aims to explore the most popular ML and DL methods that have been applied for climate change mitigation and adaptation. Another aim is to determine the most common mitigation and adaptation measures/actions in general, and in urban areas in particular, that have been studied using ML and DL methods. For this purpose, word frequency analysis and topic modelling, specifically the Latent Dirichlet allocation (LDA) as a ML algorithm, are used in this study. The results indicate that the most popular ML technique in both climate change mitigation and adaptation is the Artificial Neural Network. Moreover, among different research areas related to climate change mitigation and adaptation, geoengineering, and land surface temperature are the ones that have used ML and DL algorithms the most .

**2.(c) Title: -Rainfall Prediction using Machine Learning Author: -Ishwarya, Santhurthi, Shanthi, Varsha Year: -2020**

**ABSTRACT: -**

Machine learning is an important decision support tool for crop yield prediction, including supporting decisions on what crops to grow and what to do during the growing season of the crops. Several machine learning algorithms have been applied to support crop yield prediction research. In

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this study, we performed a Systematic Literature Review (SLR) to extract and synthesize the algorithms and features that have been used in crop yield prediction studies. Based on our search criteria, we retrieved 567 relevant studies from six electronic databases, of which we have selected 50 studies for further analysis using inclusion and exclusion criteria. We investigated these selected studies carefully, analysed the methods and features used, and provided suggestions for further research. According to our analysis, the most used features are temperature, rainfall, and soil type, and the most applied algorithm is Artificial Neural Networks in these models. After this observation based on the analysis of machine learning-based 50 papers, we performed an additional search in electronic databases to identify deep learning-based studies, reached 30 deep learning-based papers, and extracted the applied deep learning algorithms. According to this additional analysis, Convolutional Neural Networks (CNN) is the most widely used deep learning algorithm in these studies, and the other widely used deep learning algorithms are Long-Short Term Memory (LSTM) and Deep Neural Networks (DNN).

## 3. PROBLEM STATEMENT

Agriculture is the strength of our Indian economy. Farmer only depends upon monsoon to be their cultivation. The good crop productivity needs good soil, fertilizer and also good climate. Weather forecasting is the very important requirement of each farmer. Due to the sudden changes in climate/weather, the people are suffered economically and physically. Weather prediction is one of the challenging problems in current state. The main motivation of this paper to predict the weather using various data mining techniques. Such as classification, clustering, decision tree and also neural networks. Weather related information is also called the meteorological data. In this paper the most commonly used weather parameters are rainfall, wind speed, temperature and cold.

### 3.1 Limitation Of System

Improved Planning: Accurate rainfall predictions enable farmers to plan their agricultural activities more effectively. This includes optimal planting times, irrigation scheduling, and harvesting plans. Resource Optimization: Farmers can optimize the use of resources such as water, fertilizers, and pesticides based on predicted rainfall. This helps in reducing costs and minimizing environmental impact. Risk Mitigation: Farmers can better prepare for periods of drought or excessive rainfall, reducing the risk of crop failure. This can lead to increased overall crop yield and income stability.

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Precision Agriculture: Machine learning models can provide localized predictions, allowing for precision agriculture practices. This means that farmers can tailor their approach to specific areas, optimizing productivity.

## 4. PROPOSED SYSTEM

Rainfall is important for food production plan, water resource management and all activity plans in the nature. The occurrence of prolonged dry period or heavy rain at the critical stages of the crop growth and development may lead to significantly reduce crop yield. India is an agricultural country and its economy is largely based upon crop productivity. Thus, rainfall prediction becomes a significant factor in agricultural countries like India. Rainfall forecasting has been one of the most scientifically and technologically challenging problems around the world in the last century. If you are considering the advantages and disadvantages of a proposed rainfall prediction system for agricultural crop production using machine learning, it's important to note that these points will depend on the specifics of the proposed system. However, here are some general considerations:

### 4.1 Advantages:

1.Tailored Approach: A well-designed machine learning model can provide a more tailored and accurate approach to rainfall prediction, taking into account local factors and specific conditions of the agricultural area.

2.Increased Accuracy: The proposed system, if carefully developed and trained, may offer improved accuracy in predicting rainfall patterns, allowing farmers to make more informed decisions.

