Project Report

Date	25 Nov 2023
Team ID	591647
Project Name	Machine Learning Approach For Predicting The Rainfall
Maximum Marks	5 Marks

1. INTRODUCTION

1.1 Project Overview

Objective: Develop a machine learning model for rainfall prediction, enhancing preparedness and resource allocation for weather-related activities.

Dataset: Meteorological data encompassing variables such as temperature, humidity, wind speed, atmospheric pressure, and historical rainfall patterns.

Methodology:

1.Data Preprocessing: Clean and handle missing values in meteorological datasets.

2.Feature Selection: Identify crucial meteorological variables influencing rainfall patterns.

3.Model Selection: Experiment with regression models, time series analysis, and ensemble methods to predict rainfall accurately.

4.Training: Optimize the model's predictive capabilities using historical meteorological data.

5.Validation: Assess model performance against real-world rainfall data to ensure reliability.

Expected Outcomes:

1.Accurate Predictions: High accuracy in forecasting rainfall patterns for specific regions and time frames.

2.Influential Factors Identification: Insights into the meteorological variables contributing significantly to rainfall predictions.

3.Resource Optimization: Enable efficient allocation of resources and planning for agriculture, water management, and disaster preparedness.

Impact: Enhance societal resilience to weather-related challenges by providing reliable rainfall predictions, ultimately contributing to improved resource utilization and disaster mitigation efforts.

1.2 Purpose

The purpose of the Rainfall Prediction project using Machine Learning is to leverage advanced computational techniques to develop accurate and timely predictions of rainfall patterns. This project serves several key objectives:

1. Enhancing Preparedness: By accurately forecasting rainfall, the project aims to improve preparedness for various sectors such as agriculture, water resource management, and disaster response. Timely and precise predictions allow stakeholders to plan and allocate resources effectively.

2. Resource Allocation: The project seeks to optimize the allocation of resources based on predicted rainfall patterns. This includes planning for irrigation in agriculture, managing water reservoirs, and preparing for potential flood or drought situations. Efficient resource allocation contributes to sustainable development.

3. Risk Mitigation: Providing reliable rainfall predictions helps in mitigating risks associated with extreme weather events. Farmers can make informed decisions about crop planting and harvesting, and authorities can implement measures to reduce the impact of floods or water shortages.

4. Agricultural Planning: Agriculture heavily depends on weather conditions, and accurate rainfall predictions support farmers in making informed decisions about planting, irrigation, and harvesting. This, in turn, can lead to increased crop yields and reduced losses.

5. Disaster Management: Timely and accurate rainfall predictions contribute to better disaster management. Authorities can take proactive measures to handle potential floods or landslides, improving overall public safety.

6. Scientific Understanding: The project contributes to a better understanding of the relationships between meteorological variables and rainfall. This knowledge is valuable for meteorologists, climate scientists, and researchers studying the impact of climate change on weather patterns.

7. Environmental Monitoring: Monitoring and predicting rainfall patterns are essential for assessing the health of ecosystems. Understanding precipitation trends can aid in the conservation and sustainable management of natural resources.

In summary, the Rainfall Prediction project aims to harness the power of machine learning to provide reliable forecasts, ultimately leading to improved planning, resource management, and risk mitigation in various sectors impacted by weather conditions.

2. LITERATURE SURVEY

2.1 Existing problem

Background:

Rainfall prediction is crucial for agriculture, water resource management, mateorological studiesand disaster preparedness. Traditional methods struggle with accuracy, requiring machine learning integration into forecasting models.

Challenges:

1.Limited Spatial and Temporal Resolution:

Rainfall prediction models struggle with high-resolution spatial and temporal predictions due to the dynamic nature of weather systems and the need to capture fine-scale variations in diverse regions.

2.Data Sparsity and Quality :

The scarcity of reliable meteorological data and data quality issues pose a significant challenge to machine learning models, affecting their ability to make precise predictions.

3.Nonlinear and Complex Relationship: Rainfall patterns are influenced by complex interactions between meteorological variables, which conventional machine learning models may struggle to capture, leading to suboptimal predictions in diverse climatic factors.

4.Generalization Across Regions: Generalizing rainfall prediction models across geographical regions is challenging due to potential differences in climate characteristics between regions, limiting their applicability.

5.Dynamic Climate Changes: Climate change necessitates the development of models that can effectively incorporate dynamic precipitation patterns to provide reliable long-term rainfall predictions.

6.Integration of Remote Sensing Data: The integration of remote sensing data, such as satellite imagery and atmospheric measurements, is crucial for enhancing the accuracy and reliability of rainfall predictions.

Project Rationale:

Addressing the aforementioned challenges is crucial for advancing the field of rainfall prediction using machine learning. This project aims to leverage advanced computational techniques to overcome existing limitations, providing more accurate and timely rainfall predictions. By doing so, the project seeks to contribute to improved resource management, disaster preparedness, and sustainable development in regions prone to weather-related challenges. Through the integration of machine learning into rainfall prediction models, we aim to enhance the reliability of forecasts and facilitate informed decision-making for various stakeholders.

2.2 Problem Statement Definition

The delayed recognition of impending rainfall patterns poses a critical challenge in meteorological studies, leading to limitations in resource planning, agriculture management, and disaster preparedness. Several challenges contribute to this issue:

Challenges:

1. Ineffective Early Warning Systems:

Traditional methods of rainfall prediction often lack the capability to provide timely and accurate warnings. Delayed recognition of rainfall patterns hampers the effectiveness of early warning systems, limiting the ability to implement proactive measures.

2. Complexity in Meteorological Data Analysis:

Analyzing the vast and intricate meteorological datasets, which include variables such as temperature, humidity, wind speed, and atmospheric pressure, presents a significant challenge. The complexity of these data sets hinders the identification of subtle yet crucial patterns influencing rainfall.

3. Limited Temporal Resolution:

Current rainfall prediction models may lack the necessary temporal resolution to capture short-term variations and sudden weather changes. This limitation is particularly problematic in regions where rapid shifts in weather conditions can have immediate and substantial impacts.

4. Sparse Data in Certain Regions:

Some geographical regions may suffer from data sparsity, making it challenging to develop accurate and region-specific rainfall prediction models. The lack of comprehensive data in certain areas limits the ability to create robust and reliable forecasting systems.

Project Significance:

This project aims to address the aforementioned challenges by applying machine learning techniques to enhance the accuracy and timeliness of rainfall predictions. By developing a more advanced and data-driven approach to rainfall forecasting, the project seeks to revolutionize meteorological practices. The ultimate goal is to enable precise and early predictions of rainfall patterns, empowering stakeholders in agriculture, water resource management, and disaster response to make informed decisions and implement proactive measures effectively. Through this endeavor, we aspire to contribute to improved resource utilization, enhanced disaster preparedness, and sustainable development in regions vulnerable to the impacts of unpredictable weather conditions.

3. IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas

An empathy map is a simple, easy-to-digest visual that captures knowledge about a user's behaviors and attitudes. It is a useful tool to help teams better understand their users. Creating an effective solution requires understanding the true problem and the person who is experiencing it. The exercise of creating the map helps participants consider things from the user's perspective along with his or her goals and challenges.

