PROJECT SYNOPSIS REPORT

On

Development of Explainable AI (XAI) based model for prediction of heavy/high impact rain events using satellite data

Submitted By

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Abstract:

Heavy rainfall events can have devastating impacts on communities, infrastructure, and the environment. Timely and accurate prediction of such events is crucial for effective disaster management and mitigation.

This project aims to develop an Explainable Artificial Intelligence (XAI) based model that can predict heavy or high-impact rain events using satellite data. The proposed model will utilize advanced machine learning algorithms and techniques to analyze satellite data from INSAT/3DR and other relevant sources. The model will be trained on a large dataset of historical rainfall events and corresponding satellite imagery to learn patterns and relationships between the two.

Keywords: Explainable AI (XAI), AI (Artificial Intelligence) Model Interpretability, Heavy Rain Prediction, Predictive Modeling, Machine Learning, Deep Learning, Climate Data, Rainfall Prediction, Meteorological Satellites.

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Chapter 1

1. Introduction

Machine Learning (ML) –based models such as Random Forest (RF), Support Vector Machine (SVM) and deep Convolutional Neural Network (CNN) will yield good result on rain prediction. The high impact assigned to 1 and low impact assigned to 0. Explanations for AI model predictions can be given using trust building Explainable AI (XAI) model like Shapley Additive Explanations (SHAP) and Local Interpretable Model-Agnostic Explanations (LIME).A web application can be developed with Python and Java Script that provides a user-friendly interface for users to interact with the AI model and XAI module. The application can be furnished with key features to allow users to submit satellite data and receive rain predictions and displaying explainable components for knowing how they interact with each other.

1.1Motivation

Developing an Explainable AI (XAI) model for predicting heavy/high impact rain events using satellite data is a fascinating and crucial topic. The motivation behind this lies in the need for accurate and interpretable models to forecast extreme weather conditions like heavy rainfall. By leveraging satellite data, which provides a vast amount of information about the Earth's atmosphere and weather patterns, we can enhance our ability to predict such events.

1.1 Requirement Analysis

1. Collect and preprocess satellite data with atmospheric parameters.
2. Select and engineer relevant features for predicting heavy rain events.
3. Develop an Explainable AI model using interpretable algorithms.
4. Utilize interpretability techniques like SHAP values and feature importance plots.
5. Validate the model's performance with metrics and cross-validation.
6. Create a user-friendly interface for displaying predictions and explanations.

1.2 Aim

Development of Explainable AI (XAI) based model for prediction of heavy /high impact rain events using satellite data

The aim of this project is to ensure that every secondary school student can access effective career guidance supported by AI-based counseling, aptitude tests, and detailed career paths. Our goal is to empower students to make well-informed decisions about their future careers by providing them with personalized support tailored to their individual strengths and interests.

1.3 Objectives

Develop an XAI-based model: Design and develop an XAI-based model that can predict heavy or high-impact rain events using satellite data with high accuracy and reliability.Improve prediction accuracy.

Achieve a minimum accuracy of 90% in predicting heavy or high-impact rain events using the developed XAI-based model.Provide explainability: Develop an explainability module that can provide transparent and interpretable insights into the decision-making process of the XAI-based model. Our system includes an explainable AI module (XAI) to enhance interpretability. The final output is delivered through a user-friendly web application, showcasing model accuracy and providing explanations for the generated prediction.

Chapter 2

2. Problem Formulation

The problem formulation for the project involves creating an Explainable AI model that can accurately predict heavy rain events using satellite data while ensuring transparency in the model's decision-making process. Key steps include data preprocessing, feature selection, and engineering to identify essential variables for precise predictions. The model will utilize interpretable algorithms to provide clear explanations for its forecasts, enhancing trust and understanding. Validation processes will be used to assess the model's accuracy and reliability.

2.1 Problem Definition

The problem definition for the project is to develop an Explainable AI model that accurately predicts heavy rain events using satellite data while ensuring transparency in the decision-making process. This involves preprocessing data, selecting relevant features, and engineering them to identify key variables for precise predictions. The model will utilize interpretable algorithms to provide clear explanations for its forecasts, enhancing trust and understanding. Validation processes will be employed to evaluate the model's accuracy and reliability. Additionally, a user-friendly interface will be created to present predictions and explanations in an easily understandable manner.

2.2 Proposed System Architecture/Prototype

1. Data Collection: Gather satellite data with atmospheric variables like temperature, humidity, and cloud cover.
2. Feature Selection: Identify key variables influencing heavy rain predictions and engineer them for model accuracy.
3. Validation: Test the model's accuracy through cross-validation and performance metrics assessment.
4. User Interface: Create an intuitive interface displaying predictions and explanations for users.
5. Deployment: Implement the system for real-time heavy rain forecasting, either in the cloud or on-premise infrastructure.