3.Real-time Updates: If the proposed system includes real-time data processing capabilities, farmers can receive timely updates on changing weather conditions, enabling them to adjust their plans accordingly .

4.Adaptability: Machine learning models can adapt and learn from new data, potentially improving their accuracy over time as more information becomes available.

5.User-Friendly Interfaces: If the system is designed with user-friendly interfaces, it can be accessible and easy for farmers to use, making it more likely to be adopted by a wider range of users.

6. Integration with Other Technologies: The proposed system may have the potential to integrate

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with other agricultural technologies, creating a comprehensive and interconnected approach to crop management.

## 5. IMPLEMENTATION

### 5.1.Data Collection

The data used for this work was collected from meteorologist's centre. The case data covered the period of 2012 to 2015. The following procedures were adopted at this stage of the research: Data Cleaning, Data Selection, Data Transformation and Data Mining. Weather data: In these module weather data plays a crucial role in our daily lives and various industries, from agriculture to transportation and emergency preparedness. Understanding and effectively utilizing weather data can help individuals and organizations make informed decisions, improve safety, and optimize operations.

1. Types of Weather Data: Weather data encompasses a wide range of information collected from various sources, including meteorological stations, satellites, weather balloons, and weather radars. The key types of weather data include:

a. Temperature: Information about the current and forecasted temperature, which impacts clothing choices, heating and cooling needs, and agricultural practices.

b. precipitation: Data on rainfall, snowfall, and other forms of precipitation, critical for water resource management, flood forecasting, and agricultural planning.

c. Humidity: Measures the amount of moisture in the air, influencing human comfort, crop health, and weather patterns.

d. Wind Speed and Direction: Wind data is vital for aviation, renewable energy generation.

### 5.2. Data Cleaning And Selection:

In this stage, a consistent format for the data model was developed which is search missing data, finding duplicated data, and weeding out of bad data. Finally, system cleaned data were transformed into a format suitable for data mining. At this stage, data relevant to the analysis like decision tree was decided on and retrieved from the dataset. The Meteorological dataset had ten attributes in that

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were using two attributes for future prediction. Due to the nature of the Cloud Form data where all the values are the same and the high percentage of missing values in the sunshine data both were not used in the analysis. Agricultural yield water required for different types of crops: Agricultural yield prediction is a vital area of study that can benefit from the application of predictive modelling. Accurate yield predictions can help in optimizing agricultural production, managing supply chains, and ensuring food security. It has been created to emulate real-world agricultural data, complete with introduced outliers to challenge and improve the resilience of predictive models.

**5.3 Classification of rainfall**

1.Rainfall Intensity: Predicting the intensity of rainfall into categories such as light, moderate, or heavy. This classification helps farmers anticipate the amount of water their crops will receive and plan irrigation accordingly.

2.Rainfall Probability: Predicting the likelihood of rainfall occurrence within a specified time frame. This helps farmers make decisions on whether to irrigate, plant, or harvest based on the probability of rainfall.

3.Rainfall Duration: Predicting the duration of rainfall events, classifying them into short, moderate, or prolonged periods. This information aids in scheduling agricultural activities and managing water resources.

4.Seasonal Rainfall Patterns: Predicting the seasonal rainfall patterns, such as dry, monsoon, or wet seasons. This classification helps farmers plan the timing of planting and harvesting cycles.

5.Rainfall Phase: Predicting the phase of rainfall, distinguishing between convective and stratiform rainfall. Differentiating between these types of rainfall events is important for understanding their impact on crops and soil.

6.No Rainfall vs. Rainfall: Predicting whether there will be rainfall or no rainfall within a specified time frame. This binary classification is fundamental for farmers to decide whether to irrigate or rely on natural precipitation.

7.Threshold-based Rainfall: Categorizing rainfall into predefined thresholds, such as below normal, normal, and above normal. This helps farmers assess the adequacy of rainfall for crop growth.

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8.Rainfall Distribution Patterns: Predicting the distribution pattern of rainfall events, such as uniform or sporadic. This information is crucial for planning irrigation and nutrient application schedules.