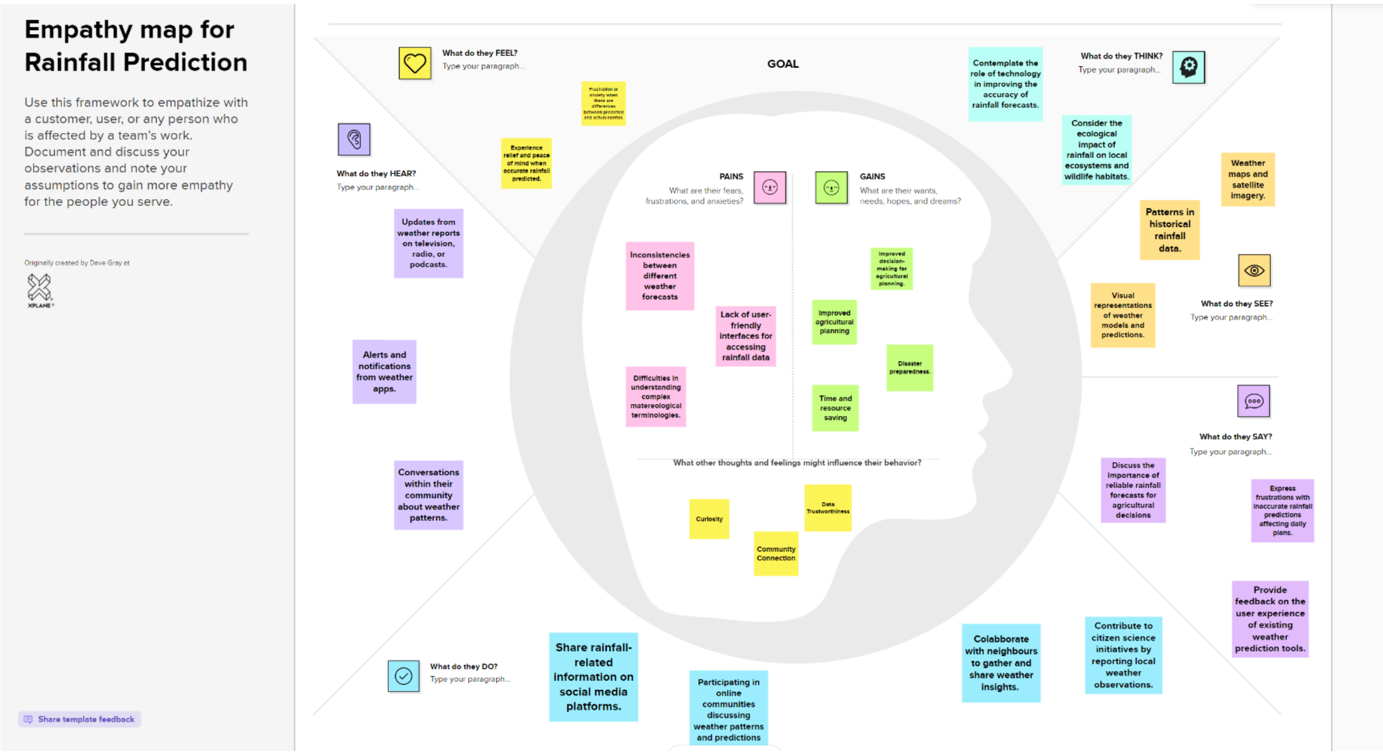
Problem statement:

This project aims to improve early rainfall prediction using machine learning algorithms, enhancing resource allocation, agricultural planning, and disaster preparedness. The project uses meteorological data and factors like temperature, humidity, wind speed, and atmospheric pressure to develop a robust predictive model. The goal is to identify patterns and make precise predictions, impacting various sectors. The project aims to contribute to meteorology by enhancing early rainfall prediction, leading to more efficient resource allocation, better agricultural planning, and improved disaster preparedness. This could revolutionize weather-related challenges and benefit communities and industries.

Reference:

https://app.mural.co/t/machinelearningapproachforra0976/m/machinelearningapproachforra0976/1699870457900/9b4d0927a390292ab785df5fbe9bb0d4554d1e73?fromVisitorModal=true&sender=e07c4e81-f41b-4cf4-928d-0d7f5c962d71

Empathy Mapping:

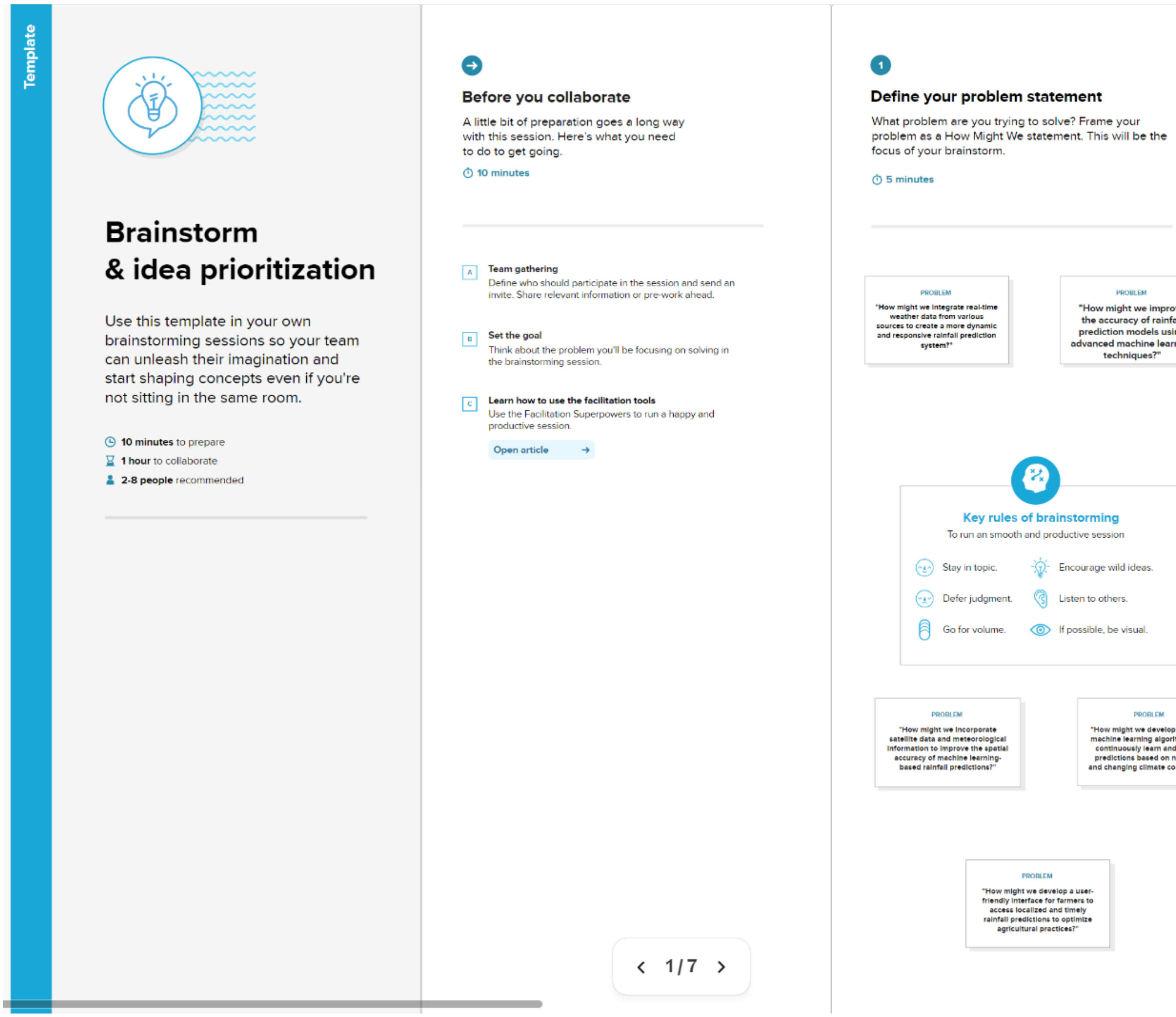


3.2 Ideation & Brainstorming

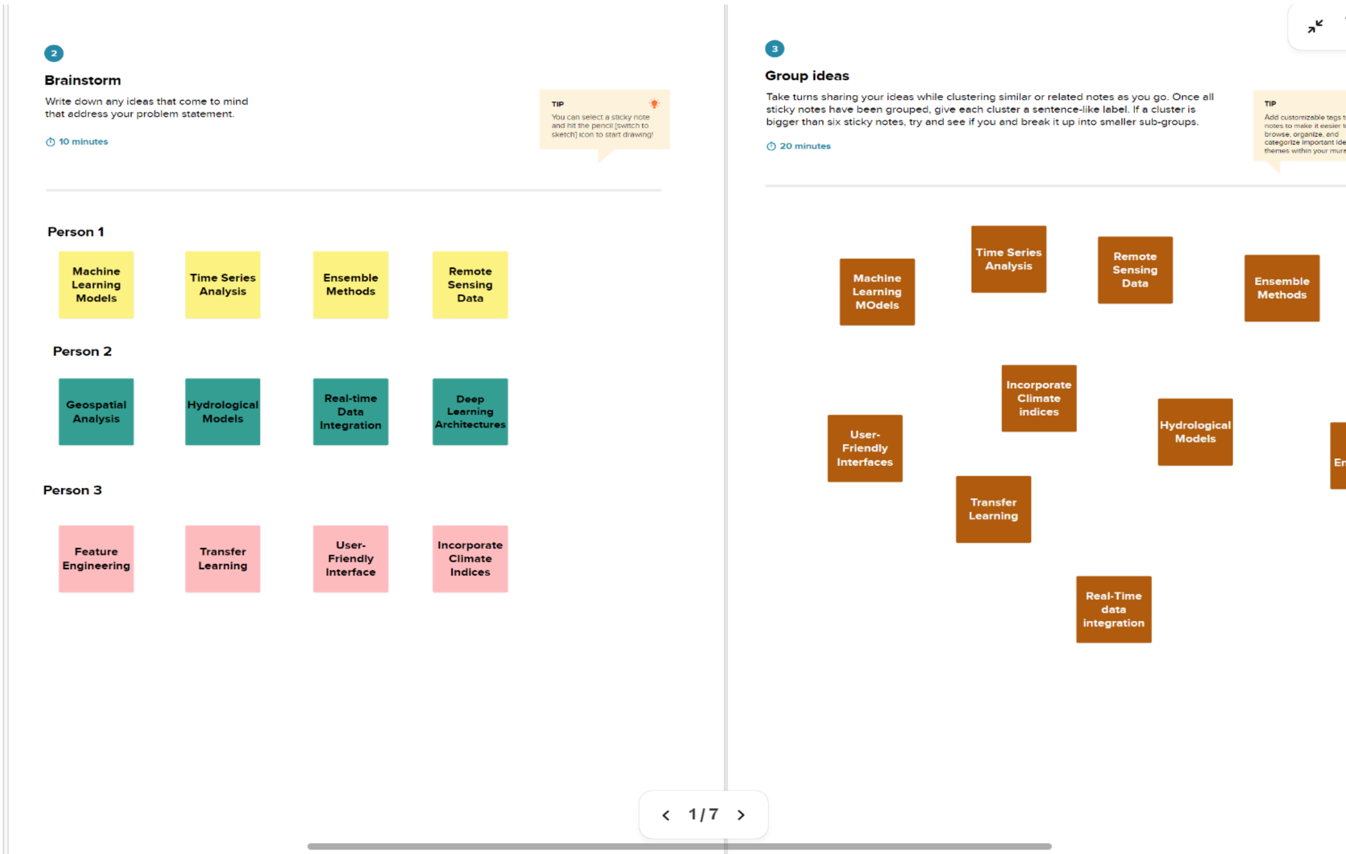
Brainstorm & Idea Prioritization Template:

Brainstorming provides a free and open environment that encourages everyone within a team to participate in the creative thinking process that leads to problem solving. Prioritizing volume over value, out-of-the-box ideas are welcome and built upon, and all participants are encouraged to collaborate, helping each other develop a rich amount of creative solutions.

