Weather Prediction

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1 Abstract

This project aims to develop a real-time weather prediction system that forecasts temperature based on key weather parameters such as humidity, wind speed, and precipitation. By integrating a weather API, the system fetches real-time data and uses a trained machine learning model to predict temperature. The project employs advanced machine learning techniques like linear regression or gradient descent to ensure accurate predictions. It provides users with a seamless interface for accessing temperature forecasts, which can be utilized for various applications like agriculture, transportation, and daily planning. The system is designed to offer timely and reliable predictions with minimal latency.

2 Introduction

2.1 Background

Weather prediction plays a critical role in various sectors, including agriculture, transportation, and daily planning. Traditional methods rely on statistical models and extensive historical data but often lack real-time adaptability. Advances in machine learning enable accurate predictions using real-time data from APIs. These models analyze parameters like humidity, wind speed, and precipitation to forecast temperature. By integrating APIs and machine learning, we can create efficient, scalable, and real-time weather prediction systems.

2.2 Objective

The objective of this project is to develop a real-time weather prediction system using a trained machine learning model. It aims to forecast temperature based on humidity, wind speed, and precipitation data fetched via a weather API. The system seeks to provide accurate and timely predictions to support decision-making in weather-dependent activities.

2.3 Scope

The project focuses on predicting temperature based on real-time weather data using machine learning models. It aims to integrate weather APIs for data fetching and provide accurate predictions.

- Utilize real-time weather data from a reliable API for prediction.
- Predict temperature using machine learning models based on key weather parameters.
- Provide an interactive interface for displaying predictions to users.

3 Methodology

3.1 System Design

The system comprises the following components:

- **C**ollect historical weather data and preprocess them.
- **T**rain a machine learning model (for example, linear regression or gradient descent model) using humidity, wind speed and precipitation as independent variables and temperature as dependent variable.
- **I**ntegrate a weather API to obtain real-time data.
- **U**se the trained model to predict the temperature in real time from API data.
- **D**eploy the application using a platform such as Stream-lit for user interaction.

3.2 Sequence of Operations

1. **F**etch real-time weather data via API
2. **P**redict temperature using the trained model
3. **D**isplay predictions to the user.

3.3 Functional and Non-Functional Requirements

Functional Requirements:

- Fetch data: The system must fetch real-time weather data (humidity, wind speed, and precipitation) using a weather API.
- Predict Weather: The system must predict the temperature based on the data recovered using a trained machine learning model.

Non-Functional Requirements:

- Performance: The prediction must be generated within 2 seconds after the data is retrieved.
- Scalability: The system should handle multiple API calls simultaneously without degrading performance.

4 Results

Preliminary testing of the system has demonstrated:

The system accurately predicts temperature within $\pm 2^{\circ}C$ of the actual value based on real-time data, demonstrating efficient use of the API and machine learning integration.

5 Reference

datasets:: https://elong/put-mean-data-on-maps?select=weather$_{d}ata.csvwww.kaggle.com/code/mike$d

Research Paper:: https://ieeexplore.ieee.org/abstract/document/8938211

Open Weather MAp API Key:: https://ejournal.uksw.edu/ijiteb/article/view/2302