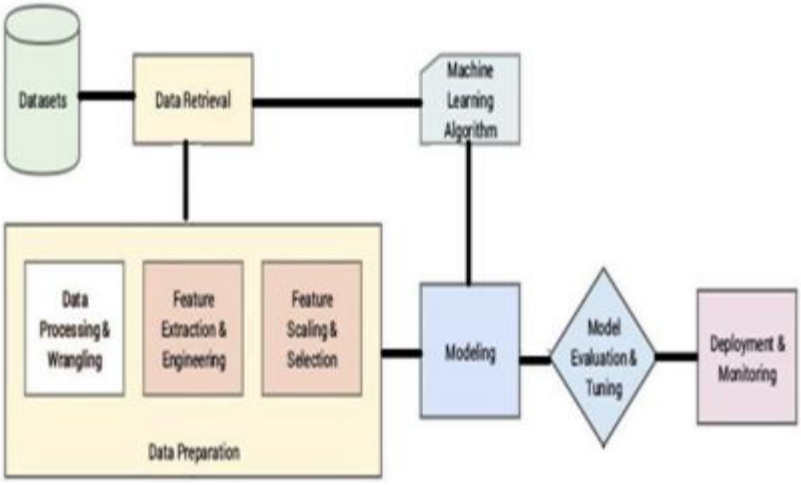
9.Extreme Weather Events: Identifying extreme weather events like storms, cyclones, or heavy rainfall that may have a significant impact on crop production. Farmers can take preventive measures in response to these predictions.

10.Localized Rainfall Predictions: Providing predictions at a localized level, helping farmers in specific regions plan their agricultural activities based on the expected rainfall in their area.

### 5.4 .DATA TRANSFORMATION

"This is also known as data consolidation". It is the stage in which the selected data is transformed into forms appropriate for data mining. The data file was saved in Commas Separated Value (CVS) file format and the datasets were normalized to reduce the effect of scaling on the data. 4. DATA MINING STAGE The data mining stage was divided into three phases. At each phase all the algorithms were used to analyse the meteorological datasets. The testing method adopted for this research was percentage split that train on a percentage of the dataset, cross validate on it and test on the remaining percentage. There after interesting patterns representing knowledge were identified.