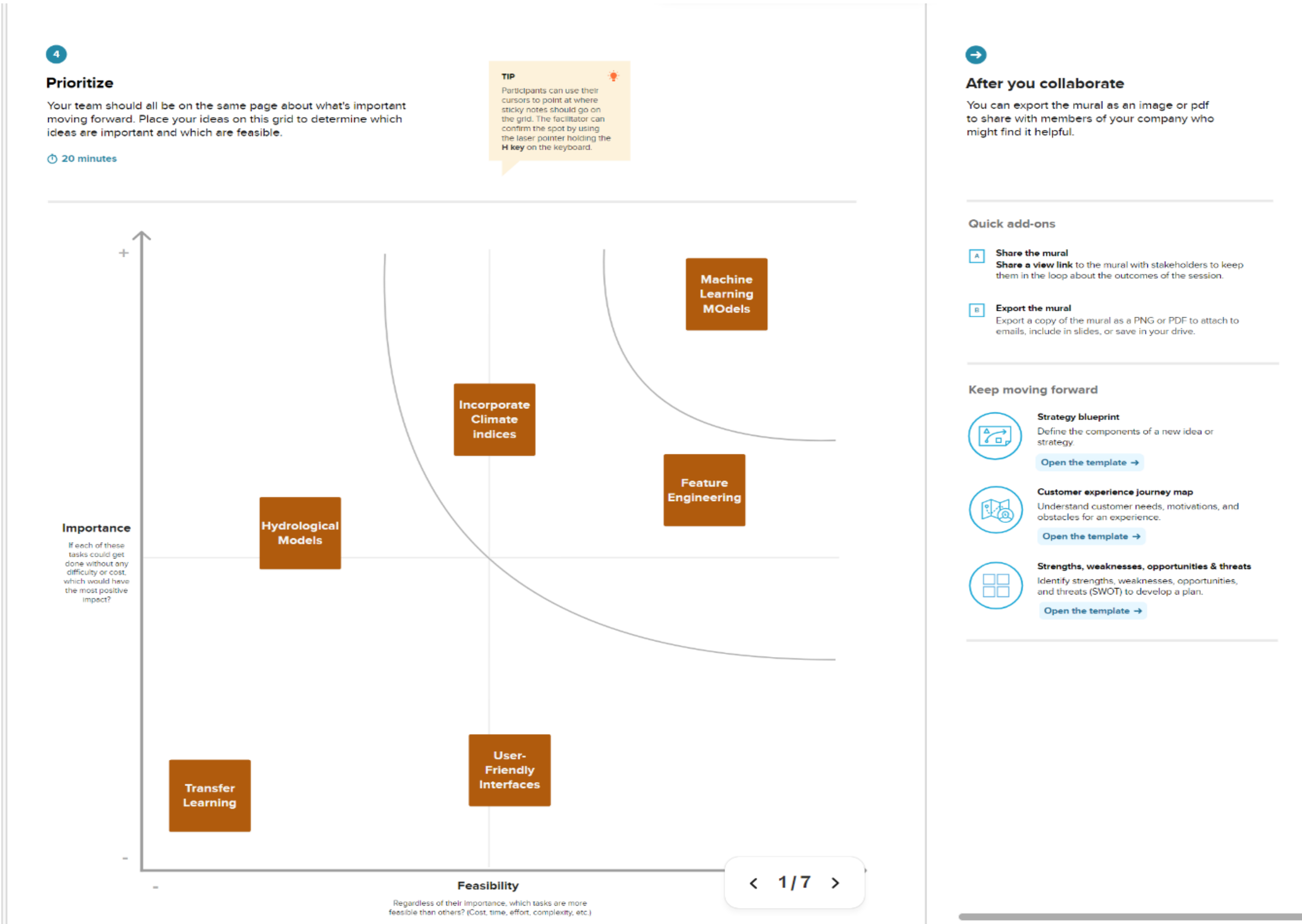
Step-1: Team Gathering, Collaboration and Select the Problem Statement:



Step-2: Brainstorm, Idea Listing and Grouping:



Step-3: Idea Prioritization Reference:



<u>Reference:</u>

https://app.mural.co/t/machinelearningapproachforra0976/m/machinelearningapproachforra0976/1700491865492/9461bb8384a837065a65b0ca660f1695e4559e7d?sender=ufcfe1545e8c4bf1d5d5b4077

4. REQUIREMENT ANALYSIS

4.1 Functional requirement

1.Data Input:

The system should accept a diverse set of meteorological data, including but not limited to temperature,

humidity, wind speed, atmospheric pressure, and historical rainfall patterns.

2.Data Preprocessing:

- Implement data cleaning and preprocessing algorithms to handle missing values, outliers, and ensure data consistency in meteorological datasets.
- Validate and standardize input data to prepare it for analysis, addressing issues related to data quality and completeness.

3.Feature Selection:

- Identify and select relevant meteorological features that significantly influence rainfall patterns.
- Implement algorithms for automatic feature selection to enhance the efficiency of the rainfall prediction model.

4. Model Training:

- Utilize machine learning algorithms to train the predictive model based on historical meteorological data.
- Optimize the model for accuracy using a subset of the meteorological dataset, considering factors such as spatial and temporal variations.

5.Prediction Output:

- Generate accurate and timely predictions for rainfall patterns in specific regions and time frames.
- Provide clear and interpretable results, including graphical representations and statistical metrics, for meteorologists and relevant stakeholders.

6.Integration with Meteorological Systems:

- Ensure seamless integration with existing meteorological information systems.
- Allow for easy interoperability with databases, satellite data, and other relevant sources to enhance the accuracy and reliability of rainfall predictions.

7.Alerting and Notification:

- Implement an alerting system to notify relevant authorities, stakeholders, and the public about predicted extreme weather events, including heavy rainfall, floods, or droughts.
- Allow customization of alert thresholds and notification preferences.

8.Scalability:

- Design the system to handle varying data volumes and scale efficiently to accommodate the growing demand for accurate rainfall predictions.
- Implement mechanisms for scaling the model training and prediction processes based on computational

resources.

9.User Interface:

- Develop a user-friendly interface for meteorologists and decision-makers to interact with the system.

- Provide visualization tools for displaying predicted rainfall patterns, historical data, and model performance metrics.

10.Documentation and Training:

- Create comprehensive documentation for system installation, configuration, and usage.

- Provide training materials and sessions for meteorologists and system administrators to ensure effective utilization of the rainfall prediction system.

4.2 Non-Functional requirement

1.Performance:

- The system should provide real-time or near-real-time predictions, ensuring timely responses to changing weather conditions.

- It must handle large datasets efficiently, delivering accurate predictions without significant latency.

2.Scalability:

- The system should scale horizontally to accommodate an increasing volume of meteorological data and user requests.

- It must be designed to handle potential future expansions and increased computational demands.

3.Reliability:

- The system should exhibit high reliability, minimizing downtime and ensuring continuous availability, especially during critical weather events.

- It must include failover mechanisms to mitigate the impact of potential system failures.

4.Security:

- Implement robust security measures to safeguard meteorological data, user information, and system components.

- Ensure secure communication channels and authentication mechanisms to prevent unauthorized access.

5.Usability:

- Design an intuitive and user-friendly interface for meteorologists and decision-makers to interact with the system easily.

- Provide clear documentation and training materials to facilitate quick adoption and effective use of the system.

6.Interoperability:

- Ensure compatibility and interoperability with existing meteorological information systems, databases, and data sources.
- Support standard data formats to facilitate data exchange with external systems.

7.Maintainability:

- Design the system with modular components for ease of maintenance and updates.
- Provide documentation and tools to assist system administrators in troubleshooting and resolving issues efficiently.

8.Compliance:

- Ensure compliance with relevant meteorological data standards and regulations.
- Adhere to ethical considerations and data privacy regulations governing the use of meteorological information.

9.Performance Monitoring and Logging:

- Implement comprehensive logging mechanisms to record system activities and events.
- Include performance monitoring tools to track system performance, identify bottlenecks, and optimize resource usage.

10.Environmental Considerations:

- Minimize the system's environmental impact, considering energy efficiency and resource utilization.
- Adhere to green computing practices where feasible.

11.Accessibility:

- Design the user interface to be accessible to individuals with disabilities, ensuring inclusivity.
- Provide alternative means of interaction for users with varying accessibility needs.

5. PROJECT DESIGN

5.1 Data Flow Diagrams & User Stories

A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. The DFD is also called as bubble chart .A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.

1.The user figure out the climatic reading inputs he/she has to give in the application they have asked for.

