🌦️ Project Title: Weather Prediction App using Machine Learning

Objective

The objective of this project was to develop a machine learning-based weather prediction application capable of forecasting rainfall based on atmospheric parameters. The goal was to apply supervised learning techniques on real-world weather datasets and deploy an interactive tool for user predictions.

Tools and Technologies Used

- **Programming Language:** Python
- **Libraries:** scikit-learn, pandas, NumPy, matplotlib, seaborn
- **Model Used:** Random Forest Regressor / Classifier
- **Platform:** Google Colab (for training), Streamlit (for deployment)
- **IDE:** VS Code / Jupyter Notebook

Dataset

- The dataset included daily weather observations:
  - Temperature
  - Humidity
  - Atmospheric pressure
  - Wind speed
  - Rainfall indicators
- **Preprocessing Steps:**
  - Handling missing values
  - Feature scaling and normalization
  - Correlation matrix for feature selection
  - Train-test split (80-20)

Model Development

- The Random Forest model was chosen due to its ability to handle both classification and regression tasks, and its robustness to outliers.
- The model was trained to predict the possibility of rainfall based on historical weather data.

- Evaluated using metrics like **accuracy**, **R^2 score**, and **confusion matrix** (for classification case).

Deployment

- The trained model was saved and deployed using **Streamlit**.
- The app provides a user-friendly interface with sliders/input fields for:
  - Temperature
  - Humidity
  - Pressure
  - Wind Speed
- **Outputs:**
  - Predicts the **chance of rainfall**
  - Displays prediction with **visual feedback**
  - Graphs showing **feature importance**

Features

- Real-time input for key weather parameters
- Prediction of rainfall likelihood
- Interactive web interface with visualization
- Deployment-ready for educational or awareness use

Outcomes

- Enhanced understanding of data preprocessing and model evaluation techniques.
- Learned how to translate an ML model into a user-facing product.
- Understood practical use cases of Random Forest and feature importance.

Applications

- Can be used in mobile or web-based climate monitoring tools.
- Applicable in agriculture, travel, and outdoor event planning.
- Foundation for more advanced forecasting models (e.g., time-series models or IoT-based systems).

Conclusion

The Weather Prediction App demonstrates the practical application of machine learning in environmental forecasting. It serves as a solid mini-project that bridges theory and real-world implementation. With further improvements such as live data API integration or multi-day forecasting, it can be scaled for broader use cases.