## 6. ARCHITECTURE DIAGRAM




## 7. EXPECTED RESULTS

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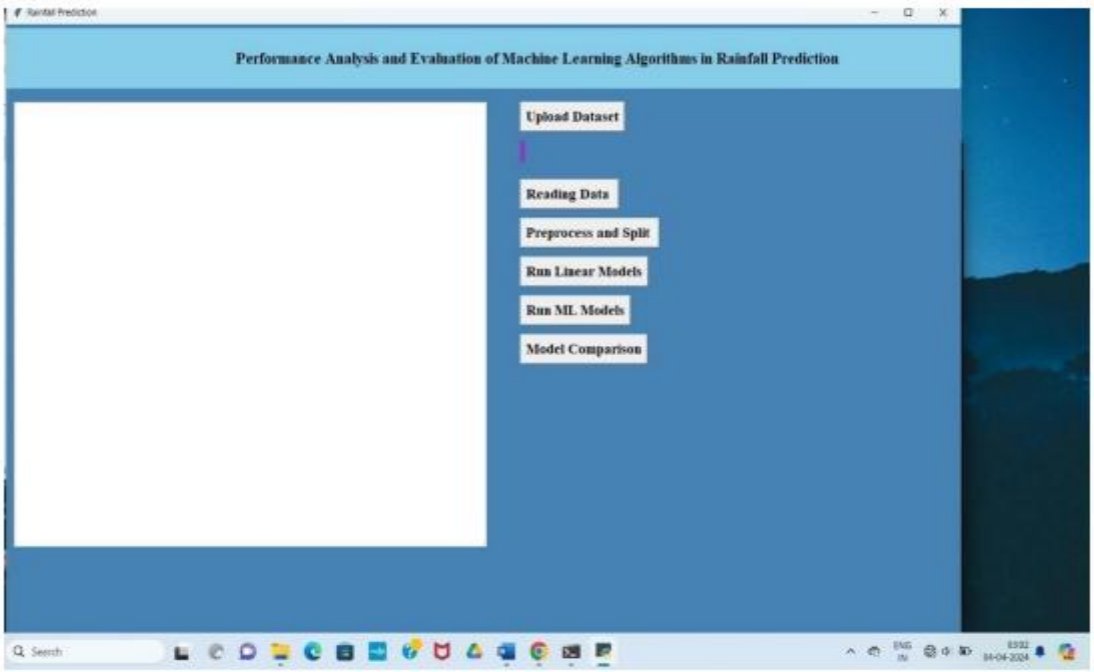
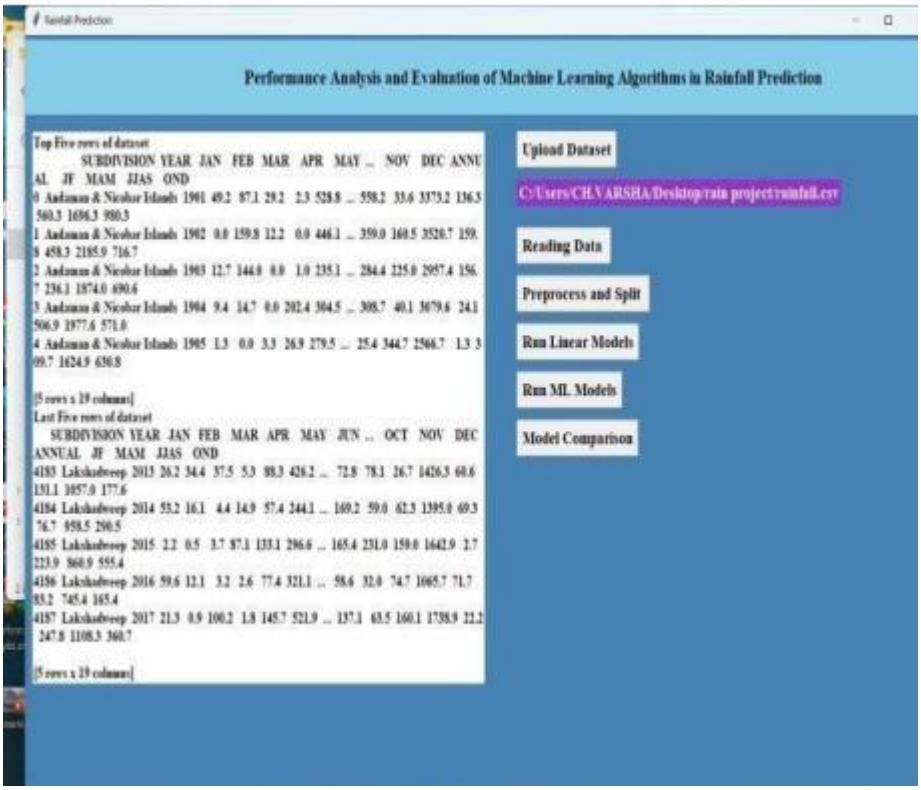