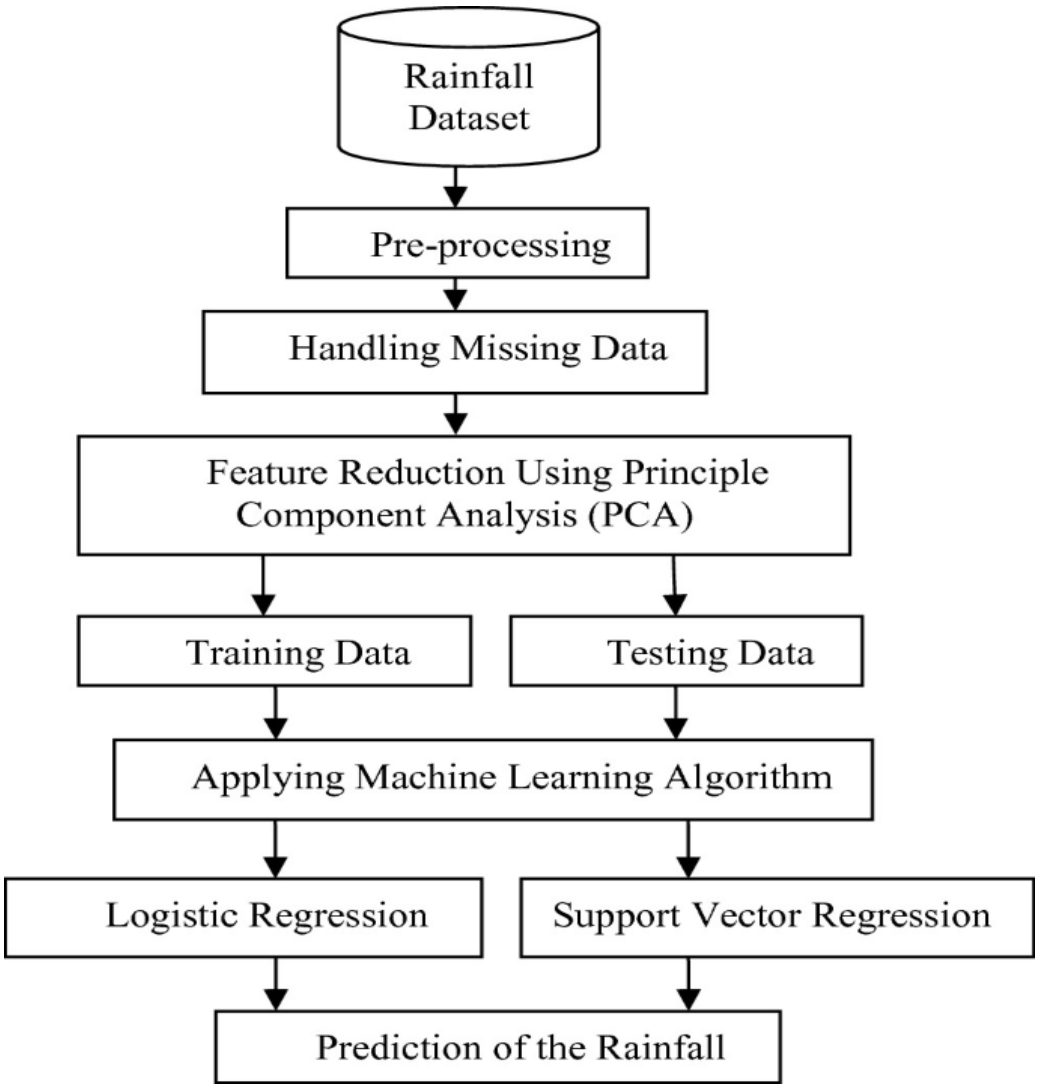

Fig 2.1: Flowchart of student career counselling platform

The flow chart you shared outlines the detailed process of creating a machine. It seems to start with gathering materials, then moves on to design, fabrication, assembly, testing, quality check, final inspection, and finally, completion. Each step likely plays a crucial role in ensuring the machine is built correctly and functions as intended. It's like a roadmap guiding the way from the beginning to the finished product! That flow chart you shared is like a step-by-step guide to making a machine! Each box probably represents a task or action needed to create the machine, like gathering materials, assembling parts, and testing the final product.

Chapter 3

Expected Outcome of the project

The anticipated result of adhering to the flow chart for crafting a machine is the successful creation of a fully operational device. Following each step meticulously, starting from gathering materials to the final inspection, ensures that the machine is assembled accurately, complies with quality standards, and is prepared for use.

1. Well-Constructed Machine : Following the flow chart for creating a machine is expected to result in the production of a machine that is sturdy, reliable, and functions as intended. Each step in the process, if executed correctly, contributes to the overall quality and effectiveness of the final product.

2. Precision and Quality Standards: Progressing through the outlined steps, starting from gathering materials to the final inspection, ensures that the machine is built with precision and attention to detail. The emphasis on quality checks throughout the process aims to guarantee that the machine meets the required standards for performance and durability.

3. Structured Success : The flow chart acts as a structured roadmap that guides the entire manufacturing process, akin to a recipe for success. By following each step diligently, the likelihood of achieving the desired outcome of a fully functional and well-crafted machine is significantly increased.

Chapter 4

Project Estimates & Tentative schedule

Phase 1: Requirement Analysis and Design (1 month)

Phase 2: Development of User Interface and Backend (month1-2)

Phase 3: Integration of Satellite data (month 1-2)

Phase 4: Testing and Quality Assurance (week 1-4)

Phase 5: Deployment and Maintenance (week 1-4)

Role of each group members

- Ms. Tamanna Nebhani : Data Engineer/Analyst
- Ms. Janvi Zamre : Dataset Manager
- Ms. Tanushree raut : Tester
- Ms. Sanskruti Deshmukh : Project Manager

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