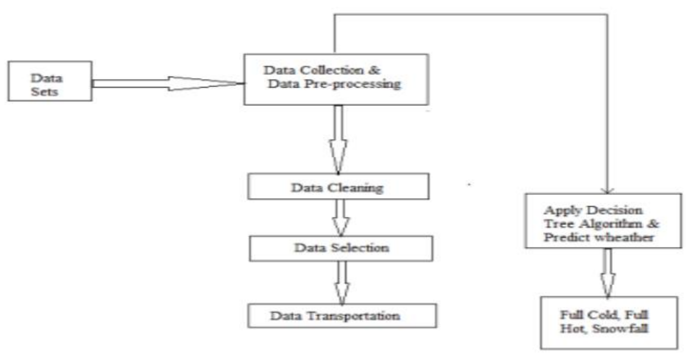
2.User enter the inputs like Location,Humidity at different timings,wind Direction at different timings,year etc.

3.The data is sent for processing to evaluation.

4. Finally the result is extracted and passed to application.

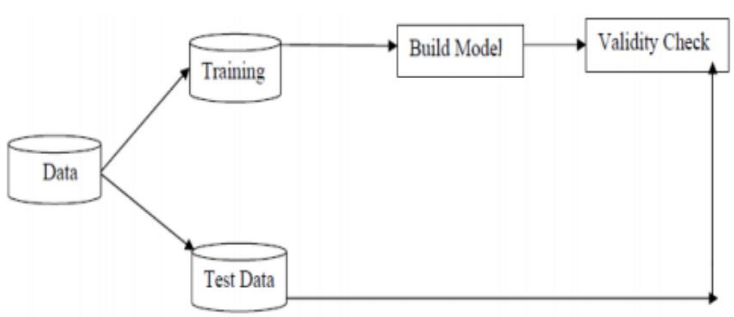
5. The Finalized data is visualized in the UI using the result.

Level 0:



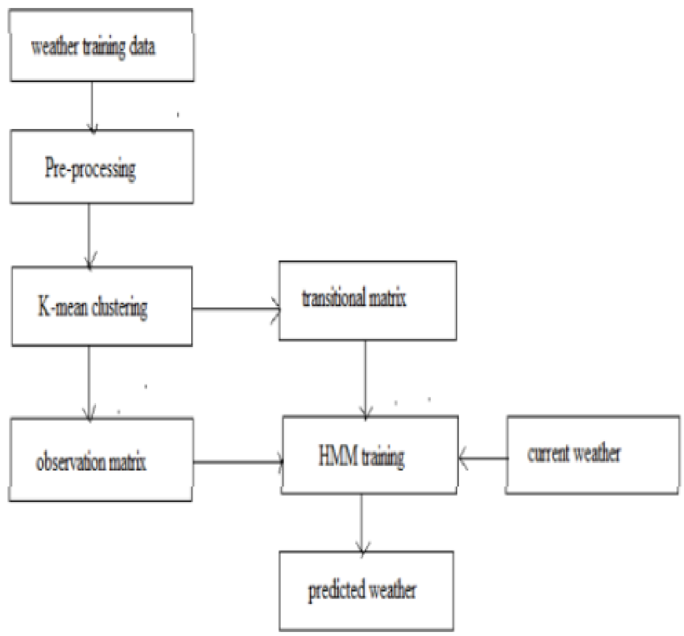
DataFlow Diagram 1

Level 1:



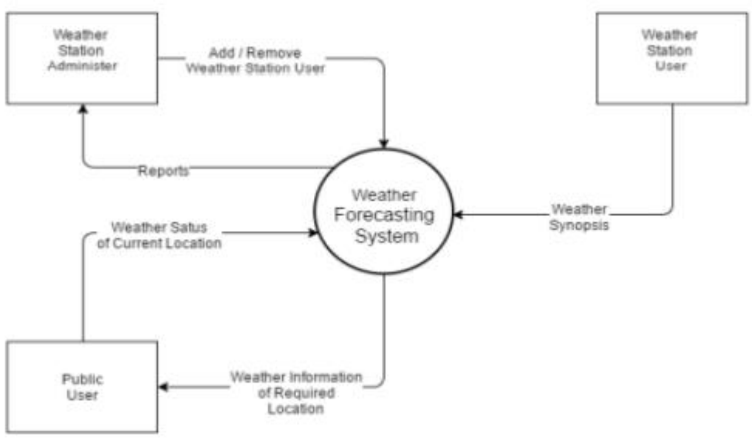
DataFlow Daigram 2

Level 2:



DataFlow Diagram 3

Level 3:



DataFlow Diagram 4.

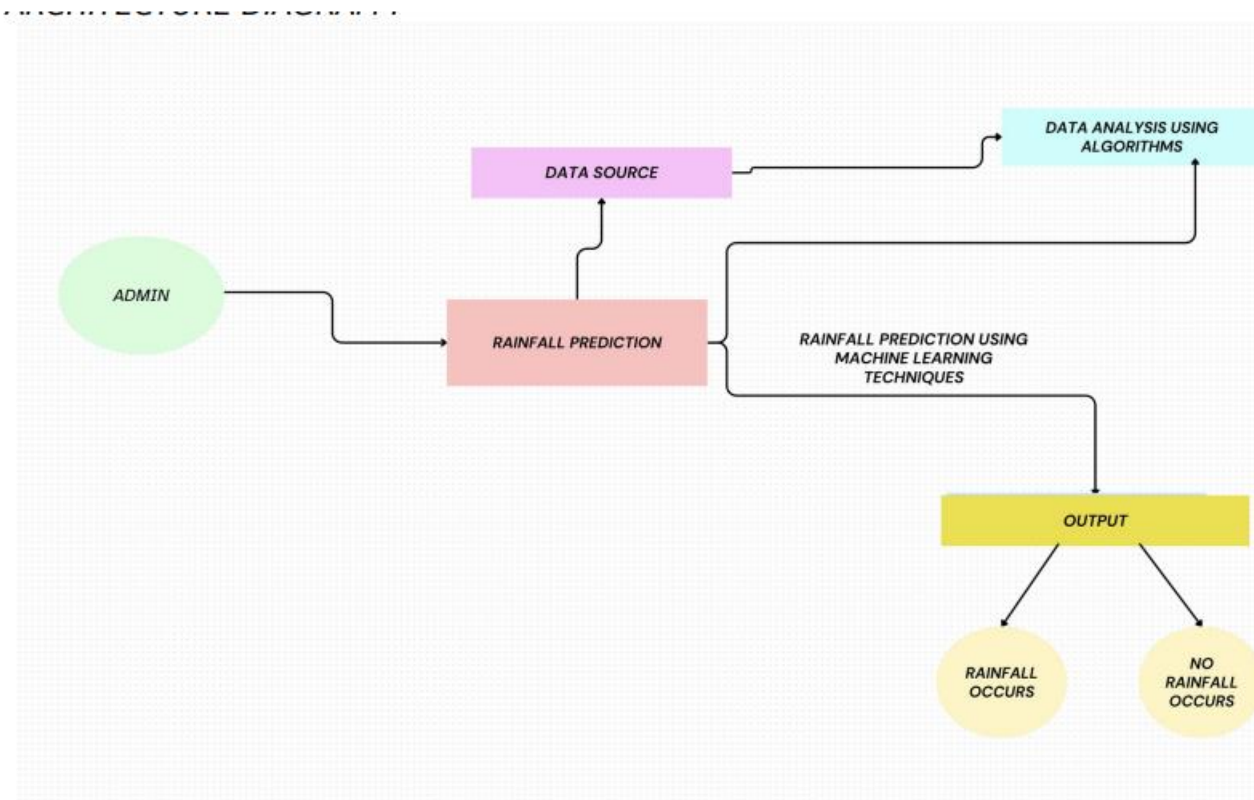
USER STORIES:

User Type	Functional Requirement (Epic)	User Stor	User Story / Task	Acceptance criteria	Priority	Release
Administrator	Sec urity and Com plian ce	USN-1	As a user, I can Ensure Data Security and Compliance	The system should implement robust security measures to protect patient data, including encryption, access controls, and regular security audits.	High	Sprint-1
Farmers and event managem ent companie s	Login	USN-2	As a user, I can log into the application by entering email & password	They should have access to prediction results The system should provide relevant statistical information and visualization tools to help	High	Sprint-1
Data Scientist	Data Access and Model Training	USN-3	As a user, I can Access and Use Historical Data for Model Training	Data scientists should have access to a diverse dataset with patient profiles and historical diabetes diagnosis records. The system should allow data scientists to extract, preprocess, and use this data for training and other works.	High	Sprint-1
Researcher	Result Analysis and Research	USN-4	As a user, I can Access and Analyze Prediction Results	~Researchers should have access to prediction results for further study and analysis.The system should provide relevant statistical information and visualization tools to help researches	High	Sprint-1
All Users (General)	Login	USN-5	As a user, I can log into the application by entering email & password	~Users who forget their passwords should be able to reset them securely through a password recovery process. ~The system should track login	Medium	Sprint-1

All Users (General)	Dashboard	USN-6	Create User Dashboards	~After successful login, each user should have access to a personalized dashboard. ~The dashboard should display relevant information based on the user's role and access rights, providing an overview of key features and data. Healthcare	High	Sprint-1

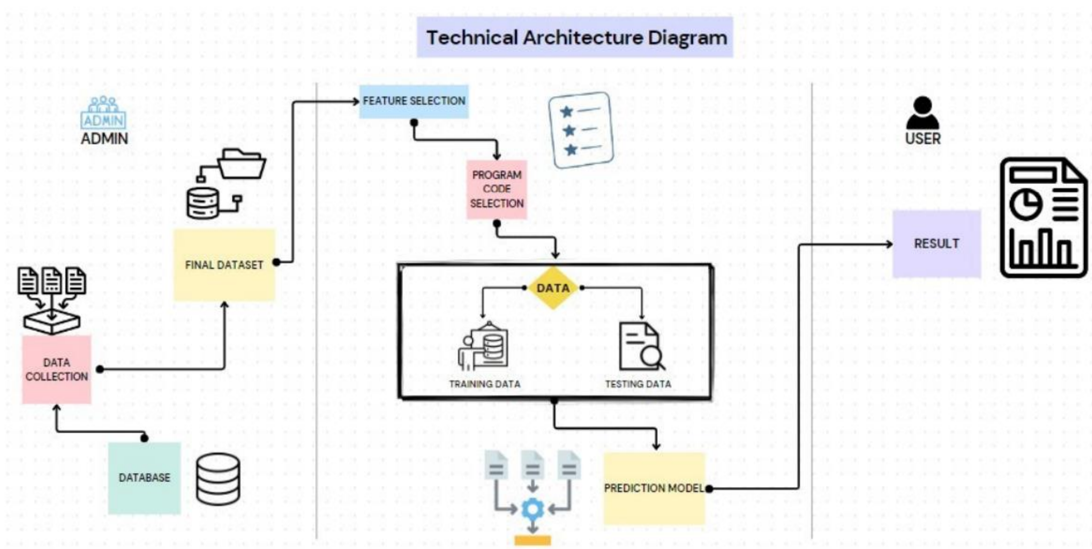
Cust omer (Web user)	User Registration and Profile	USN-7	Register and Create User Profile	~Customers should be able to register on the platform by providing necessary information, including name, email, and password. ~After registration, customers should have the ability to create and edit their user profiles,	High	Sprint-1
Cust ome r Care Exec utive	Customer Managemen	USN-8	Manage Customer Profiles	which may include ~Customer care executives should be able to search for and view customer profiles. ~Executives should have the ability to update customer information and medical data as provided by the customers. ~Customer care	High	Sprint-1
Administrat or	Sec urity and Com plian ce	USN-9	As a user, I can Ensure Data Security and Compliance	executives should The system should implement robust security measures to protect patient data, including encryption, access controls, and regular security audits.	High	Sprint-1

5.2 **Solution Architecture**



6. **PROJECT PLANNING & SCHEDULING**

6.1 Technical Architecture



6.2 Sprint Planning & Estimation

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Data Acquisition and Preprocessing	USN-1	As a data scientist, I want to collect historical meteorological data for training the rainfall prediction model. As a data engineer, I want to clean and preprocess the collected data to remove outliers and handle missing values.	5	High	Akash
Sprint-2	Model Development	USN-2	As a machine learning engineer, I want to choose and implement a suitable machine learning algorithm for rainfall prediction	8	High	sahith
Sprint-3	Model Evaluation and Fine-Tuning	USN-3	As a machine learning engineer, I want to fine-tune hyperparameters to improve the model's accuracy after the splitting of data into testing and training.	6	Medium	Leela Krishna
Sprint-4	Model Interpretability and Explainability	USN-4	As a stakeholder, I want a clear understanding of how the rainfall prediction model makes its predictions.	7	Medium	Akash
Sprint-5	Deployment and Integration	USN-5	As a system administrator, I want to deploy the trained model into a real-world environment and integrate it with existing systems.	10	High	Sahith

6.3 Sprint Delivery Schedule

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	5	6 Days	01 Nov 2023	07 Nov 2023	30	21 NOV 2023
Sprint-2	8	7 Days	07 Nov 2023	14 Nov 2023		
Sprint-3	6	6 Days	14 Nov 2023	20 Nov 2023		
Sprint-4	7	6 Days	15 Nov 2023	21 Nov 2023		
Sprint-5	10	5 Days	16 Nov 2023	21 Nov 2023		

Velocity:

Imagine we have a 10-day sprint duration, and the velocity of the team is 20 (points per sprint). Let's calculate the team's average velocity (A iteration unit (story points per day)

$$AV = \frac{sprint\ duration}{velocity} = \frac{20}{10} = 2$$

AV=30/36=0.83

7. CODING & SOLUTIONING

- Code sets up a Flask web application for rainfall prediction.
- Pre-trained machine learning model (`Rainfall.pkl`) is loaded using `pickle`.
- User-input features are scaled using a loaded scaler (`scale.pkl`).

- HTML templates (`index.html`, `chance.html`, `nochance.html`) for UI rendering.