Uploading the dataset




Getting information of annual rainfall

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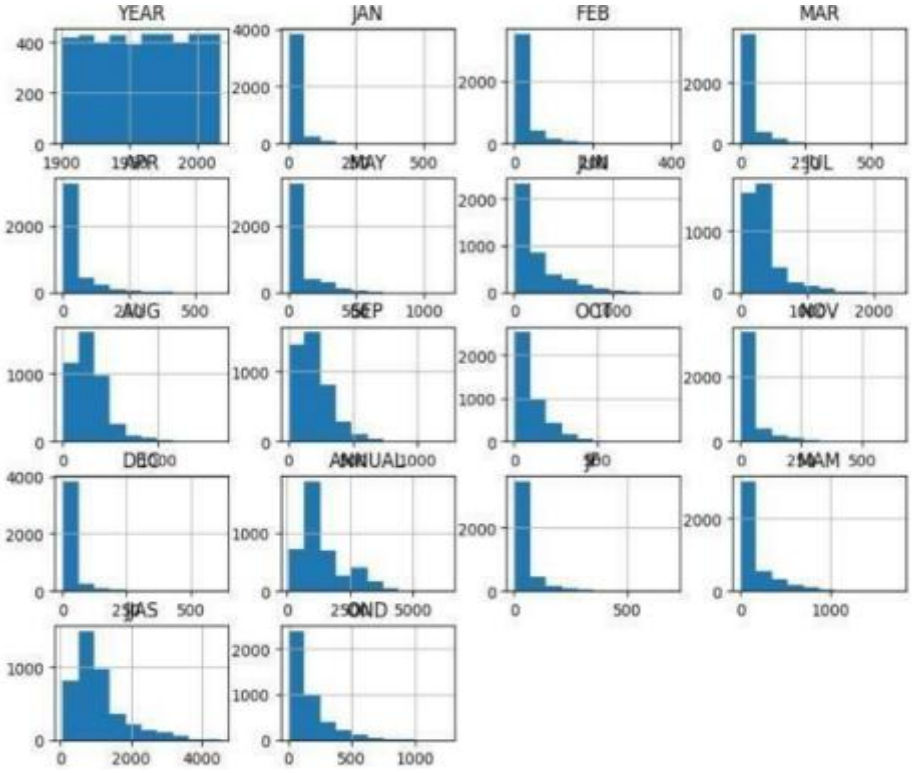
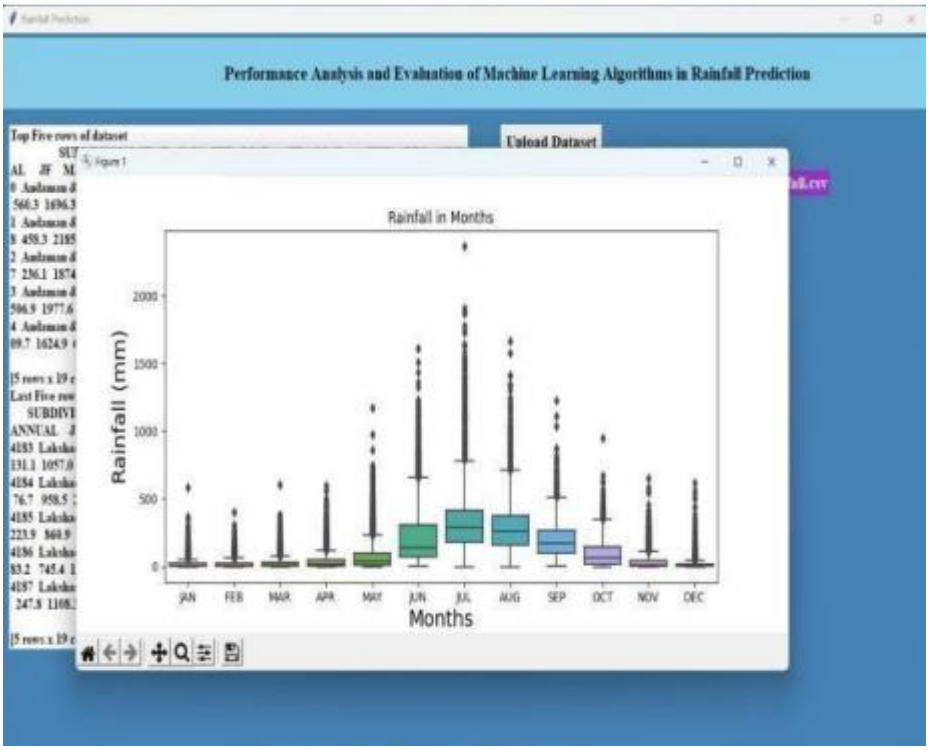



Annual rainfall in monthly wise




Rainfall graph

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## 8. CONCLUSION

Weather forecasting is a meteorological work that easy to modify researcher work by applying the numerical weather prediction method. Weather forecasted by using various data mining techniques especially classification clustering and neural network, decision tree. The key aim for improving the classification and prediction performance for the traditional; weather prediction model is designed and developed in this work. But some limitation of the model is also observed, thus in near future need to be review before use of the proposed technique. And also soil there are some issues and challenges in which better implement of data mining technique should be implemented in field of weather forecasting.

## 9. FUTURE WORK

The future work of the project would be the improvement of architecture for light and other weather scenarios. Also, can develop a model for small changes in climate in future. An algorithm for testing daily basis dataset instead of accumulated dataset could be of paramount Importance for further research.

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