- User input from HTML form is processed for prediction.

- Loaded model predicts rainfall based on user input.

- Different HTML templates are rendered based on prediction results.

- Port is configured dynamically for flexibility.

- Code hints at potential Heroku deployment.

- Background images enhance visual appeal.

- Predictions include images encoded in base64 format.

- Logic for handling user input from the HTML form.

- Pandas used for creating and manipulating data frames.

- Reliance on external libraries like NumPy, Matplotlib, Pandas, scikit-learn.

- Application runs in debug mode for easier debugging.

8. PERFORMANCE TESTING

8.1 Performace Metrics:

```
acc_score = accuracy_score(y_pred, y_test)
recall_score = recall_score(y_pred, y_test, average='macro')
print(f"Accuracy: {acc_score}, recall: {recall_score}")
```

```
Accuracy: 0.9411764705882353, recall: 0.8701662292213474
```

9. RESULTS

9.1 Output Screenshots:

Classification report:

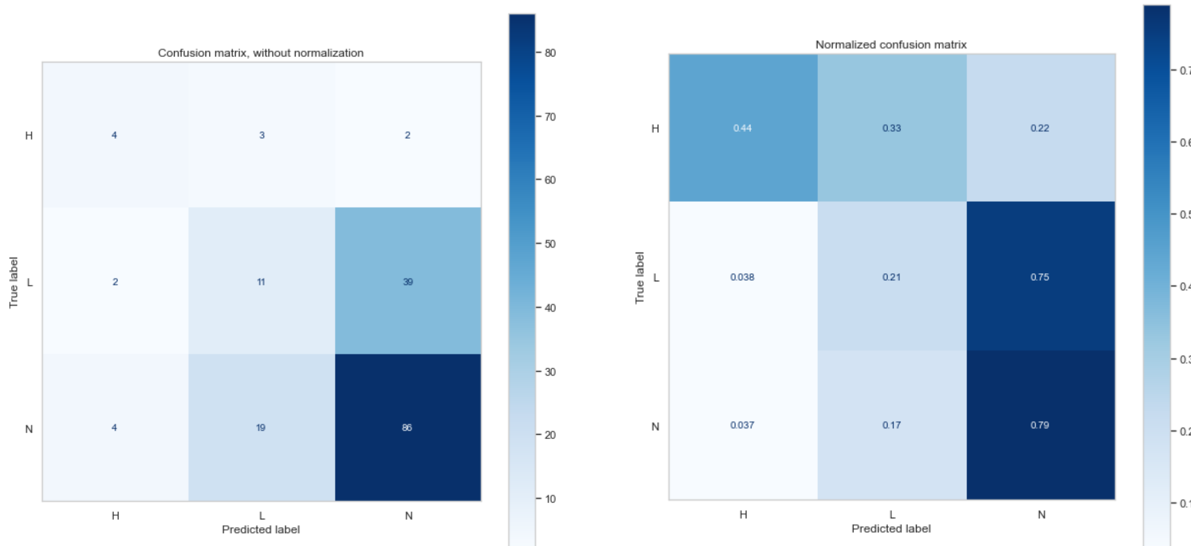
```
print(classification_report(y_test, y_pred))
```

```
              precision    recall  f1-score   support

           0       0.40      0.44      0.42         9
           1       0.33      0.21      0.26        52
           2       0.68      0.79      0.73       109

    accuracy                           0.59       170
   macro avg       0.47      0.48      0.47       170
weighted avg       0.56      0.59      0.57       170
```

Confusion matrix:



10. ADVANTAGES & DISADVANTAGES

Advantages:

1.Improved Accuracy:

- Machine learning models can analyze complex relationships in meteorological data, leading to more accurate

rainfall predictions compared to traditional methods.

2.Early Warning Systems:

- Machine learning enables the development of robust early warning systems, allowing for timely alerts and proactive measures in response to extreme weather events.

3.Enhanced Resource Allocation:

- Accurate rainfall predictions assist in optimizing resource allocation for agriculture, water management, and disaster preparedness, improving overall resource efficiency.

4.Customization for Different Regions:

- Machine learning models can be tailored to specific geographical regions, capturing local nuances and improving the precision of rainfall forecasts.

5.Data-Driven Insights:

- The application of machine learning allows for the extraction of valuable insights from extensive meteorological datasets, contributing to a better understanding of weather patterns.

6.Adaptability to Climate Change: -

Machine learning models can adapt to changing climate conditions, providing more robust and reliable predictions even in the face of dynamic environmental factors.

Disadvantages

1.Data Quality Challenges:

- The accuracy of machine learning models heavily depends on the quality of input data. Incomplete or inaccurate

meteorological datasets can lead to suboptimal predictions.

2.Complex Model Interpretability:

- Some machine learning models, especially complex ones like neural networks, may lack interpretability, making it

challenging to understand the reasoning behind specific predictions.

3.Computational Resource Requirements:

- Training and running sophisticated machine learning models for rainfall prediction may require significant

computational resources, posing challenges in terms of infrastructure and costs.

4.Dependency on Historical Data:

- Machine learning models rely on historical data for training. Changes in climate patterns that are not represented in

the training data may impact the model's ability to predict accurately.

5.Overfitting and Generalization Issues:

- Machine learning models may overfit to the training data, capturing noise rather than true patterns. Ensuring proper

model generalization to new and unseen data is a critical challenge.

6.Ethical and Social Implications:

- The application of machine learning in weather prediction raises ethical considerations, especially concerning the responsible communication of predictions and potential socio-economic impacts on communities.

7.Continuous Model Maintenance:

- Machine learning models need regular updates and maintenance to adapt to changing climate patterns. Failure to

keep models up-to-date may lead to a decline in prediction accuracy over time.

8.Limited Understanding of Unseen Events:

- Machine learning models may struggle to predict rare or unprecedented weather events for which there is limited historical data, making it challenging to provide accurate forecasts in such cases.

11. CONCLUSION

In conclusion, Machine learning is revolutionizing rainfall prediction by improving accuracy, early warning systems, and resource allocation. It can customize predictions for different regions and provide data-driven insights, providing a more comprehensive understanding of meteorological patterns. However, challenges such as data quality, model interpretability, and computational resource requirements need to be addressed effectively. Continuous efforts in refining data collection processes, ensuring model transparency, and optimizing computational infrastructure are crucial for the sustained success of these predictive systems. Ethical considerations, including responsible communication of predictions and awareness of potential social and economic implications, must be integrated into the deployment of machine learning models in weather forecasting. Balancing technological advancements with ethical principles ensures that the benefits of improved predictions are realized without causing harm or disruption to communities. A holistic and responsible approach is essential to harness the full potential of machine learning for better-prepared societies, sustainable resource management, and improved disaster resilience.

12. FUTURE SCOPE

The future scope for Rainfall Prediction using Machine learning is promising and encompasses several area of development and enhancement.

Integration of Advanced Models:
Future research can explore the integration of more advanced machine learning models, including deep learning and ensemble methods, to further improve the accuracy and robustness of rainfall predictions.

Incorporation of Remote Sensing Data:
Enhancing the integration of remote sensing data, such as satellite imagery and atmospheric measurements, can contribute to a more comprehensive understanding of meteorological conditions, leading to more accurate predictions.

Real-time Predictions:
Advancements in computational capabilities can enable the development of real-time prediction models, allowing for instantaneous updates and timely responses to rapidly changing weather conditions.

Predictive Analytics for Extreme Events:

Future research can focus on developing models specifically tailored for predicting extreme weather events, such as hurricanes, cyclones, or prolonged periods of heavy rainfall, enhancing the ability to mitigate the impact of such events.

Climate Change Adaptation:
As climate change continues to affect weather patterns, there is a growing need for models that can adapt to changing environmental conditions. Future research can explore methodologies that incorporate climate change data into rainfall prediction models.

13. APPENDIX

Source Code:

App.py:

```
import numpy as np
import pickle
import joblib
import matplotlib
import matplotlib.pyplot as plt
import time
import pandas
import os
from flask import Flask, request, jsonify, render_template


app = Flask(__name__)
model = pickle.load(open('C:/Users/SmartbridgePC/Desktop/AIML/Guided projects/rainfall_prediction/IBM flask push/Rainfall IBM deploy/Rainfall.pkl', 'rb'))
scale = pickle.load(open('C:/Users/SmartbridgePC/Desktop/AIML/Guided projects/rainfall_prediction/IBM flask push/Rainfall IBM deploy/scale.pkl','rb'))

@app.route('/')# route to display the home page
def home():
    return render_template('index.html') #rendering the home page

@app.route('/predict',methods=["POST","GET"])# route to show the predictions in a web UI
def predict():
    #  reading the inputs given by the user
    input_feature=[float(x) for x in request.form.values() ]
    features_values=[np.array(input_feature)]
```

```
    names = [['Location', 'MinTemp', 'MaxTemp', 'Rainfall', 'WindGustSpeed',
      'WindSpeed9am', 'WindSpeed3pm', 'Humidity9am', 'Humidity3pm',
      'Pressure9am', 'Pressure3pm', 'Temp9am', 'Temp3pm', 'RainToday',
      'WindGustDir', 'WindDir9am', 'WindDir3pm', 'year', 'month', 'day']]
    data = pandas.DataFrame(features_values,columns=names)
    data = scale.fit_transform(data)
    data = pandas.DataFrame(data,columns = names)
     # predictions using the loaded model file
    prediction=model.predict(data)
    pred_prob = model.predict_proba(data)
    print(prediction)
    if prediction == "yes":
        return render_template("chance.html")
    else:
        return render_template("nochance.html")
     # showing the prediction results in a UI
if __name__=="__main__":

    # app.run(host='0.0.0.0', port=8000,debug=True)    # running the app
    port=int(os.environ.get('PORT',5000))
    app.run(port=port,debug=True,use_reloader=False)
```

index.html:

```
<!DOCTYPE html>
<html>
<head>
  <meta charset="UTF-8">
  <title>Rainfall prediction</title>
</head>
<body background="https://wallpaperaccess.com/full/701614.jpg" text="black">
  <div class="login">
    <center><h1>Rainfall Prediction</h1></center>
    <form action="{{ url_for('predict')}}" method="post">
      <label for="Location">Location:</label>
      <select id="Location" name="Location">
        <option value="2">Albury</option>
        <option value="4">BadgerysCreek</option>
        <option value="10">Cobar</option>
```

```
  <option value="11">Coffs Harbour</option>
  <option value="21">Moree</option>
  <option value="24">Newcastle</option>
  <option value="26">NorahHead</option>
  <option value="27">NorfolkIsland</option>
  <option value="30">Penrith</option>
  <option value="34">Richmond</option>
  <option value="37">Sydney</option>
  <option value="38">Sydney Airport</option>
  <option value="42">Waggawagga</option>
  <option value="45">Williamtown</option>
  <option value="47">Wollongong</option>
  <option value="9">Canberra</option>
  <option value="40">Tuggeranong</option>
  <option value="23">MountGinini</option>
  <option value="5">Ballarat</option>
  <option value="6">Bendigo</option>
  <option value="35">Sale</option>
  <option value="19">Melbourne Airport</option>
  <option value="18">Melbourne</option>
  <option value="20">Mildura</option>
  <option value="25">Nhil</option>
  <option value="33">Portland</option>
  <option value="44">Watsonia</option>
</select>

<select id="Windsepped3pm" name="Windspeed3pm">
  <option value="14">W</option>
  <option value="15">WNW</option>
  <option value="0">WSW</option>
  <option value="7">NE</option>
  <option value="13">NNW</option>
  <option value="10">N</option>
  <option value="2">NNE</option>
  <option value="1">SW</option>
  <option value="6">ENE</option>
  <option value="11">SSE</option>
  <option value="12">S</option>
```

```
        <option value="9">NW</option>
        <option value="3">SE</option>
        <option value="8">ESE</option>
        <option value="5">E</option>
        <option value="4">SSW</option>
      </select>   
      <br>
      <br>
      <br>
      <button type="submit" class="btn btn-primary btn-block btn-large" style="height:30px;width:200px">Predict</button>
    </form>
    <br>
    {{ prediction_text }}
    <br>
    <br>
    <img src="data:image/png;base64,{{url_3}}" alt="Submit Form" height="180" width="233"
onerror="this.style.display='none'" />
    <img src="data:image/png;base64,{{url_1}}" alt="Submit Form" height="180" width="233"
onerror="this.style.display='none'" />
    <img src="data:image/png;base64,{{url_4}}" alt="Submit Form" height="180" width="233"
onerror="this.style.display='none'" />
    <br>
    <br>
    <img src="data:image/png;base64,{{url_2}}" alt="Submit Form" height="150" width="711"
onerror="this.style.display='none'" />
  </div>
</body>

</html>
```

Chance.html:

```
<!DOCTYPE html>
<html>

<head>
  <meta charset="UTF-8">
  <title>Rainfall prediction</title>
</head>
```

```
<body        background="https://wnavprd.blob.core.windows.net/images/guide/chris-seufert-cape-cod-rain-beach-1406-110-1.jpg"
text="black">
  <div class="login">
    <center>
      <h1>No chances of rain today.</h1>
    </center>
  </div>
</body>

</html>
```

NoChance.html:

```
<!DOCTYPE html>
<html>

<head>
  <meta charset="UTF-8">
  <title>Rainfall prediction</title>
</head>

<body background="https://cdn.tourradar.com/s3/tour/1500x800/139566_d97baf8c.jpg" text="black">
  <div class="login">
    <center>
      <h1>No chances of rain today, enjoy your outing.</h1>
    </center>
  </div>
</body>

</html>
```

GitHub & Project Demo Link:

Github link:

https://github.com/smartinternz02/SI-GuidedProject-613545-1700498955/tree/main

Demo video link:

https://drive.google.com/file/d/1svEBR_0n1nWPvwBV7BAwkL-oU_bP5aYi/view?usp=share_link